Final Report
for
International Competitiveness Element and Downstream Potential of mining industry

FR-5

SECTOR PLAN FOR SUSTAINABLE DEVELOPMENT OF THE MINING SECTOR IN THE LAO PDR

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1 Introduction - Assessment of International Competitiveness and Downstream Potential

1.1 Development of the mining sector in an LDC (Least Developed Country).

1.1.a. Traditional mining sector development - Evolution
The economically developed countries have reached their present state of technical development over more than 200 years by, among other activities, progressive invention, innovation, experimentation and investment in capital, human education and exploitation of their natural resources. For over 100 years trade in raw materials has developed to satisfy their increasing demand for minerals, which were never or are no longer available locally. In these countries, modern geological science, mining methods and practice, mining equipment and the legislative, market and financial support have all evolved into their present form over this 200-year period by continuously building and improving on previous knowledge.

1.1.b. Modern mining sector development - Revolution
Since the middle of the 20th century many governments have aspired to achieve for their peoples the same standards of living and development enjoyed by those living in the industrialised countries. By combining the demand from these countries with the aspirations of less developed countries, mutually advantageous trade alliances are formed, which encourage the creation of resources led growth in the latter whilst satisfying the raw materials needs of the former. In today’s global economy some demand/supply alliances are directly between companies in one country and another; other trading relationships have commodity market mechanisms to connect the seller with the buyer. In all cases market led competition for commodities tends to drive market pricing. In most cases the trade is between private and stock-traded companies as opposed to governments.

The creation of a mining sector in an LDC helps to stimulate economic growth by attracting the investment of mainly foreign capital to build mines and export minerals. It may not take 200 years to establish a sustainable mining sector in an LDC it will require time to establish all of the supporting legislation, human capacity and infrastructure needed to sustain the sector. Typically some 25 years may be necessary to achieve this depending on the level at which the supporting elements are already in place. In comparison with the 200 yr. period of evolution of the industry in the developed countries, this 25 years requires a ‘revolutionary’ approach to mining sector development.

1.2 The roles of public and private sectors in creating a mining industry.

1.2.a. Public sector role
The public sector must establish fair and internationally competitive legislation and regulation for its mining sector. It also needs to foster all of the support mechanisms needed to provide the industry with capital for investment and expansion, personnel to work and manage the mines and robust infrastructure to provide the access for equipment and egress for distribution of the mined products to markets. Today the public sector needs also to protect historical land rights and to minimise the environmental and social
impact on communities local to mining operations. The legislation and regulation should take into account the existing mining activity, including formalisation of the artisanal mining sector so that all operations are legal, regulated and controlled within a single framework.

The principal elements needed from government are:

- The creation of a competitive legislative framework based on accepted international practice tailored to local and regional needs.
- The creation of a practical and workable regulatory regime
- The establishment of a Mining Ministry equipped and manned to deal with the specific needs of the industry. This ministry will be responsible for:
  - Geology
  - Geological prospecting and mapping
  - Mineral deposit analysis and evaluation
  - A minerals testing laboratory
  - Permitting and Licensing
  - The operation of an efficient cadastral office
  - Mining legislation, regulation and their development
  - The enforcement of Mines and Quarries regulations
  - Mining environmental and social issues
  - Mines Safety
  - Mining Investment promotion.
- Personnel competent to manage and implement the necessary administrative, technical and regulatory functions of the Ministry.
- Personnel competent to deal with local, regional and international investors
- The development of educational facilities to train young people in all geological, mining and related economic, legal and financial disciplines to manage the sector. The numbers trained should be based on forecasts for long term sector growth.

1.2.b. Private sector Role - Investors
Private sector interests fall into three categories and differ according to the scale of mining in which they invest. The first two categories tend to be locally and regionally based. The third category is usually large, possibly regional but typically multinational. From smallest to largest the investors are:

- Artisanal and small scale - Investment is very limited, and may include very basic equipment costing between US$5k – 50k. Investors/operators are local entrepreneurs, small loose associations between villagers and mineral traders, who see an opportunity to take advantage of cheap labour to selectively exploit small deposits for high-grade mineralization. At the upper end of this scale more formal arrangements may exist.
The operators take little interest in any regulation or formal permitting procedure and prefer not to be regulated in any way. They pay little attention to environmental, social or safety issues. These miners lack formal qualification and bring little technology to their operations.

- **Medium scale** - These operations supply to local or even regional demand and require investment in small to medium scale productive equipment. Investors may associate to raise the sum required to initiate a mining operation. Investment may be in the order of US$50,000 (e.g. cassiterite) to US$ 10,000,000, (e.g. small-scale mining of bulk commodities such as coal) to purchase equipment needed to provide the productive and processing capacity. These investors recognise the need to accept some regulation (as it protects their interests in tenure of a property) and have knowledge of issues related to the environment, social responsibility and safety. Their financial capacity to adhere to the law in these matters is limited. To remain efficient as producers they do bring moderate levels of technology to their operations.

- **Large scale**. These investors are usually large national or medium to large international companies prepared to invest multi-millions of dollars over the long term to operate large or rich deposits that provide at least a realistic worst case return on their investment. Investment is only made after exhaustive analysis of the many risks involved in mining (see below). Such investors have a reputation to maintain and respect the rule of law and the regulatory regime, adhering to all requirements relating to the environment, social issues and safety. These investors expect to use the latest technologies in their operations, principally to drive costs down, to maximise the use of assets and to extract the maximum value from their deposits.

### 1.3 Investor perspectives of competitiveness

The investing mining company selects a deposit based on its perception of risk to capital and potential return on investment. In deciding where to invest it will consider the benefits of one location vs. those of another. Thus levels of risk become competitive, with the lowest risks being in those places which offer the most attractive (from the investor’s point of view) conditions. These perceptions of risk apply to all three categories of investor above. The key criteria that investors in medium and large scale operations use to analyse their risks are set out in table 1 below. (Section 4 of this report discusses these factors in the Lao context):

**Table 1. Key risk criteria from an investor’s perspective**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Investor’s perspective -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand</td>
<td>Existence and size of domestic, adjacent, regional &amp; international markets.</td>
</tr>
<tr>
<td>Geology</td>
<td>The geological context and quality and quantity of geological information available.</td>
</tr>
<tr>
<td>Infrastructure 1. Transport</td>
<td>State of infrastructural development and any additional cost to meet the investor’s needs for access and egress to operations.</td>
</tr>
<tr>
<td>Infrastructure 2. Supporting industries</td>
<td>Sustainability of mining operations requires support from suppliers of all kinds such as metal fabrication, machining, mechanical and electrical engineering, chemical, gas, fuel, power, IT and office equipment.</td>
</tr>
<tr>
<td>Labour force 1.</td>
<td>Availability of skilled labour for exploration, development and production, labour costs</td>
</tr>
<tr>
<td><strong>Labour force 2.</strong></td>
<td>Availability of mining education and a continuing supply of technically educated local people to work in the industry.</td>
</tr>
<tr>
<td><strong>Financing 1.</strong></td>
<td>Value, availability and convertibility of local currency, currency market fluctuations, inflation &amp; interest rates. Local banks understanding and investing in the sector.</td>
</tr>
<tr>
<td><strong>Financing 2.</strong></td>
<td>Rights to convert and repatriate profits in ‘hard currency’.</td>
</tr>
<tr>
<td><strong>Taxation &amp; Royalties 1.</strong></td>
<td>Standard for all investors, competitive in both regional and international context and impartially applied to all investors.</td>
</tr>
<tr>
<td><strong>Taxation &amp; Royalties 2.</strong></td>
<td>Understanding of the need for incentives at certain stages of the mine establishment process. (e.g. relaxation of customs duties on imported equipment)</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Mining technologies need developing in parallel with the prioritisation of investment targets by government. Inadequacies in mining technology should be minimal.</td>
</tr>
<tr>
<td><strong>Mining legislation 1</strong></td>
<td>Simple procedure for acquisition, tenure and transfer of mining rights. Simple investment procedures. Transparent and impartial treatment of all investors by government in handling prospecting, exploration and mining licences. Transparent arrangements for transfer of licences.</td>
</tr>
<tr>
<td><strong>Mining legislation 2</strong></td>
<td>Clear laws and regulation on mining environmental, social and sustainability issues</td>
</tr>
<tr>
<td><strong>Regulation</strong></td>
<td>Practical, straightforward, applied in a co-operative spirit.</td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td>Abundant, systematic, complete, clear and supplied in easily transported electronic formats. Information system should comply with international standards.</td>
</tr>
<tr>
<td><strong>Political &amp; economic</strong></td>
<td>Government and economic stability, quality of governance, impartiality of government at all levels</td>
</tr>
<tr>
<td><strong>Previous Investor experience</strong></td>
<td>Mining investors dislike risk. The presence of well known prior investors who are able to offer satisfactory references of their investment experience can positively influence confidence levels of potential investors</td>
</tr>
</tbody>
</table>

An investor will analyse, weigh and score his perception of each of these criteria, assigning a high score for low risk. Generally speaking, emerging countries like Laos have low scores which present investors with high risks. In these countries, the sudden start of investment promotion activity may have a negative effect. Without a concerted effort by government to implement measures and policies that rapidly improve the evaluation of these criteria, those investors who react to the promotional activity may soon be disappointed. Promotional activity should be implemented in concert with a programme of change which establishes competitive policies and practices including realistic plans for the future development of the infrastructure in country.
2. **Lao P.D.R. – background and regional context.**

2.1 **Recent political and economic history**

Laos, officially the Lao People's Democratic Republic or Lao P.D.R, is a landlocked country in Southeast Asia, bordered in the Northeast by Myanmar (previously known as Burma), Yunnan Province of the People's Republic of China to the Northwest, Vietnam to the East, Cambodia to the South, and Thailand to the West. With a population of 6.22 million it is one of a few remaining officially Socialist states. Twenty years ago, in 1986, its government initiated an Open Door policy and all-round reforms, which were consecrated by the 1991 constitution proclaiming the adoption of the Market Economy Mechanism, decentralising control and allowing the development of private enterprise. Starting from a very low base the results of this have been impressive with growth averaging 6% during the period 1988-2004, apart from a short pause beginning in 1997, when the Asian economic crisis caused growth to slow.

As in many developing countries, the major urban centres have experienced the most growth. The economies of Vientiane, Luang Prabang and Savannakhet in particular have experienced significant booms in recent years. Laos' economy is heavily dependent on investment and trade with its larger and richer cousin, Thailand. Pakxe has also experienced growth.

2.2 **The present situation of its infrastructure and some comparisons with neighbours**

Despite the high growth rate much of the country lacks adequate infrastructure:-

- It has no ports or railways but a 35km link using the Friendship Bridge (designed and built by Australia, opened in 1994) is being planned for construction to connect Vientiane with Thailand by the end of 2006.
- It has only a basic paved-road network of 9,673km and 12,042km of rural roads.
- It has 44 airports
- Internal telecommunications fixed-line links are limited although the use of cell phones in the cities is now extensive.
- Electrical generating capacity exceeds network demand but is poorly distributed, with continuous supply in only a few urban areas; the network does not extend to many rural areas and where it is in place the supply is often intermittent.
- Unexploded ordnance for the Vietnam War remains a most serious environmental and safety issue.

The infrastructure in Laos is hampered by many problems, and is much less developed than in neighbouring countries...

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT</th>
<th>LAOS</th>
<th>THAILAND</th>
<th>VIETNAM</th>
<th>CHINA</th>
<th>TANZANIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Area</td>
<td>km²</td>
<td>236,800</td>
<td>514,000</td>
<td>329,560</td>
<td>9,596,960</td>
<td>945,087</td>
</tr>
<tr>
<td>Population</td>
<td>millions</td>
<td>6.22</td>
<td>65.44</td>
<td>83.54</td>
<td>1,306,304</td>
<td>37.45</td>
</tr>
</tbody>
</table>
* Tanzania, in Africa, has been selected as a comparator because it has a successfully developing and promoted mining sector based on prospectivity, which is similar to that of Laos.

2.3 Economic conditions and trends

A subsistence farming economy still accounts for half of Lao GDP and provides 80% of total employment. The economy receives aid from the IMF and other international sources and from new foreign investment in food processing and mining, most notably of copper and gold. Tourism is the fastest growing industry in the country.

A long trade embargo by the United States was lifted in 1995 and in 2004, following Lao improvements on Human Rights issues and in 2006 the U.S. finally granted Laos Normal Trade Relations (NTR) status, which reduces US tariffs on Laos exported goods and is an incentive for further Lao trade growth.

Relations with China have also been improving. China now permits its citizens to travel more freely to Laos. Chinese tourists will account for nearly 25% of the total number of visitors to Laos by the end of 2006. Building a tourist infrastructure to cater to this package market will significantly impact Luang Prabang and other culturally important cities and further economic growth and job creation.

Since the collapse of the Soviet Union and a reduction in Vietnam's assistance, Laos has worked hard to improve relations with its other neighbours. Great effort has particularly been made with Thailand, its main trading partner and Laos' main access to the sea. Since 1987, steady progress has been achieved, helped by the construction and opening in 1994 of the Australian funded and built Friendship Bridge between the two countries. Thailand ranks first on the list of Direct Foreign Investment in the Lao PDR.

During the past 20 years Laos' emergence from international isolation has been marked by improved and growing relations with other more distant nations especially Australia, Japan, India and EU countries France, Sweden and the UK. (Lao’s exports enter the EU duty-free due to its status in the Quota-Free Generalized Preferential System.)

Laos was admitted into the Association of Southeast Asian Nations (ASEAN) in July 1997 and applied to join WTO in 1998. It then chaired ASEAN for 2004-05 and hosted the annual ASEAN Post-Ministerial and Regional Forum meetings in July 2005, and the ASEAN Economic Ministers-Closer Economic Relations (AEM-CER) meetings in September 2005. Laos is also a member of the Mekong River
Commission, the Secretariat of which was relocated to Vientiane in 2004. It is advantageously situated at the centre of the SE Asia region and borders five developing countries.

Table 3  
Headline economic indicators for Laos, 2001 - 2006

<table>
<thead>
<tr>
<th>USS millions</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005(f)</th>
<th>2006(f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic growth (%)</td>
<td>5.7</td>
<td>5.9</td>
<td>5.9</td>
<td>5.0</td>
<td>7.5*</td>
<td>7.5*</td>
</tr>
<tr>
<td>Inflation (%)</td>
<td>7.8</td>
<td>10.6</td>
<td>15.5</td>
<td>11.9</td>
<td>7.8</td>
<td>7.8</td>
</tr>
<tr>
<td>Public sector balance (%GDP)</td>
<td>-4.5</td>
<td>-4.1</td>
<td>-5.8</td>
<td>-3.9</td>
<td>-4.1</td>
<td>-3.9</td>
</tr>
<tr>
<td>Exports</td>
<td>350</td>
<td>371</td>
<td>401</td>
<td>437</td>
<td>563</td>
<td>663</td>
</tr>
<tr>
<td>Imports</td>
<td>567</td>
<td>583</td>
<td>618</td>
<td>752</td>
<td>764</td>
<td>864</td>
</tr>
<tr>
<td>Trade balance</td>
<td>-217</td>
<td>-212</td>
<td>-217</td>
<td>-315</td>
<td>-201</td>
<td>-201</td>
</tr>
<tr>
<td>Current account balance (%GDP)</td>
<td>-6.9%</td>
<td>-6.3%</td>
<td>-5.9%</td>
<td>-8.9%</td>
<td>-8.0%</td>
<td>-6.7%</td>
</tr>
<tr>
<td>Foreign debt (%GDP)</td>
<td>155.1%</td>
<td>161.1%</td>
<td>114.3%</td>
<td>98.5%</td>
<td>94.8%</td>
<td>95.4%</td>
</tr>
<tr>
<td>Debt service (%Exports)</td>
<td>17.3%</td>
<td>14.9%</td>
<td>16.7%</td>
<td>19.2%</td>
<td>16.1%</td>
<td>14.6%</td>
</tr>
<tr>
<td>Foreign currency reserves (in months of imports)</td>
<td>2.6</td>
<td>3.8</td>
<td>3.9</td>
<td>3.2</td>
<td>2.8</td>
<td>2.5</td>
</tr>
</tbody>
</table>

* Note that the dramatic rise in the forecast growth for 2005 is largely due to the revenues gained from the Sepon mine gold and copper exports. 2006 is also forecast to reach 7.5% growth for the same reason.

In 1986, the Lao Government launched its New Economic Mechanism, with the aim of moving away from a centrally-planned economy towards an open market. Since then the Lao PDR has made steady progress towards economic reform and continues to develop a comprehensive legal framework and the necessary infrastructure to encourage and attract foreign investment. In the mid-1990’s there was a particular emphasis on the hydropower sector.

Laos is classified as an LDC and relies on donor assistance. Presently, the average per capita income among Laos's population of between 5.7 and 5.8 million is estimated at US$ 399 per year, and US$1,900 on a PPP basis (2004). Lao Government spending has been severely curtailed in order to improve economic fundamentals. Social indicators are also among the lowest in the region, with an estimated average life expectancy in 2004 of 54.7 years.

A National Census* in 1995 and various household surveys made with the assistance of the Swedish Government Agency SIDA has enabled checks which demonstrate that the population growth rate is only 2.4% per year and that the year 2005 population is only 5.7 million. This means that per capita GDP is far higher than World Bank estimates.

Since 2001, the mining and construction sectors have been strengthening the foundation for economic growth and helped to provide stability. Demand for wood, textiles, and electricity exports has been strong from Laos’ two main trading partners, Thailand and Vietnam. More large investment projects in the hydropower and mining sectors continue to benefit the economy. However, growth is still vulnerable, with poor agricultural productivity subject to variable weather conditions. The sector is of crucial importance to the poor economy and farming and forestry still generate about 50% of GDP and 80% of jobs. Structural reforms have been slow and public sector restructuring is constrained by too close ties

* Census by Lao PDR Statistics Centre with assistance from the Swedish Government Agency SIDA
between the business world and the Communist Party. Furthermore, the current legal system is a barrier to attracting private-sector investment and development, including that from foreign partners.

2.4 State of investment
Current investment promotion, recognising the need to add value to local resources, is directed at the following sectors:
- manufacturing capacity, especially in light industry
- agriculture and food processing
- telecommunications
- tourism
- handicrafts
- chemical production
- building materials with the purpose of substituting domestic for imported products
- work linked to the Nam Theun II hydroelectricity project – for example power distribution
- mining and hydropower development projects

Donor-funded projects offer a significant proportion of the commercial opportunities in Laos, with major multilateral agencies such as the World Bank and Asian Development Bank active in various sectors including education, health, energy, agriculture and other infrastructure development. The opportunities offered can range from advisory consultancies to small tenders to supply equipment. There is also a small but growing market for overseas education in Laos.

As for the future, Laos has many advantages. It shares borders and common interests with Thailand, Vietnam, Cambodia and China, potentially a natural economic growth area. Despite its small domestic market the large populations in the surrounding countries should create new market opportunities as transit routes are being developed. These include Regional Integration schemes such as GMS corridors, the Mekong River Projects and the ASEAN multifaceted projects.

2.5 Energy projects
The Mekong runs through west of the country and with its tributaries its course within Laos is estimated have potential for up to 20,000 MW of power generation. Lao’s present power needs are mainly provided by hydropower with excess being sold to Thailand but only about 2 per cent of the potential hydraulic energy has been tapped. Laos depends on this demand to maintain its sales and current pricing. Development plans provide for further investment and an additional 5,000 MW capacity may be added within the next 15 years. The potential to develop the grid and sell capacity to its other neighbours is also an opportunity to reduce its dependence on one customer. Laotian potential for the generation of cheap electrical energy is a favourable factor in the development of its mining sector and the attraction of investors.

By the year 2000, seven power projects were already commissioned. The government had signed MOU's for 18 projects and another 10 of over 100 MW capacity had been initially contracted and site
investigations undertaken. The development period is dependent on the mobilisation of funds in which private investors are also encouraged to participate. Assuming that construction is carried out on schedule, the total installed capacity will amount 7,279 MW with annual generation of 36,700 GWH by 2010.

The major hydro projects in planning and built are:

- Nam Theun 1. This project is currently subject to survey and planning by Malaysian interests and construction may begin in 2007-8. It will be larger than NT2 below.
- Nam Theun 2 hydroelectric project (NT2) will be the largest in Laos so far with an output of 920 MW earning US$235 million per annum in gross revenues from Thailand.

The Independent Theun-Hinboun Power Company Ltd will be the first independent hydropower project (IPP) in Laos and is a joint-venture between the Government and foreign investors.

Laos appears to have considerable coal resources but further work is necessary to determine the extent of the deposits. Coal bed methane may also be associated with these deposits. For a period the Asian economic crisis beginning in 1997 reduced Thailand's demand for fossil fuels slowing the initial development of this energy sector but this is now changing with an agreement from Thailand to build a thermal power station.

The use of charcoal must not be ignored as this fuel is used for domestic cooking in the rural areas and is also used in the manufacture of bricks and roof tiles. However, the demand for charcoal is leading to deforestation which is a continuing threat to the environment. An urgent issue for the government is to formulate and implement a plan to substitute charcoal fuel with electricity, coal or natural gas.
3. Current Status of the Lao PDR mining sector

3.1 Lao mineral occurrences

The availability of cheap energy is essential for the development of the medium and large scale sectors of the mining industry and this, combined with an abundance of water are two of the most positive features of Laos from a mining perspective. These factors combined with the geological evidence of mineral occurrences in the Lao PDR would appear to be attractive to investors. The following mineral resources are reported (Lao DGM):

Table 4 Metals and minerals known to occur in Laos

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Minerals</td>
<td>coal, lignite, natural gas</td>
</tr>
<tr>
<td>Noble metals</td>
<td>gold, silver, platinum</td>
</tr>
<tr>
<td>Base metals</td>
<td>copper, lead, zinc</td>
</tr>
<tr>
<td>Stannous etc.</td>
<td>tin, tungsten</td>
</tr>
<tr>
<td>Ferrous metals</td>
<td>iron ore, manganese, chromium, nickel, pyrite</td>
</tr>
<tr>
<td>Minor metals</td>
<td>antimony, molybdenum, bismuth, mercury, beryllium, uranium, thorium</td>
</tr>
<tr>
<td>Industrial Minerals</td>
<td>aggregates, asbestos, clays, crushed rock, dimension stone, dolomite, feldspar, graphite, kaolinite, limestone, marble, magnesite, mica, quartz, sulphur, talc.</td>
</tr>
<tr>
<td>Evaporite minerals</td>
<td>gypsum, halite, potash, sylvite</td>
</tr>
<tr>
<td>Gemstones</td>
<td>Sapphire, garnet, topaz, quartz, amethyst</td>
</tr>
</tbody>
</table>

3.2 The present status of the mining sector in Laos.

The present industry in Laos may be categorised relating to mine size:

a. Large scale with the participation of foreign multinational investors and operators
b. Medium scale regional and local operators
c. Small scale local operators and artisanal mines

3.2.a. Large scale

Typically the large-scale operators are publicly traded companies with multiple mining operations, often located in several countries. To avoid risk to their investments, these companies specialise in mining one or two linked commodities and are very knowledgeable in application of the mining and mineral processing techniques needed to operate a successful, profitable operation. Stock market regulations in their countries of origin force these companies to be rigorous in their operating practices, paying special regard to safety, the environment, post-mining remediation and sustainable development issues. On the whole they are trustworthy and fully accountable to their shareholders and adhere to an ‘information transparency’ philosophy.

Currently there are two companies operating large-scale mines in Laos and both are owned and managed by Australian companies. These are:

- Oxiana Resources Sempon gold and copper operation
- Pan Australian Resources Phu Bia operation
These two companies are forecast to contribute 8 per cent of Lao GDP by 2008. Whilst these two companies are now actively mining, other large scale operators are starting to take a serious interest in Laos.

**Oxiana resources**

The Sepon project is being developed by the Australian company Oxiana Resources, in partnership with Rio Tinto and the World Bank. This gold and copper extraction project is located in the remote Savannakhet province of south central Laos. The Sepon Project Development Area (SPDA), encompasses some 1,947 km² and contains gold, copper and silver. It is estimated to hold 3.5 million ounces of gold, one million tonnes of copper and about three times as much silver as gold. The project has been achieved in 2 phases.

Phase 1 was the development of a gold mine and associated infrastructure to produce up to 150 000 oz/year of gold, which was first poured in late December 2002.

Phase 2 involves the development of a copper mine and associated infrastructure. It started in 2003 and first copper cathode production was achieved in March 2005.

In 2004, the Sepon gold mine, which was owned and operated by Lane Xang Minerals Ltd. (100% owned by Oxiana through its wholly owned subsidiary Oxiana Resources Laos Ltd.), produced 2.5 million metric tons (Mt) of ore at a grade of 3.01 grams per metric ton (g/t) gold compared with 1.57 Mt at a grade of 4.42 g/t gold in 2003. Recovery rates for gold and silver were 85.4% and 31.3%, respectively, compared with 87.7% and 39.0%, respectively, in 2003. In 2004, the total cash operating cost rose to $6,076 per kilogram ($189 per troy ounce) from $4,340 per kilogram ($135 per troy ounce) in 2003 owing mainly to increased royalties and operating costs.

In 2004 Oxiana increased the design capacity of the Sepon gold-processing plant to 2.5 million metric tons per year (Mt/yr) from 1.25 Mt/yr. Design and construction of the expansion project was completed on schedule in 10 months with a budget of $32 million.

At the end of 2004, Oxiana also completed the Sepon copper-processing plant. Mining of the Khanong copper ore body began in late 2004, and about 45,800 metric tons (t) of ore was mined and stockpiled by the end of 2004. The mine, has a capacity to produce 1.3 Mt/yr of ore processed by a plant that uses a whole of ore leach; the resulting leachate is processed by solvent-extraction electrowinning. The copper-processing plant is designed to produce 60,000 metric tons per year (t/yr) of copper cathodes. The $235 million Khanong copper project started production of copper cathode at the end of March 2005.

The Lao PDR Government and Oxiana are currently negotiating the purchase of 10% equity shares by the Lao Government as provided by MEPA.

**Pan Australian Resources NL (PAR)**

In December 2004, PAR announced that it awarded a contract to Ausenco Ltd. for the Phu Kham copper-gold feasibility study in the 2,600-km² Phu Bia contract area 100 km northeast of Vientiane. The contract to prepare a bankable feasibility study encompassed metallurgical and infrastructure studies, mineral...
resources estimation, design of an open pit, ore reserves estimation, drilling and blasting studies, geotechnical and hydrological studies and an environmental impact assessment. This study was completed in August 2005 and confirmed the potential for the Phu Kham copper-gold deposit to support an economically viable operation at ore processing rates of 9 Mt/yr with a capital cost of $138.6 million and 12.5 Mt/yr with a capital cost of $163.8 million; annual copper-gold production will range from 57,600 to 100,000 t of copper and from 1,617 kg (52,000 troy ounces) to 2,239 kg (72,000 troy ounces) of gold in concentrate with a current mine life estimated at ten years.

The Phu Bia gold project was completed for PAR in mid 2004 confirming that the project could support a technically and economically robust oxide heap-leach gold mine based on proved and probable oxide ore reserves of 7.5 Mt at 1.1 g/t for 8,100 kg (262,000 troy ounces) of contained gold. In November 2004 PAR revised its project estimates to 8.6 Mt at 1.1 g/t for about 9,300 kg (300,000 troy ounces) of contained gold. The Phu Bia gold project started producing gold on schedule in March 2005.

PAR has accepted a 10% Lao Government buy in agreement with the Ministry of Industry and Handicrafts.

3.2.b. Medium scale regional and local operators

The characteristics of these operators differ from those of the large-scale international companies. They are frequently joint-ventures of individual Laotians who assist with employment and local regulatory issues with companies, from Vietnam, Cambodia, Thailand and China; they mine less than 500kt per year of ore or product, (e.g. gypsum) and pay scant attention to operating practices, safety, the environment and sustainable development issues, operating at the lowest cost possible. The advantage they offer Laos is that they do bring some inward investment coupled with technology and know-how to the mining sector. However, given the opportunities for added value within the country it is difficult not to believe that these companies are looting Lao resources, attracted by the low-cost labour, a poor, almost non-existent regulatory regime and a number of high grade, outcropping resources.

The commodities mined by these companies include gold, iron ore, cassiterite, sapphires, tin, gypsum and coal.

Cassiterite is produced at the Nong Sun and Phon Thiou Mines in Khammouane Province, where tin ore production is concentrated at the Phon Thiou plant in the Nam Pathene Valley. All tin concentrates, which grade between 50% and 70% tin, are exported and sold to Malaysia Smelting Corp.
After signing an agreement with the Laotian Government in July 2000, Padaeng Industry Public Co., Ltd. of Thailand began mining operations at the Kaiso zinc deposit in the Vangvieng area in late 2000. All mined zinc ore is exported to Thailand for smelting and refining.

Gypsum is produced at the Dong Hene Mine in the Province of Savannakhet by the State Gypsum Mining Enterprise. Lanexang Gypsum Co. Ltd. (LGC), which had been exploring for gypsum in Laos since 1999 operates a gypsum mine with estimated reserves of 21 Mt in the Province of Savannakhet. LGC is a joint venture of Thai Gypsum Products Plc. of Thailand (70%) and the Laotian Government (30%). The country’s gypsum production was estimated to be about 120,000 t in 2003. Much of Laos’ gypsum production is exported to Thailand and Vietnam.

The Lao government now operates the sapphire mines at Huay Xia and the Lao military also operate placer gold deposits.

Laos’ first cement plant, Wanrong Cement Plant One, is the first Chinese-Laotian joint venture and markets product as the Golden Bull brand. The country’s second cement plant, Wanrong Cement in Vang Vieng, which is located about 150 kilometres north of Vientiane has a capacity of 200,000 t/yr and began operation in March 2002.

The country’s third Chinese-funded cement plant, with a capacity of 200,000 t/yr was constructed in the Province of Saravan. The new cement factory is 100% owned by Chinese investors invested about $30 million to build the plant. This Chinese company has a 30-year contract after which it must transfer this asset to the Government of the Lao PDR.

3.2.c. Small-scale local operators

These are characterized by a mixture of Lao local interests and cross border teams that are reputed to make informal agreements with provincial governments to mine mainly placer deposits of gold and cassiterite. They bring in low capacity mechanized equipment, pay low wages and have no consideration for safety, the environment or future development. The work they carry out is often seasonal and their mining practices threaten the environment with mercury. Their activity also damages water courses and traditionally navigable tributaries of the Mekong River.

3.2.d. Artisanal miners

These are typically family- or village-based enterprises where subsistence farmers mine placers when not engaged in agricultural production. Their production is often sold to cross border buyers who take advantage of their ignorance of market prices and issues such as mine regulations, safety, environmental protection and social responsibility. It is not known how many artisanal miners work in Laos but estimates vary between 3,000 and 15,000. Given that the working population is about 1.7m this would represent about 0.0053% of the work force. The main issue here is that two valuable commodities, gold and cassiterite, are being smuggled out of Laos.
(Note: In the last three categories, i.e. B,C & D there are numerous other mine operators, (In Laos 33 mining permits are current but few details were made available for the majority.)

3.3 Recent exploration and deposit evaluation activity

The Lao company, First Pacific Mining has a joint venture with Rox of Australia to explore the sulphide potential of the Pha Luang zinc-lead-silver deposit located about 180 km north of Vientiane. Rox holds a 60% interest in the JV and will complete a Bankable Feasibility Study and issue 14 million Rox shares to First Pacific at various stages of the project. An initial drilling programme was completed in September 2005, with significant intercepts of secondary lead-zinc mineralization. Following detailed soil sampling in early 2006, further significant drill intercepts were made of sulphide lead-zinc mineralization in April 2006.

Rox also has a first right of refusal to participate in other First Pacific Mining projects in Laos, including the Met-Kasi gold-copper project, the Hinheup iron ore project, and the Vang Khi coal project.

In February 2004 Vietnam Economic Cooperation Company obtained a permit from the Laotian Government to explore and survey gypsum deposits in Nadon Hamlet, Thakhec Town, Kammuon Province. The project involved an 18-month exploration and survey in a 1,550-hectare area with start-up capital of $1 million. A report on technical and economic facts is now under consideration.

The Vietnam Chemical Corporation (VCC) is exploring for potassium salts in Noongboc district, Laos's central Khammouane province. This initiative is an important project in the framework of the Laos-Vietnam agreement on economic, cultural, scientific and technical co-operation. The first phase of this 3 year $3.4 million potassium salt exploration project started in December 2004 on a 10 square kilometres area.

Vietnamese businesses have invested in Khammouane province, including the Corporation for Economic Co-operation (COECCO) with an investment project to mine gypsum.

The outlook for mining appears to be positive with further projects planned for the next 4 – 5 years especially in the large scale (Rox) and mid scale sectors. However, despite the interest shown by Oxiana and Pan Australian during the last five years Laos is finding it difficult to attract further foreign investment.
4 Lao Mining sector Competitive Factors

4.1 Current status of competitive factors

Investors evaluate many risks, (See above, Table 1 - Key risk criteria) especially in the large scale and medium scale mining sectors. The Lao condition in relation to these risks is examined here:

- The demand for Lao minerals is not strong domestically as there are few downstream industries. However, demand is high from adjacent and regional countries for the minerals now in production in Laos. The SE Asia region has one of the highest growth rates in the world and this trend is forecast to continue. Local expertise in market research and market economics needs to be established in order to select and target external markets for investment promotion.

- Infrastructure. This significant issue is dealt with separately in 4.2 below.

- The geological setting is good but the quality and quantity of available geological information needs to be improved. Although Lao appears to have strong prospectivity, much of the country is geologically unmapped (at 1:200,000 scale) and although many mineral occurrences have been noted by, for example BRGM, BGS and DGM, few deposits have been drilled and resource estimates are scant.

- Until Sepon and Phu Bia mines started producing, the mining sector in Laos was very small and a ‘mining culture’ needs to be nurtured, based on labour and professionals having industry experience. Educational facilities are needed to provide the practical, technical and professional skills for the sector. Apart from the few specialists who were well educated abroad in the 1980’s, sufficient numbers of professional and technical people able to staff Laos mining institutions and its investor’s operations is only just emerging. Urgent action is needed to improve mining education in all aspects of geological and mining technology. In Vientiane there is a technical institute which offers mining courses; with planning and capacity reinforcement this may continue to prepare Laos for future prospecting, exploration and mining activity. The University in Vientiane needs also to provide graduate geological and mining education.

- The fiscal regime of taxation, royalties and duties as applied to the sector

In the Lao P.D.R. information about mining taxes, duties, royalties and incentives is obscure which disquiets investors. There is also conflict between the MEM and the provinces in relation to licensing, as the provincial authorities believe that they should control this process. The Government of the Lao PDR negotiates a separate arrangement for mining permits with each foreign investor, which leaves all with unease about their terms of contract. Similarly, the rules regarding arrangements for Mineral Exploration and Production Sharing Agreements (MEPA) are confused. Investors must ‘propose’ financial terms of arrangement with the Government in applications for mining licenses.

In the past, inexperience and a lack of capacity have led to confusion in the gemstone (sapphires) sector where licences are only issued on a short-term basis with no clear indication of the rules applicable for renewals. Recently, the issue of licences for mining gems and gold was halted as the
government considered its future strategy for these products. The licensing issues do not build investor confidence.

- **Incentives offered by government to attract investors**
  The Lao PDR has established a sector investment promotion office to promote investment in its mining sector. The Department of Direct Foreign Investment needs training so that it can act as a single point of contact throughout the investment process, promptly facilitating all arrangements with Lao counterparts. The department should be managed as a ‘sales office’ setting clear objectives based on those minerals which are most in demand and most easily exploited in the short term.

- **The law related to prospecting, exploration and mining, permitting and tenure and the transparency of the processes for obtaining licences for prospecting, exploring and mining does not state on what grounds and conditions they may be given. This lack of clarity is unacceptable to investors.**

- **Similarly there is no explanation of the procedure required for extending these licenses. Other concerns include uncertainty over the use of subcontractors once permits are granted, the transfer of permits and the current law which allows the government to take a share of a foreign investor’s mining operation of between 10 and 30%. (Note: This latter point is subject to protracted negotiation [e.g. Pan Australian] and takes up much investor time and well as creating an unwanted and unhealthy partnership between the investor/operator and the government/regulator)**

- **Clear and practical environmental law is needed with a cooperative approach to regulation. Laos has an environmental agency, STEA, but its resources and technical capacity are limited and it relies on staff from MEM to assist with control of the mining sector. These staff have other responsibilities and so a lack of clear focus is confusing to operators (and investors). Environmental courses need to be included within the Lao mining technical education syllabus.**

- **The MEM should provide a clear definition of ‘sustainability’ as it applies to mining sector social issues. At present Laos appears to rely on the goodwill of investors in regard to social responsibility. The two Australian investor/operators have both established programmes of community support local to their mines. Laos needs to consider more formal arrangements for the future by defining the social obligations to be adopted by all medium and large scale operators.**

- **Lao offers a good record of political stability but good governance must be improved, especially in the provinces. The central government of Lao PDR and its provincial governments still lack the technical, human and financial resources to effectively organise and control the mining sector. This, combined with the opacity of some financial transactions and lack of transparency in the application of the law is not considered acceptable by investors.**

- **Economic performance and stable fiscal policy**
  Much investment in the Lao mining sector comes from abroad but some operators have obtained finance from the domestic banking system. The internal financial market in Laos is not sufficiently large enough to raise the large capital sums needed by medium and large scale mining
investors. However, steady growth over the last several years does provide a basis for future confidence.

- Fair and just system of law applied equally to all investor interests. Because of issues related to sapphire mining Laos was recently considered as high risk by mining investors. This attitude is changing as larger companies are seen to be successful in starting their operations in the country.

4.2 Infrastructural issues – Is Laos a special case?

4.2.a The main infrastructural issues

The adequacy, quality and distribution of infrastructure including paved roads and rail links, which remain passable in all weather, internal air links, power and continuity of its supply and good tele-communications coverage, are all essential in a modern society.

The topography of Laos imposes significant constraints on the development of infrastructure. Without paved roads and rail links the development of a modern mining sector is severely constrained. Whilst gemstones, gold, silver and to a certain extent copper may be hauled over dirt roads large tonnages of metals or their concentrates exceeding more than 100,000 tpy require either better-maintained highways or rail transport.

In the case of bulk commodities such as iron ore, potash or coal it is necessary to consider rail, river barge or maritime transport only. Mines for these products (other than coal which may be burned close to the mine to produce thermal power) must produce in excess of 500,000tpy if they are to remain competitive in regional and global markets.

These infrastructural issues impact on the pace at which mine development may proceed in Laos and it is logical that the first major foreign investments have come from gold and copper miners. Other than for local sale, coal, iron ore and potash will remain unattractive until suitable infrastructure is in place for their transport. The pace of development of Lao infrastructure and of its mining sector are interdependent and sectoral planning must take account of this.

Infrastructural support – A - equipment

Construction of infrastructure requires investment. Normally projects are funded by government and implemented by domestic companies. To implement projects such as major roads, bridges, water drainage, damming and diversion, building of railroads and loading/unloading facilities, heavy-duty construction equipment is needed and this may require foreign partnerships. Large projects will require significant investment and going forward Laos is likely to need significant grant aid to build its infrastructure

Infrastructural support – B - personnel

Construction equipment needs to be operated safely and maintained in working order by workers with mechanical, electrical, electronic and maintenance management skills. Thus a corps of qualified work persons needs to be developed through nationally funded and designed but provincially delivered training schemes.
The interdependence of large scale mining and infrastructure has a huge negative impact on the potential for mining investment in Laos. The government needs to consider this as a priority for urgent action. Without suitable road and rail links the potential for mining potash, coal and iron ore will not be achieved. The lack of infrastructure is both obvious and highly constraining and confirms that Laos cannot go forward (in mining) without addressing this issue.

4.3 **Status of current environmental management in the Lao mining sector**

4.3.a *Environmental Issues related to Lao’s mining and mineral processing activity*

Environmental management is an essential adjunct to modern mine planning and is an important consideration in investment decision making. Most of the small and medium scale mining operations in Lao work without any environmental plan, protection or procedures for post-mining mitigation. This has left mining areas scarred by artisanal and small scale mining as no rehabilitation or land reclamation activities have been implemented. Lao mining and processing environmental issues are common to many jurisdictions and elsewhere and during the last 25 years much scientific effort and analysis has been devoted to developing methods and systems to prevent environmental damage at source and to rehabilitate damaged areas. There is clear evidence that some of the senior staff at the MEM understand these problems but there are insufficient resources to implement preventative or remedial action.

In Laos it is only the two major operators, Sempon and Phu Bia, which have written Environmental Impact Assessments prior to mine implementation; both mines adhere to a strict regime of environmental standards, procedures and practices. These two companies may be seen as an advantage to Laos as they have ‘imported’ international standards of practice which may be used as a realistic benchmark for other operations.

The three main environmental issues in Lao’s mining sector are:

- The needs to assess, quantify, survey and implement remediation at ‘legacy mining sites’. i.e. sites of past mining and processing operations where environmental damage has not been remediated.
- The need to quickly establish a mining environmental office with central, provincial and local responsibility for environmental control, monitoring, planning and education. This office will need human resources, a laboratory, policing powers and administrative systems to enable it to take enforcement action when mine and process operations are in default.
- The need to start actively policing Lao’s environmental regime in the mining sector by ensuring the rules are respected by all mine and process operators and through a long term process of environmental education in mining areas.

In Laos evidence of environmental damage in mining areas is manifested by:

- Excessive silting of watercourses and stream systems
- Extensive surface erosion in the vicinity and downstream of mining operations
- Areas of land subjected to superficial silt sedimentation
- Areas of land abandoned due to no rehabilitation
Extensive areas of ponded stagnant water

In areas of medium and large scale mining there are other environmental issues:

- Some silting of rivers and streams from tailings runoff
- Intermittent dust issues related to the operation of heavy machinery
- Issues related to noise in the immediate vicinity of mines
- Damage to fragile infrastructure caused by high volume of vehicle movements
- Damage to the ecology immediate to operations as further land is prepared for mining
- Occurrences of chemical spillage causing catastrophic damage to streams and rivers

Similarly there are environmental impacts related to mineral processing activities as follows:

- Coverage of large areas with coarse and fine tailings
- Excessive silting of streams and watercourses from tailings or screening runoff
- Stream blocking which causes floods
- Discharge of trace metal solids and dissolved salts into streams;
- Denial of land, water and forest use in the vicinity of large operations
- Formation of polluted water pools near processing sites

Furthermore the washing media and water from processing is discharged directly into stream systems or onto adjacent land aggravating the pollution impact.

The MEM needs to be reinforced to provide the capacity to manage this sector effectively. There are a number of reasons for this:

- The MEM management capacity is inadequate for the demands on its services. Good managers are having to deal with environmental issues on an ‘ad hoc’ basis.
- Knowledge, experience and expertise in environmental matters are limited.
- There are insufficient environmentally qualified personnel within the organisation
- The laboratory is old and has few facilities for the analysis of environmental samples
- The MEM has little control or power at the provincial level
- The MEM has no resources or framework for the establishment of mining environmental educational programmes for small and medium scale operators in the provinces

These environmental issues need to be considered within a plan for the realignment of responsibilities and capacity within the MEM.

4.3.b Environmental Organisation and Role in Environmental Preservation

Management of the environment in Laos is the responsibility of the Science, Technology and Environment Agency, STEA. The present environmental laws were enacted in 1999 and a decree to implement these was agreed in 2002. Responsibilities for environmental matters are spread through different ministries and summarised in the table below.
Table 5. Lao environmental institutions

<table>
<thead>
<tr>
<th>ENVIRONMENTAL INSTITUTIONS</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Environment</td>
<td>Main coordinating agency for environmental planning</td>
</tr>
<tr>
<td>Science Technology and Environment Organization</td>
<td>Management activities across all sectors</td>
</tr>
<tr>
<td>Ministry of Agriculture and Forests, Department of Forestry</td>
<td>Key agency in the area of natural resource management</td>
</tr>
<tr>
<td>Ministry of Industry and Handicrafts</td>
<td>Responsible for industrial environmental issues</td>
</tr>
<tr>
<td>Division of Environmental Management</td>
<td>Environmental issues in mining development</td>
</tr>
<tr>
<td>Division of Mineral Resource Management</td>
<td>Environmental requirements for hydropower projects</td>
</tr>
<tr>
<td>Electricite du Laos</td>
<td>Design of pollution and occupational health standards</td>
</tr>
<tr>
<td>Ministry of Communication, Transport, Post and Urban environmental management</td>
<td>Water supply and sanitation</td>
</tr>
<tr>
<td>Ministry of Public Health</td>
<td>Urban environmental management</td>
</tr>
<tr>
<td>Regional administrations</td>
<td>Local environmental issues</td>
</tr>
</tbody>
</table>

4.4 Negative factors for competitiveness and remedies

Factors such as topography, infrastructure and the tax and legal/regulatory frameworks were examined in relation to international competitiveness. Table 5 summarises these and offers potential remedies. The remedies need inclusion within a long term development plan for the sector to be coordinated by the MEM with cooperation from other ministries such as Finance, Transport, Education, Health and Employment. Until this plan is developed and implemented change will be slow with officials confronted by a complex mix of tasks and responsibilities which need planning to priorities and handle. For example, the same officials at the MEM are currently responsible for mine safety, mine environmental issues and day-to-day cadastral management tasks. With unclear organisational responsibilities some tasks are being accomplished on an ‘ad hoc’ basis. This situation may be remedied through business analysis of the current MEM structure and operation, planning and the implementation of restructuring and training programmes.

Table 6 Negative factors impacting on mining investment in Laos

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>NEGATIVE FACTORS</th>
<th>POTENTIAL REMEDIAL ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geography &amp; Climate</td>
<td>-Mountainous with many rivers</td>
<td>-Requires long term approach to planning and implementing new roads, bridges and possibly railways</td>
</tr>
<tr>
<td></td>
<td>-High seasonal rainfall</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Open borders difficult to patrol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-No direct access to sea</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Requires long term approach to planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and implementing new roads, bridges and possibly railways</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Mining sector specialists need to train</td>
<td></td>
</tr>
</tbody>
</table>
| Infrastructure | -Tropical climate creates health issues | border police  
- Mining companies should be obliged to participate in local health education & care |
|---|---|---|
| - Poor road network impassable in monsoon. Many unpaved.  
- No railway  
- Mekong mainly un-navigable  
- Power network incomplete  
- Poor telecom beyond cities  
- Few river bridges – long transit times | - Plan and implement roads drainage, power grid, telecoms and bridges in areas of mining potential  
- Consider long term possibilities for Mekong navigation & coordinate with road & railway planning |
| Institutions | - MEM too centralised with little regional presence  
- MEM capacity to manage insufficient  
- Technical facilities (labs) inadequate  
- Office facilities unsuited to purpose  
- Organisation needs restructuring to redefine responsibilities purpose & focus | - Prepare MEM business plan to define responsibilities purpose and focus  
- Plan resource additions and training for MEM  
- Plan new premises including labs and equipment  
- Commence plan implementation |
| Safety | - Unexploded ordnance (UXO) prevalent  
- Criminal gangs disrupt travel  
- Risk of harassment at borders | - Focus UXO activity onto mineral potential areas  
- Improve policing and customs resources |
| Technology and labour skills | - No tradition of formal mining  
- Limited higher mining education  
- Limited vocational mining education | - Build on the mining education capability in the Vientiane Technical Institute  
- Encourage more education exchanges for best students & establish degree level mining education courses at Vientiane University |
| Information infrastructure | - Capacity to manage sector insufficient  
- Reporting systems inadequate | - Define needs of sector, especially reporting  
- Establish simple working procedures, practices & documents  
- Train users thoroughly  
- Phase in Implementation after training |
| National development program | - Needs to be related to mining activity & prospectivity | - Reconsider plan to take account of mining needs and importance.  
- Adjust Plan |
| Economic Policy | - Importance of sector potential should be better communicated  
- Should allow more Lao people to invest in sector  
- Banking sector is weak - foreign banks are barred from country-wide operation | - Develop best and worst case forecasts for sector performance  
- Focus investment promotion activity best long term opportunities  
- Develop mechanisms to permit local individual investment |
- Lao banks need to improve loan structures
- Banking skills and capacity need upgrading
- Permit foreign banks to operate provincially
- Policy needs to change for mining sector enabling long term lending
- Implement training programmes by international commercial banks

| Tax regime          | Needs updating to allow for international trends in mining taxation policy | -Adapt or change tax regime to be highly competitive with similar jurisdictions
|                     | Needs to consider methods of collecting tax from small scale and artisanal miners | Slowly introduce taxation to small scale and artisanal sector. Use training, better pricing and incentives to achieve this
|                     | Lao Government must rethink its 10% advance royalty policy | Modify the whole approach to Government revenue derived from mining taxes

| Law                 | Need to be oriented to encourage more foreign participation and JV’s in sector | Upgrade to latest industry standards

| Regulation          | Inadequate and unimplemented | -Establish an inspectorate based at the MEM
|                     | Require trained resources to implement | -Train a corps of inspectors
|                     |                                 | -Establish regional bases
|                     |                                 | -Educate impacting organisations e.g. local and provincial government

### 4.5 Positive factors for investment
As with negative factors, positive factors affecting investment include topography, infrastructure, systems, technology, economic policy, and law, among others. Table 7 describes positive factors affecting mining investment in Laos

Table 7. Positive factors affecting mining investment in Laos.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>POSITIVE FACTORS</th>
<th>COMPETITIVE ADVANTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geography &amp; Climate</td>
<td>- Geography permits multiple dam construction</td>
<td>- Abundant cheap electric power</td>
</tr>
<tr>
<td></td>
<td>- High seasonal rainfall</td>
<td>- Modern mining uses much water, its abundance infers low cost supply</td>
</tr>
<tr>
<td></td>
<td>- High average temperatures</td>
<td>- No heating of plant, workshops or equipment needed</td>
</tr>
<tr>
<td></td>
<td>- Laos at hub of Mekong region and can benefit from multilateral trade</td>
<td>- Easy access to all regional partners</td>
</tr>
<tr>
<td></td>
<td>- Abundant mineral occurrences</td>
<td>- Very promising prospectivity</td>
</tr>
<tr>
<td></td>
<td>- Laos is a very attractive country</td>
<td>- Pleasant place to work</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>- Low population density</td>
<td>- Time to improve infrastructure is reduced &amp; small local populations see benefits</td>
</tr>
<tr>
<td></td>
<td>- Government can align development to mining sector needs</td>
<td>- Need can be tuned to specific projects</td>
</tr>
<tr>
<td>Institutions</td>
<td>- MEM can be upgraded quickly</td>
<td>- Modernisation of MEM will place it ahead</td>
</tr>
<tr>
<td>Safety</td>
<td>-Relatively low crime rate</td>
<td>-Reduces security costs</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Technology and labour skills</td>
<td>-Large young population keen to work in technical industries</td>
<td>-Training is wanted &amp; readily accepted</td>
</tr>
<tr>
<td></td>
<td>-Also keen to take graduate education</td>
<td>-Diplomas in geology &amp; mining education are already available in Vientiane</td>
</tr>
<tr>
<td>Information infrastructure</td>
<td>-Reporting requirements not over intrusive (yet)</td>
<td>-Opportunity to help MEM formulate a rational reporting regime</td>
</tr>
<tr>
<td>National development program</td>
<td>-Starts to recognise importance of sector</td>
<td>-Encourages mining investment and activity which is perceived as a way to develop the Lao economy</td>
</tr>
<tr>
<td>Economic Policy</td>
<td>-Importance of sector is understood by some politicians and economists</td>
<td>-Laos is eager to further develop sector</td>
</tr>
<tr>
<td></td>
<td>-Recent policy improvements have opened up labour, investment and business opportunities</td>
<td>-Investment promotion in mining is considered important</td>
</tr>
<tr>
<td></td>
<td>-Private sector is actively encouraged</td>
<td>-Economy is becoming more market oriented</td>
</tr>
<tr>
<td></td>
<td>-Government is developing a market economy</td>
<td>-Permit foreign banks to operate provincially</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Deregulation, decentralisation and cooperation all in process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Private sector now subject to market forces on wages and prices</td>
</tr>
<tr>
<td>Law</td>
<td>-Laws in pace against expropriation of property, nationalisation or requisition</td>
<td>-Tax regime is not entirely cohesive but steps have been and will be taken to improve system and thus encourage inwards investment in the private sector</td>
</tr>
<tr>
<td></td>
<td>-Incentives include reduced tax rates, tax exemptions, tax holidays, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Profit tax (corporate income) 20%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Import tax 1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Profits may be repatriated</td>
<td></td>
</tr>
<tr>
<td>Laws</td>
<td>-In right circumstances mining law is acceptable but there are still some issues</td>
<td>-Government starts to recognise need to modify to international norms</td>
</tr>
<tr>
<td>Regulation</td>
<td>-By adopting international best practice investors should not suffer intrusive regulation</td>
<td>-Early bird investors should be able to guide the government on appropriate measures.</td>
</tr>
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</table>
5. Comparison of Lao mining law with other Mining Jurisdictions

The comparison of mining laws of Laos with neighbouring countries shows a noticeable difference. However, mining laws vary throughout Indochina and in many instances do not appear to meet international standards. For example, the only country of Indochina to clearly outline royalties in its mining law is Thailand. In contrast, the African country of Tanzania (which is used as a comparator in this report) has a mining law that is considered to meet international standards and which is viewed as attractive to investors. Thus, in terms of mining law, Indochina is considered less attractive than Tanzania.

At present, Laos does not have a competitive disadvantage compared with its neighbours. This is an opportunity for Laos to become the leader in mining legislation reform in the region, setting out a more competitive agenda in line with international standards.

Table 8. Comparison of main mining law features in SE Asia and Tanzania

<table>
<thead>
<tr>
<th>↓Criteria</th>
<th>Cambodia</th>
<th>Lao PDR</th>
<th>Myanmar</th>
<th>Tanzania</th>
<th>Thailand</th>
<th>Vietnam</th>
<th>Yunnan, China</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong></td>
<td>Mines and Minerals</td>
<td>Mining Law</td>
<td>Mines Law</td>
<td>Mining Act</td>
<td>Minerals Law Thai Year</td>
<td>Minerals Resources Law</td>
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<tr>
<td><strong>Minerals Covered</strong></td>
<td>Some Exclusions</td>
<td>Some Exclusions</td>
<td>Excludes gems and radioactive</td>
<td>No Exclusions</td>
<td>No Exclusions</td>
<td>No Exclusions</td>
<td></td>
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<tr>
<td><strong>Hydrocarbons Exempted</strong></td>
<td>1. All No</td>
<td>Yes</td>
<td>Yes</td>
<td>Separate law</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
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<tr>
<td></td>
<td>2. Oil+Gas Only</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Yes</td>
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<td></td>
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<tr>
<td><strong>Coverage</strong></td>
<td>1. All Land Not Specified</td>
<td>Not Specified</td>
<td>Some areas excluded</td>
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<td>Yes</td>
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<td>2. National Land Only</td>
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<tr>
<td><strong>Protected Areas</strong></td>
<td>1. All Prohibited</td>
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<td>Not Specified</td>
<td>Prohibited</td>
<td>Prohibited</td>
<td>Prohibited</td>
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<tr>
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<td>2. Case by Case</td>
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<td></td>
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<td>Mineral Deposit Priority vs.</td>
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<td>Stages</td>
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</tr>
<tr>
<td>1. Prospecting</td>
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<td>FDI Allowed</td>
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<tr>
<td>Permit</td>
<td>After 2 Years Work</td>
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<tr>
<td>Minimum Work</td>
<td>After Completion</td>
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<tr>
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</tr>
<tr>
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<tr>
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<tr>
<td>jointly</td>
<td>Maximum + 1 Year</td>
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<tr>
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</tr>
<tr>
<td>1. Direct</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Allowed</td>
<td>Yes Yes Yes Yes-</td>
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<td></td>
</tr>
<tr>
<td>2. Minimum</td>
<td>No No No Not Specified</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing</td>
<td>Via SOE or Central Agency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>First Offer Right</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Not Specified</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Proceeds</td>
<td>Local Currency</td>
<td></td>
<td></td>
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</tr>
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<td>Not Specified</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Not specified</td>
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</tr>
</tbody>
</table>
Planning of the Laos mining sector needs to include a timely review of all mining law and regulation to bring Laos into line with international standards. This issue is important and if dealt with very soon may help to offset the very negative impact of infrastructural shortcomings.
6.0 Markets - demand for Laos’ mined products.

There are issues that affect all mining markets and in defining Laos’ approach to planning investment promotion, two need special attention:

6.1 The mining cycle and investment timing
Increasing commodity prices, usually the result of increased demand and shortening supply, lead mining companies to increase production and add capacity. Extra supply emerges over time, as ramping up production capacity can take up to two or three years to achieve depending on the type of mine. When additional supplies move into the market prices start to decline. A point may be reached when the higher cost or inefficient producers are no longer competitive and are forced to ‘mothball’ or even close mines. At price levels near to peak the desire to invest in projects and open new mines is strong but investment and profitability need to be based on the analysis of worst case prices over the long term and an awareness of investment plans in adjacent and regional countries. Thus Laos may consider the present time as a strong reason to develop more copper, tin and gold operations and to start developing fertiliser and iron ore deposits. However, given the several years in which it takes to plan and develop a mine, current demand and prices are almost certain to be false premises on which to base investment decisions.

6.2 The extent of knowledge of its deposits, the value of its resources, and the prioritisation of their development.
Although Laos is known to have many occurrences of minerals and some significant deposits the precise extent and value of most is unknown. The present state of policy, law and regulation in the mining sector is likely to put at risk Laotian resources, which are unquantified, by allocating licences to operators who may be better qualified and equipped to understand their worth. There is a strong case for establishing an adequate capability to support a minerals industry before allocating many of the resources to foreign or joint venture partners.
Laotian interests must be considered in developing resources. Whilst the need to generate foreign exchange is important, with Laos’ poor infrastructure a national minerals development plan must take into consideration the local need for industrial minerals for construction purposes as well as the parallel need for income derived from commodity sales. There is a strong argument for the rapid development of industrial minerals deposits on a provincial scale (in mining terms small to medium sized pits and quarries) to support a bold national scheme of infrastructural improvements, essential to support mining sector development.

6.3 Implications for Lao PDR of growing demand in export markets
To prepare this report, from those minerals known to occur in Laos, MINDECO has selected the following for consideration when examining demand. These commodities were chosen because they are being produced in Laos now or known to be present in commercial quantity.
Precious metals: Gold and Silver. These are already produced by Laos and in the case of gold both Oxiana and Pan Australian do so on a large scale. The gold is exported to Australia for further refining.

Base metals: Copper, lead, zinc, tin (cassiterite). Copper is produced by Oxiana and sold in China, Malaysia Taiwan, Thailand and Vietnam. Tin is produced from placer deposits with all ore production being sold to Malaysia for smelting although production has declined from 1030 tonnes in 1997 to 593 tonnes in 2003. Zinc is mined by a JV between the Lao Government and a Thai company.

Ferrous metals: Iron ore. The known reserves are in excess of 62million tonnes but this is not yet mined.

Fuel minerals: Coal. The known resource is significant but currently only 60,000 tonnes per year are mined.

Industrial minerals: Potash, Barytes, Gypsum, Limestone for cement. Clays for brick and tile. Large deposits of potash are known to occur in Laos and in 2005 companies from China and Vietnam have taken licences to develop these deposits. Laos also produces over 100,000 tpy gypsum which is sold to Vietnam. Clays are used to manufacture tiles in two joint ventures with Thai companies.

Construction minerals: Limestone (crushed), sands and gravels. Some limestone is exported to Vietnam for cement manufacture and gravels and sand are needed by the local construction industry.

Gemstones: Sapphires are mined by the government and sold mainly into Thailand

These minerals are grouped by market demand in table 9. This table is based on information concerning imports by the countries listed. These countries have been categorised as follows:

- Countries Adjacent to (bordering) Laos, i.e. the most geographically accessible markets. China is the most important of these and this market is discussed in more detail later.
- ASEAN countries which include some adjacent to Laos and others more distant, separated by land or sea.
- Regional developing and developed economies. These include Bangladesh, India, Japan, South Korea and Taiwan. All of these countries have limited natural resources and depend on imported raw materials to sustain their industrial output.
- The rest of the world. This includes Australia.

Table 9. shows which commodities are imported by the countries in each of the categories described above (data on imports extracted from USGS country reports 2004).

Whilst Laos needs to consider its market selections there other factors which have a strong influence on defining which commodities are best sold locally, to countries adjacent and to countries within the region, including its ASEAN partners. The influencing factors are:

- Demand and capability of supply
- Cost of transport to market relative to commodity value.
• Grade, consistency, and quality of supply
• Price
• Continuity of supply.

6.4 Time to market
Laos is not now in a position to supply most markets for most of its known mineral occurrences. Apart from the Australian operations and the developing ROX operation, others are medium/small scale, artisanal and often seasonal. Adjacent, ASEAN and regional markets need all-year-round supplies of commodities in commercial quantity to sustain industrial processes and manufacturing plants. Furthermore the Lao infrastructure is not capable of guaranteeing regular supply.

By planning and implementing the development of Lao mines in concert with the necessary infrastructure, it will be possible to phase the completion of mine building to coincide with the completion of its necessary transport infrastructure. As a guide, table 10 shows the estimated time that will be needed to complete licensing, feasibility, financing and construction of typical mines based on Lao mineral resources.

For example, the table shows that there are between 8 and 13 years required to develop large producing operations for potash and iron ore. This should be sufficient time, if funds are available, to prepare road and/or rail transport to serve these mines.
Table 9. Commodities which Laos produces which are also imported by countries adjacent, members of ASEAN and regional to Laos.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Au</th>
<th>Ag</th>
<th>Cu</th>
<th>Pb</th>
<th>Zn</th>
<th>Sn</th>
<th>Fe</th>
<th>Coal</th>
<th>KCl</th>
<th>BaSO4</th>
<th>Gypsum</th>
<th>Cement</th>
<th>Clay</th>
<th>Lst.</th>
<th>Gravel</th>
<th>Sand</th>
<th>Sapphire</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>kg</td>
<td>kg</td>
<td>tonnes</td>
<td>tonnes</td>
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<td>tonnes</td>
<td>tonnes</td>
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<tr>
<td>Lao production 2005</td>
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<td>3405</td>
<td>30480</td>
<td>0</td>
<td>1,100</td>
<td>450</td>
<td>0</td>
<td>60,000</td>
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<tr>
<td>Bangladesh</td>
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<td>Regional</td>
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<tr>
<td>Taiwan</td>
<td>Regional</td>
<td>√</td>
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<td>Rest of World</td>
<td>Global</td>
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<td>√</td>
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<td>√</td>
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</tbody>
</table>
Table 10. Estimates of time required to develop mines for the selected commodities.

<table>
<thead>
<tr>
<th>Category</th>
<th>Commodity</th>
<th>Scale of mining</th>
<th>Type of mining (note 1)</th>
<th>Time before build</th>
<th>Time to finance years</th>
<th>Time to develop years (Note 2)</th>
<th>Min/Max time to produce years (Notes 3 &amp; 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precious metals</td>
<td>Gold</td>
<td>Small</td>
<td>Placer</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2 to 3</td>
</tr>
<tr>
<td></td>
<td>Gold</td>
<td>Large - heap leaching</td>
<td>Open pit</td>
<td>2</td>
<td>2</td>
<td>3 to 5</td>
<td>5 to 7</td>
</tr>
<tr>
<td></td>
<td>Silver</td>
<td>Medium (In association with lead)</td>
<td>Open pit</td>
<td>2</td>
<td>2</td>
<td>3 to 5</td>
<td>5 to 7</td>
</tr>
<tr>
<td>Base metals</td>
<td>Copper</td>
<td>Large - heap leaching</td>
<td>Open pit</td>
<td>2</td>
<td>2</td>
<td>3 to 5</td>
<td>5 to 7</td>
</tr>
<tr>
<td></td>
<td>Lead</td>
<td>Medium</td>
<td>Open pit</td>
<td>2</td>
<td>2</td>
<td>3 to 5</td>
<td>5 to 7</td>
</tr>
<tr>
<td></td>
<td>Zinc</td>
<td>Medium (In association with lead)</td>
<td>Open pit</td>
<td>2</td>
<td>2</td>
<td>3 to 5</td>
<td>5 to 7</td>
</tr>
<tr>
<td></td>
<td>Tin Cassiterite</td>
<td>Small</td>
<td>Placer</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2 to 3</td>
</tr>
<tr>
<td>Ferrous metals</td>
<td>Iron Ore</td>
<td>Large</td>
<td>Open pit</td>
<td>2</td>
<td>3</td>
<td>5 to 8</td>
<td>8 to 13</td>
</tr>
<tr>
<td>Fuel minerals</td>
<td>Coal</td>
<td>Large</td>
<td>Open pit</td>
<td>2</td>
<td>3</td>
<td>5 to 8</td>
<td>8 to 13</td>
</tr>
<tr>
<td></td>
<td>Coal</td>
<td>Medium</td>
<td>Underground shaft access</td>
<td>2</td>
<td>3</td>
<td>5 to 8</td>
<td>8 to 13</td>
</tr>
<tr>
<td>Industrial Minerals</td>
<td>Potash</td>
<td>Large</td>
<td>Underground shaft access</td>
<td>2</td>
<td>3</td>
<td>5 to 8</td>
<td>8 to 13</td>
</tr>
<tr>
<td></td>
<td>Barytes</td>
<td>Medium</td>
<td>Open pit or Underground</td>
<td>1</td>
<td>2</td>
<td>3 to 8</td>
<td>5 to 11</td>
</tr>
<tr>
<td></td>
<td>Gypsum</td>
<td>Medium</td>
<td>Open pit or Underground</td>
<td>1</td>
<td>2</td>
<td>3 to 8</td>
<td>5 to 11</td>
</tr>
<tr>
<td></td>
<td>Limestone for cement</td>
<td>Medium</td>
<td>Quarry</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2 to 3</td>
</tr>
<tr>
<td></td>
<td>Clays</td>
<td>Small - medium</td>
<td>Quarry</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2 to 3</td>
</tr>
<tr>
<td>Construction materials</td>
<td>Limestone crushed</td>
<td>Small</td>
<td>Quarry</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2 to 3</td>
</tr>
<tr>
<td></td>
<td>River gravels</td>
<td>Small</td>
<td>Placer</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2 to 3</td>
</tr>
<tr>
<td></td>
<td>River sands</td>
<td>Small</td>
<td>Placer</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2 to 3</td>
</tr>
<tr>
<td>Gemstones</td>
<td>Sapphires</td>
<td>Small</td>
<td>Placer</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2 to 3</td>
</tr>
</tbody>
</table>

Notes
1. This refers to the most usual extraction method
2. This refers to the typical time needed to build mine & process plant once finance and permits are in place
3. Minimum time is based permitting and financing in parallel being followed by mine development
4. Maximum time is based on permitting, financing and mine development all being in series
6.5 Trends in the production, consumption, and import of mineral products in Laos' neighbouring countries

6.5.a China

The Chinese economy, with more than 1.2 billion people will continue to demand large volumes of metals and energy minerals until well beyond the middle of this century. Laos has the time to establish a sustainable, environmentally safe and socially aware mining sector to supply this. Its proximity to China and particularly Yunnan province will give it an edge in terms of transport economics for bulk minerals such as iron ore, coal and potash. With an efficient sector, (implied as the mines will be new investments using the latest equipment and technology) once it starts to produce from these resources it should be able to derive long term sales.

It is possible that China will remain a market for mined products well into the future (Fig. 1). Within China, exploration is rapidly being promoted, and intensive efforts are also being made to invest in neighbouring countries, such as Mongolia. The same sorts of activities are unfolding in other countries as well. Therefore, it is essential for MEM and investors to have a thorough understanding of these trends.

Table 11 SWOT Analysis of the China Effect

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Chinese demand likely to remain relatively high for next decade</td>
<td>- It is difficult to forecast the future demand in China and for how long present trends will continue.</td>
</tr>
<tr>
<td>- The proximity of China makes it the logical largest trading partner for Laos</td>
<td>- A sound marketing approach usually involves selling to several customers in order to spread risk due to failure of one.</td>
</tr>
<tr>
<td>- Both countries share have a similar political outlook – Communist control with liberalisation of markets</td>
<td>- Chinese investment in sector may open door to poor social, environmental and sustainable development practices</td>
</tr>
<tr>
<td>- China has the capacity to invest in infrastructure to obtain the commodities it needs</td>
<td>- A sustainable mining sector, considering future long term domestic needs for resources may be a better option than short term plunder which will deplete future domestic supply</td>
</tr>
<tr>
<td>- Chinese demand is high and immediate</td>
<td>- Chinese technology is not up to standards of other more advanced mining partners e.g. Australia</td>
</tr>
<tr>
<td>- Chinese technology is more advanced than Laotian, thus Laos can learn from China</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>- JV’s with Chinese partners may accelerate development in the sector</td>
<td>- A rush to develop ventures with Chinese investors is likely to overwhelm an already under resourced DMG and encourage further corruption in the sector</td>
</tr>
<tr>
<td>- Inviting Chinese companies to participate in sector may encourage other ‘western’ investors to compete, accelerating sectoral growth</td>
<td>- China may tie mining related infrastructure development to long term commodity supply contracts tying prices into straightjacket deals,</td>
</tr>
<tr>
<td>- Chinese are known to offer ‘infrastructural</td>
<td></td>
</tr>
</tbody>
</table>
packages’ to encourage favours from developing countries. Laos could use this to negotiate power network, road and railroad investment.

- A surge in investment and thus royalties will assist with funding better sectoral law, regulation, environmental, social and sustainability programmes.
- Development of the sector would also help to stimulate more technical education in Laos

Since 2000 China’s demand for commodities of all kinds has soared and Table 10 shows growing demand and prices for commodities which Laos may have the potential to supply. However, whilst China’s markets may be attractive to its close neighbours several points need closer scrutiny. Nonetheless, there is rapidly growing demand for most mineral products in China.

Table 12  Selected commodities demand in China 2000 – 2004 by value (US$)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Year</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
<td>2001</td>
</tr>
<tr>
<td>Electric power</td>
<td>96267</td>
<td>94790</td>
</tr>
<tr>
<td>Crude fertilizer</td>
<td>5078</td>
<td>4128</td>
</tr>
<tr>
<td>Iron Ore conc.</td>
<td>1,857,699</td>
<td>2,502,759</td>
</tr>
<tr>
<td>Copper conc.</td>
<td>805,976</td>
<td>898,066</td>
</tr>
<tr>
<td>Tin</td>
<td>76115</td>
<td>79654</td>
</tr>
<tr>
<td>Zinc</td>
<td>201,726</td>
<td>214,053</td>
</tr>
<tr>
<td>Base metal ores</td>
<td>448,008</td>
<td>749,043</td>
</tr>
<tr>
<td>Coal</td>
<td>68,598</td>
<td>87,502</td>
</tr>
</tbody>
</table>

Note: 2005 figures not yet available

6.5.b Thailand

The adjacent country of Thailand is growing its downstream industries by making effective use of underground resources and industrial minerals. Cement and ceramic plants are coming into production, and both production and consumption have been increasing since 2000. Some industrial minerals, particularly materials used in the ceramics industry, are imported, but nearly all of the industrial minerals are produced domestically (Figs. 2,3,4). Thailand possesses the technology to both develop and use its resources. While
Thailand may be a market for some Laotian products, Laos should still be considered a country in need of technology transfer and technical training.

As a promotional tool, Laos should consider the establishing JV’s with Thai customers so that over time more and more value may be added in Laos to the point where finished products are exported, rather then raw materials. As Thailand develops Thai labour will become more costly, thus it will be in the interest of Thai manufacturers to transfer downstream activity to lower-cost Laos in order to remain competitive.

Fig. 1. Thailand’s mineral production
Thailand has a developed agricultural industry and thus may present a future market for potash fertiliser when it becomes available from Laos. Similarly, Thailand has a high demand for electrical power. This could be supplied from both hydro sources and coal fired power stations using coal mined in Laos. In both of these cases more work needs to be done to evaluate the Lao deposits and then investors/partners need to
be identified to supply capital and know how for projects. MINDECO sees these developments as projects that may be realised in the mid term, i.e. 8-12 years’ time.

6.5.c Vietnam
Vietnam has a fast developing Mining sector, which is based on good prospectivity similar to that of Laos. Vietnam is actively promoting the use of its industrial minerals and has been active in Laos to secure supplies of industrial minerals that do not occur in Vietnam or that are easier to procure in Laos. With many industrial minerals the primary cost consideration is that of transport. Considering the size of markets in neighbouring Vietnam, Thailand and China, it is likely that these markets are opportunities for development of Laos’ industrial minerals when they are processed to the necessary quality (grade) and their cost to end user remains competitive. This potential is likely to be constrained until better transport conditions prevail.

Currently, Vietnam is importing gypsum, limestone and fertiliser industrial minerals. Although Laos is not yet producing potash commercially, this must be a priority for the future.

6.5.d ASEAN
Laos is supplies cassiterite to Malaysia for smelting. (Historically Malaysia was the principal global supplier of tin but this role has now been taken over by Brazil). Malaysia also offers Laos opportunities exporting for gold, copper, lead, potash and gypsum. Of these only the metals can realistically be considered at present, again because of the infrastructure and limited capacity of supply. Malaysia has a very well developed industrial base and because of its financial capacity and political stability it should be considered as an important potential partner by Laos.

Other ASEAN markets such as the Philippines and Brunei and Indonesia are large and much more developed than Laos. However, they are distant and in the case of Indonesia are developing their own mineral industries. These ASEAN markets should be considered as secondary priorities by Laos until it is closer to establishing a range of mined products that it is capable of supplying in commercial quantities.

6.5.e Regional
The regional markets (with the exception of China which is treated as an adjacent market above) are dominated by Japan, S. Korea, Taiwan and to a lesser extent N. Korea which has both political links and some strategic mineral supply interests in Laos. Of these the most promising is Japan, which is strongly lacking in mined commodities and needs to buy metals and industrial minerals of all kinds, throughout the world, in order to guarantee its industrial producers adequate raw material supplies.
Japan, of all the regional markets also has powerful financial and technical capacity and a history of partial ownership and control of its foreign investments in mining ventures to guarantee its supplies. It is thus a
most important potential partner for Laos. If Laos supply capability is developed, copper, lead, zinc and iron ore would be commodities favoured by Japan.

Japan has the advantage of reputation and experience in developing partnerships with developing countries. To develop mines and, in some cases primary conversion technology to produce raw metal, Laos will need both technology and finance, both of which Japan is able to supply. Japan must be a priority target for investment promotion by Laos.

South Korea, which has a developed industrial economy, is also a potential partner. North Korea has close ties with Laos because of historical political association. However, other than for its own strategic purposes it is unlikely to have the economic capacity to provide either capital or know-how to Laos.

6.5.f Global

Australia (a regional country in the sense of Pacific Basin region of which Indo-China is a part) with its dominant position in Lao mining, exported US$ 61.1m worth of gold and copper from Laos in 2003-04 which is 90.1% of all Laos’ mineral exports.

Australia is the current largest mining partner in Laos and is likely to remain so for some time. However, Australian interests will probably remain focused on gold, copper, lead, zinc and iron ore, all commodities for which it has strong technical expertise and production experience.

Apart from Australia, Laos is unlikely to need to export its commodities to other distant destinations given the significant growth in the Asia Pacific area. However, India, Bangladesh and Sri Lanka may also represent future opportunities, especially for fertiliser minerals.

Bullion, i.e. Gold and Silver, may eventually be refined in Laos. In this case this could be offered on the international markets with the objective of achieving the best prices available for these metals.

Over time Laos should encourage partners from a variety of countries to participate in its mining sector. To rely on one dominant partner, for example China would place Laos in a weak position, if for example market demand changed, alternative and cheaper supplies were found in China or some political issue caused a disruption to trade between the two countries.
7. Supply Issues – technology and investment

7.1 Technology

MINDECO has commented on the time needed to evolve mining technology at the start of this paper on competitiveness. Laos, fitting the revolutionary model of development, will not have time to develop its own mining technologies. Nor need it do so as these are well known and readily obtainable from industry partners. However, to support its developing mining industry Laos will need to provide educational capability and sufficient capacity at its university and in its technical schools to educate a corps of people able to work in the industry. A wide range of disciplines are needed:

- Chemistry and Physics, both necessary to understand mineral processing
- Biology for environmental purposes
- Mathematics, needed for accounting and IT
- Computer technologies to use in plant and business management and all technical matters related to geology, mapping, maintenance, design, data collection and storage, data interpretation, communications.
- Engineering of all kinds, mechanical, mining, electrical, electronic, computer, transport and structural.
- Surveying both topographic and geological
- Management, business, operations and process
- Languages to permit dialogue with investors and to assist with promotional work
- Economics and statistics to enable positioning of the industry in a global context.

This list is only a sample of the subjects needed. The mining sector development plan will need to incorporate an educational needs analysis and plan, which in turn should be coordinated with planning for educational requirements in other sectors.

Similarly, Laos will need to encourage the development of small businesses capable of providing local services to maintain, rebuild and in some cases replace equipment used in mining and processing. Artisanal skills such as turning, welding, building, structural steel assembly, motor rewinding and painting will all require teaching to international standards together with the appropriate safety measures associated with each discipline.

Laos with its small population should perhaps consider obtaining advice and forming a partnership with the government of a smaller country that has recently shown excellent progress in respect of the skills development of its young people. Singapore and Mauritius have made significant progress during the past 20 years in this respect and are possible candidates.

Foreign investors, if serious, will bring their latest (and thus, presumably most efficient) technology with them when developing mines. This will apply to the large and medium scale sectors.

The input of technology to the small scale and artisanal sectors will most likely need to be the responsibility of a unit within the MEM, as foreign partners are unlikely to be involved at this scale. It is possible to envisage a unit that has expertise in both funding co-operatives and providing simple
technologies and training to support this sector. The funding would be provided by local banks, possibly with some guarantees from central government (in turn funded from the royalties obtained from the large and medium scale sectors.) This should be a very specific and focused agency within the MEM, not an add-on to some other MEM activity.

7.2 Investment
In the large and medium scale sectors investment the amounts of money needed to develop mines are unlikely to be available within Laos. The profiles of funders are likely to be:

- Large scale: External multinational mining companies and grant or loan aid to Lao government from external aid sources (e.g ADB).

- Medium Scale: External regional, ASEAN and adjacent based companies with some local Lao partner participation.

(Comment has been made concerning the small scale and artisanal sector in the last paragraph of 7.1 above.)

At present the competitiveness of Laos compared with other mining jurisdictions is likely to be a barrier to investment from all parties. The issues related to mining law are further aggravated by problems associated with infrastructure, the skills base, political risk and lack of detailed geological information all of which have been discussed earlier in this section.

It should be noted that the scale of investment needed for larger mines is huge with amounts between US$ 250million and US$ 750million being quite common. In the case of medium scale operations investments amounting to tens of millions of dollars are common and to a great extent amounts depend on the type of separation and processing required to dress the minerals. It is in this medium scale sector that most investment is likely to occur in the short term and surface deposits of industrial and fuel minerals, e.g. gypsum and coal that require little processing, are already proving to be attractive to investors from adjacent countries.
8 Advantages and Disadvantages of Laos to different Investor types

8.1 Introduction

Sections 1.3 and 4 above have discussed the principal positive and negative factors that foreign mining investors in Laos will encounter. However, the level of risk for investors is not simply judged by the specific issues that have been discussed but by the amount of investment that is put at risk by any single risk event that may occur to reduce or stop mine production and thus slow or stop the flow of money needed to provide a return on the investment. Examples of such events are:

- Government intervention to close mining until some legal or financial issue is resolved. (In Laos this already occurred in 2000 at a foreign managed sapphire mining operation).
- A ‘bad’ monsoon where rainfall is such that access to a mine becomes impossible for several weeks. This is related to bad infrastructure but may be an increasing risk due to climate change resulting in more intense precipitation.
- Customs procedures at the border holding up essential components. For example, many large scale mines depend on one large crusher for breaking all product entering the mill. If a drive shaft, motor or cone bearing breaks it is essential that a replacement may be obtained immediately.

8.2 Types of Investor

8.2a Large Scale Investors

The types of company investing at this level will be amongst the 100 or so the multinational mining companies that produce some 70 to 80 % of the world’s metals and industrial minerals. These companies are very risk averse. There are different risks depending on the types of mineral mined, for example a gold/copper operation which produces metal at site will be less preoccupied with the condition of the infrastructure than an industrial mineral producer of potash who will need to ship large tonnages (in excess of 500,000 tpy) to market. This analysis looks at common issues and then some specific issues in this respect.

Laos is attractive because:

- Currently competition for concessions between the multi nationals is not great. This is largely as a result of the shortage of geological data. However, the companies that are willing to develop this information themselves have found good quality deposits and evidence of further good mineralisation adjacent to their principal targets.
- The Government is opening up to mining investment. Thus the investment climate is continuously improving.
- There is plenty of unskilled labour at relatively low cost.
- Water is abundant and power availability is adequate and also likely to become cheaper as more hydropower comes on-stream.

Laos in unattractive because:

- The Lao government reserves the right to make a ‘buy in’ of to up to 30% of the mine value after it is established.
The infrastructure is poor and links to adjacent countries and ports are inadequate. Also, to date there is no rail network.

The issues related to licensing, security of tenure, government investment in mining (and the conflict created by this dual role as investor and regulator) and the lack of transparency in the MEM’s dealing with private companies, confuse the investor. He seeks absolute stability over the long term. The risks associated with uncertainty are not acceptable to most investors whose established company policy is not to pursue ventures in jurisdictions with these risks.

Lack of graduate level specialists to manage and operate mines. Mining education requires development in Laos.

Laos specific issues:

- Industrial minerals. The poor infrastructure will have a particular negative impact on all operations but especially on those for iron ore, industrial minerals and fuel minerals, which typically use rail, river and seaport facilities for getting their product to market.
- Gold copper and other precious and base metals. The good prospectivity will continue to attract ‘junior’ companies to look for these metals. These are carefully observed by the multinationals as they take the exploration risks. In cases where the prospects are good the junior companies are then bought out by the multinationals. Laos needs to adapt its legislation to facilitate and not obstruct this process of licence transfer as it is a common transaction on the route towards mine development.

8.2b Medium Scale Investors

In terms of the practical issues related to mining these companies benefit or suffer from the same problems as the large scale investors. However, in the case of the medium scale operators there is a greater dependence on joint venture operations. Also, medium scale investors tend to be from adjacent or regional countries and are mainly interested in metallic placer deposits and industrial minerals.

Laos is attractive because:

- Medium scale miners find the formalities of regulation burdensome. Thus Laos, with legislation but little capacity to police operations, has an advantage for them as they can operate without too much state interference. This applies to both safety and environmental issues. It is an attraction that needs to be removed by better policing and introduction of a cooperative policy which encourages the best to remain operating whilst weeding out the ‘bad’ operators.
- There are many known small occurrences of minerals and cheap labour to exploit these. The disadvantage of this is that little money stays in Laos, the profit being taken abroad.

Laos is unattractive because:

- The banking sector is not geared to provide mining finance. This is critical if Lao people are to be enables to invest in mining operations. It also reduces the Lao capacity to participate in joint
ventures, thus giving local people little control over both operation and ownership of medium scale mines.

- The lack of clarity over regulation and licensing is felt at this scale.

8.2c Small Scale Investors

These operators benefit or suffer from the same problems as the medium scale operators but also see other advantages.

Laos is attractive because:

- The policing of operations is very weak. Small scale mines, taking little risk and with a minimum of equipment can produce from placer and surface mines at low cost. Their operators also take advantage of the ignorance of local people regarding the true market value of the products mined (e.g. cassiterite, gold, sapphires.)
- At present, at this scale there is no control over polluting behaviour or the need to reinstate the environment after mining. This keeps small scale costs to a minimum.

Laos is unattractive because:

- The monsoon disrupts mining, especially of placer deposits and open pits for several months. These operators do not have the capital to install simple drainage measures to protect against flooding.
- The lack of clarity over regulation and licensing is felt at this scale.
- The processes involved in licensing and permitting are the same as for large scale. This is onerous for small scale operators. Laos, in preparing reformed should consider implementing simplified procedures for small scale and artisanal miners.

8.2d Artisanal Investors

Artisanal miners tend to be locally based families operating small placer or surface deposits in the neighbourhood of their home villages. At this stage they largely operate beyond any the law or regulations. Investment is not an issue for them now. As the Lao mining industry develops it will be impossible to curtail their activities, which are traditional. Therefore it will be better to establish village or village cluster based cooperatives with appropriate mechanisms for funding of simple equipment and training in mining methods, safety and environmental matters. Within the funding mechanism a means may be found to permit local people to invest in local mines.
9. **Potential promotion strategies for four categories of investor**

9.1 **Categorisation of investors**

The scale of investment in mining is generally in direct proportion to the scale of mining project envisaged. This has been used to here to categorise the types of investor required to supply adequate funding for mine operation. The mine categories considered are:

- Large scale.
- Medium Scale
- Small Scale
- Artisanal

Of these categories the last two are often combined although MINDECO considers the last to represent a classification typically given to informal and essentially illegal operations and the second last to legalised but very small mines. In the longer term, to exercise its authority over all mines in Laos one of the objectives of the MEM should be to bring all artisanal operations into a regulated structure which would then place them in the legal small scale sector. The promotion of each sector is considered here:

The analysis comments on the same criteria for each category of investor

9.1.a **Large scale mine investors**

These mines operate within the Lao regulations and to international standards. The operating companies regard safety, the environment and social issues as very important. They are operated by teams of professional and qualified mining managers and sell the large volumes of their products into international commodity markets. The income from this mining provides relative wealth and social benefits (schools, healthcare etc.) to the local community. Taxes and royalties are paid to regional and central government and in theory should benefit the whole economy. Profits after tax are repatriated, some to pay dividends to their public shareholders. Accounts are fully transparent and are reported according to strict laws agreed by the international mining community.

The investor profile of these companies ranges from institutions such as banks and insurance companies to private individuals. In Laos, the government also has a right to take up to a 30% share in these operations but does not always do so. The mine owners, operators and management plan the systems and processes that will be used in exploitation and purchase appropriate machinery. In Laos, it is inevitable that virtually all of this will be imported by the mining company.

These miners contribute to their local employees and the surrounding communities by investing in schools, healthcare and environmental measures that provide benefits which may be continued after mining ceases.
Type of investor. Multi-national mining houses, junior companies and specialised internationally medium scale companies. Invest in the range of US$50m to US$750m depending on substance to be mined. Life of operation between 10 and 50 years.

Regulation. Adhered to in all respects. Companies normally operate according to internationally accepted standards

Safety. Essential, measured and rigorously enforced

Environmental Essential, measured and rigorously enforced. Also, forward plans include measures (and financing) for mine closure.

Technology Latest and most efficient and productive available.

Training Practised throughout mine life to improve existing employees and to induct new personnel.

To attract these investors the first priority of the MEM will be to prepare and implement a mining sector plan which maps out the Lao mining sector development for the next 25 years or so. Broadly, it should be possible to put in place new Policy, Mining law and regulation designed to be the most competitive in the region, within a two – three year period. In parallel with this, programmes to improve mapping, the cadastral office and to implement a Mining Focused Investment promotion office may be started. These actions may be coordinated planning in the transport, power and educational sectors to align future development with mining needs. The publication of this plan and evidence to show that it is being implemented will itself provide confidence to future large scale investors.

However, these are relatively passive (despite their necessity) steps in comparison with the active role that must be pursued by the Mining IPO to identify, inform and encourage major investors to consider Lao in their future mining plans. This will require marketing research, direct contact with prospective investors, participation at Investment shows, the preparation and careful presentation of data in seminars, and technical papers in the trade press and prompt active follow up of all enquiries. The IPO will need to ‘hard sell’ the advantages of Laos to a mix of multi-national and regional players. These will include not only mining companies but also Governments and Institutions with a strategic interest in securing their future mineral supplies. Thus China, Thailand and Japan will also be priorities for this activity.

9.1.b Medium scale mine investors

These mines, although smaller than the large scale operations, require the same regulation `with regard to safety, the environment or social issues. As joint ventures they may have a few supervisory staff from abroad but will use local for supervisory and operator tasks. It is likely that they will be less well regulated than the self-regulating large scale sector and so policing safety and the environment at this scale becomes more important. The income from this mining is generally gained abroad from sale of exported product
which may have further value added to it (e.g. kaolin used in tile manufacture in Thailand). Thus for Laos, records of production are important in order to extract the full royalty and taxes from the operators.

These middle-range investors are profit oriented and not concerned with what they can invest in an operation but more with what may be extracted from it. Equipment and processes may be inadequate and practices may take short cuts in terms of safety and environmental.

These miners do not consider communities as their responsibility and will need to be educated in this respect.

- **Type of investor.** Government, manufacturing companies seeking cheaper raw materials, small mining companies from adjacent countries, large local companies forming joint ventures with foreign partners. Investments of more than US$ 20m are rare and between US20-50m very rare. Safety, environmental and educational programmes must be imposed within the investment package and any joint venture arrangement
- **Regulation.** Maximum within capacity of MEM. Should include property boundaries for the avoidance of disputes with other miners. Regulation enforcement may be reduced once operators are seen to adopt and maintain good practice.
- **Safety.** Essential and rigorous
- **Environmental** Essential and rigorous
- **Loan guarantees** Initially the government may need to assist the Lao JV partners with financial incentives provided through the Lao banks.
- **Technology** Over time the import of old or used equipment should be phased out for safety and environmental reasons.
- **Training** Essential for both managements and employees

Again, to attract these investors the first priority of the MEM will be to prepare and implement a mining sector plan which maps out the Lao mining sector development for the next 25 years or so. The new Policy, Mining law and regulation and the other improvements designed to be the most competitive in the region, will all apply to these operations.

The publication of this plan and evidence to show that it is being implemented will itself provide confidence to future medium scale investors. However, to encourage Joint ventures between Lao companies and these foreign investors, most of which are from adjacent countries at this scale, a system of bank funding for the Lao partners will need to be established.

The Mining IPO will need also to identify, inform and encourage these types of investor to consider Lao in their future mining plans. An important marketing tool will be ‘gap analysis’ which may be used to identify opportunities, for example among cement producers where Laos could provide an additional source of raw materials. This will require marketing research, direct contacts with suitable partners,
participation in regional and ASEAN mining and investment events and preparation and careful presentation of economic data in seminars, and technical papers in the trade press and prompt active follow up of all enquiries.

The IPO will need to sell the advantages of Laos to a mix of players based in the region and especially in adjacent countries. This activity may be best conducted by having a small team travelling to make direct contact and conduct sales meetings with prospective JV partners. These will include not only mining companies but also Governments and Institutions with a strategic interest in securing their future mineral supplies. Thus China, Vietnam Thailand and Malaysia will be priorities for this activity.

9.1.c Small scale mine investors

These mines like to operate with as little regulation as possible. In many respects this sector is just a slightly better organised type of artisanal mining. The mines are operated by (often exploited) part time labour using unsafe practice to obtain small quantities of product which the owners export and sell abroad.

The income from this mining provides a seasonal cash supplement to the subsistence farming of family groups who otherwise would live outside of the cash economy.

Major investors do not usually become involved with this level of activity. However, in some instances the product buyers do invest in some rudimentary equipment to help the miners increase their productivity or to access, for example, deeper water or deeper pits. This equipment may include pumps, simple conveyors and screens and generators to provide power.

These small scale mines are dangerous but do provide additional income to families and communities and thus this activity needs to be encouraged and regulated by the MEM. This may be achieved in future by establishing bank loan facilities which would be able the owners to obtain small loans for equipment and eventually to adopt safer and more efficient practices. Once more formal operations are established, record keeping, accountability and regulation may then be encouraged with simple training schemes to instil best practice and understanding of the need to operate legally and with environmental consideration.

- Type of investor. Small companies from Laos and adjacent countries. Owner operators.
- Regulation. Minimal at first but gradually better enforced in parallel with training programmes. Should also include property boundaries for the avoidance of disputes with other miners.
- Safety. Essential and fit for purpose
- Environmental Essential and in the case of gold, aimed at understanding and dealing with mercury issues.
- Loan guarantees Through Lao banks to provide loans for equipment modernisation and upgrading.
- Technology As these small mines improve their equipment and practices they should be encouraged to form clusters according to commodity groupings. For example, local aggregates producers could be clustered to form provincial groups thus enabling more efficient buying,
management and marketing skills to develop. Eventually these provincial clusters could also be coalesced into national firms operating as medium scale multi site operations.

- Training Essential at the early stage to ensure that new practices and procedures are correctly established. May be continued over time to introduce better practices as the operations develop into larger units.

Small scale mines need to be encouraged by the MEM. Essentially, this and artisanal mining represents the historical ‘mining culture’ in Laos and its participants should be given the opportunity to develop within the emerging larger industry. As the larger scale operations are established the best miners from these operations are likely to become the labour, and in some cases, the experienced and educated artisans and managers that will be needed by the medium and large scale mines.

9.1.d Artisanal mine investors

These mines operate without regulation and thus regard to safety, the environment or social issues. They are operated by (often exploited) part time labour using unsafe practice to obtain small quantities of product, often alluvial, which is then sold at low prices to local dealers. The income from this mining provides subsistence to family groups who otherwise would live outside of the cash economy.

Investors do not usually become involved with this level of activity. However, in some instances the product buyers do invest in some rudimentary equipment to help the miners increase their productivity or to access, for example, deeper water or deeper pits. This equipment may include pumps, simple conveyors and screens and generators to provide power.

These miners contribute greatly to their immediate families and communities and thus this activity needs to be encouraged (not banned) and organised. This can be achieved by establishing cooperatives (best organised by women) which would be able to obtain small loans for equipment. Once cooperatives are established, record keeping, accountability and regulation may then be encouraged with simple training schemes to instil best practice and understanding of the need to operate legally and with environmental consideration.

- Type of investor. Government, local communities, households, itinerant traders offering a participative programme which lends very small amounts >US$10,000 to small cooperatives in return for adherence to training schemes and a minimum regime of regulation and reporting. Safety, environmental and educational programmes may all be considered within the investment package.

- Regulation. Minimal but should include property boundaries for the avoidance of disputes with other miners.

- Safety. Essential and fit for purpose

- Environmental Essential and in the case of gold, aimed at understanding and dealing with mercury issues.

- Loan guarantees Initially government but in parallel the Lao banks should be encouraged to participate in this programme as the cooperatives develop
Technology
Following establishment of the cooperatives longer term groupings of cooperatives may be established to turn the more promising mining areas into formalised small scale mines, thus increasing efficiency and fostering better practices.

Training
Essential at the early stage to ensure that new practices and procedures are correctly established. May be continued over time to introduce better practice as the operations develop into larger units.

This activity should not be curtailed by the MEM. Essentially, this artisanal mining represents the historical ‘mining culture’ in Laos and its participants should be given the opportunity to develop within the industry. As the larger scale operations are established the best miners from these operations are likely to become the labour, and in some cases, the experienced and educated artisans that will be needed by large medium and large scale mines.

9.1.e Summary of investment strategy
It becomes clear, from the evidence reviewed in the whole report as well as the considerations discussed above in this section, that the MEM needs to take a two level approach to investment in the Lao mining sector.

The first level, aimed at the large and medium scale sectors, requires a marketing approach with steps taken to inform as follows:

1. Prepare high quality information for use by potential investors
2. Research to identify the most appropriate target companies to receive the information
3. Follow up to qualify the recipients as interested or not.
4. Further follow up and dialogue with the interested parties.
5. Invitations to Laos for detailed discussions potential – site visits and meetings with existing investors
6. Continued follow up until negotiations are completed or curtailed.

This ‘selling’ cycle can be repeated with many companies and over time repeated as the number of investors increases.

At the second level, with small scale and artisanal sectors the MEM needs to act more as a financial facilitator and training organisation providing:

1. A channel to banks for small loans that will enable these classes of mines to purchase modern equipment and produce more efficiently
2. Training provision to teach these classes of mines the purposes of regulation, safety and environmental protection and the need to work according to specific rules.
3. A facilitator for clusters of these individuals and small mines to form larger and more efficient productive units.
In this role the MEM work will need to be carried out in a very cooperative spirit and not in any adversarial way. The whole approach is about improving, formalising and building on the traditional mining base that exists. It is likely to take several years before the majority of small scale and artisanal miners agree to work under the regulatory control of the MEM.
Annexe 1        Downstream potential in the mining sector

A.1    Introduction

The World Bank has asked MINDECO to consider downstream activities that might become feasible if Laos develops production capacity for some of its mineral resources. This annexe suggests possible opportunities which are offered as concepts only. Much further detailed technical and financial analysis will be required before going forward with a shortlist of realistically achievable projects.

Before downstream businesses can be created, mineral resources and associated infrastructure must be developed. Once these preconditions are met it is possible to determine whether or not there is demand (a rational economic case) for downstream business in Laos or adjacent countries. This may include regional or global demand, which in turn requires on physical access to international markets.

The potential to create downstream business will depend on issues such as the availability of appropriately skilled labour and the time and effort needed to complete transfers of technology and ‘know-how’. Industries consuming industrial minerals are easily started (e.g. clays for ceramic tile manufacture or potash for grades of fertilizer). The technologies of these industries are well understood, fairly cheap to acquire and quickly learned; furthermore there is usually a domestic market. However, in the case of metallic minerals, complex technical processes often sit between mineral production and metal consumption. The cost, scale and skills needed to install and operate these processes efficiently and profitably are an important barrier to establishing them, especially in small countries. These factors slow the pace of industrialisation inhibiting the development of their dependent downstream businesses.

A1.1.    Downstream potential factors

Laos already produces a number of metals, metal ores, industrial minerals and fuel minerals. Few are converted in country and most are exported as concentrates. In developing an approach to the issue of adding value to Lao’s mined products several factors need to be taken into consideration:

- Market needs – local, regional and international
- Skills available in country
- Costs of power, transport, buildings and land
- Costs of training
- Level of technology needed to add value
- Overall project costs including capital
- Time needed to achieve sales and ROI following project start up

Table 9 categorises the typical characteristics of down-stream operations. Examples of the types of business are:

A - jewellery producing workshop, local brick maker, metal fabricator
B - solder manufacturer, copper wire producer, iron foundry, road construction company
C - power generator, coking plant, natural gas producer and distributor, fertiliser plant

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>CATEGORY A</th>
<th>CATEGORY B</th>
<th>CATEGORY C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product &amp; process</td>
<td>-Simple to make</td>
<td>-Moderate complexity</td>
<td>-Complex product or process</td>
</tr>
<tr>
<td></td>
<td>-Traditional or low skill</td>
<td>-Multi skill</td>
<td>-Sophisticated skills</td>
</tr>
<tr>
<td></td>
<td>-Needs little training</td>
<td>-Moderate training</td>
<td>-Extensive training</td>
</tr>
<tr>
<td></td>
<td>-No or low technology</td>
<td>-Moderate technology</td>
<td>-High technology</td>
</tr>
<tr>
<td>Production facilities</td>
<td>-Simple repetitive one-off or batch</td>
<td>-Partially mechanised batch</td>
<td>-Continuous operation</td>
</tr>
<tr>
<td></td>
<td>-Small scale</td>
<td>-Medium Scale</td>
<td>-Large Scale</td>
</tr>
<tr>
<td></td>
<td>-Easily managed</td>
<td>-Moderate management</td>
<td>-Complex management</td>
</tr>
<tr>
<td></td>
<td>-Low maintenance</td>
<td>-Frequent maintenance</td>
<td>-Continuous maintenance</td>
</tr>
<tr>
<td>Financial</td>
<td>-Low capital set up cost</td>
<td>-Moderate capital need</td>
<td>-Large capital need</td>
</tr>
<tr>
<td></td>
<td>-Local funding</td>
<td>-Local and foreign (JV) funding</td>
<td>-Mainly foreign shareholding</td>
</tr>
<tr>
<td></td>
<td>-Minimum fixed asset value</td>
<td>-Moderate fixed asset value</td>
<td>-High fixed asset value</td>
</tr>
<tr>
<td></td>
<td>-Short term finance</td>
<td>-Mid term finance</td>
<td>-Long term finance</td>
</tr>
<tr>
<td></td>
<td>-Short ROI &lt;2 years</td>
<td>-Medium ROI 3-5 years</td>
<td>-Long ROI &gt;5 years</td>
</tr>
<tr>
<td>Labour</td>
<td>-Few with limited skills</td>
<td>-Mix skilled unskilled</td>
<td>-All well skilled</td>
</tr>
<tr>
<td></td>
<td>-One owner/manager</td>
<td>-Several managers</td>
<td>-Complex management</td>
</tr>
<tr>
<td>Commercial</td>
<td>-Mainly domestic sales</td>
<td>-Domestic &amp; regional sales</td>
<td>-Domestic, regional and global sales</td>
</tr>
<tr>
<td></td>
<td>-Selling direct to market</td>
<td>-Sales need distribution network</td>
<td>-Sales globally distributed</td>
</tr>
<tr>
<td></td>
<td>-Cash sales</td>
<td>-Cash &amp; mainly credit sales</td>
<td>-Large contracted sales</td>
</tr>
<tr>
<td></td>
<td>-Owner sells</td>
<td>-Small sales team + agents and distributors</td>
<td>-Global sales team + distributors</td>
</tr>
</tbody>
</table>

Over two centuries, the developed countries have constructed economies which consist of a mix of businesses of the three types above, all essentially interdependent. This has been market driven and, in every case, today’s large complex industries (C above) have started as small local enterprises (A above) providing to a specific market demand.

Less developed economies lack this balance and so to achieve this economic equilibrium require outside help in the form of analysis, planning, education, capital and know-how. However, even with outside help, the conversion of a largely agricultural economy, such as Lao’s, to a modern industrialised economy will still largely depend on progressive development through the three stages above.
Thus in seeking to identify potential for downstream added value based on the mining sector it is necessary to assess the capability of in-country human resources and also to determine which product markets may be accessed by adding value to the mined resources. Going forward, it is also possible to propose a prioritisation of further mineral prospecting and mine development based on the market needs and infrastructural development of Laos and external sales of unprocessed minerals used to generate income for development. Coupled with appropriate incentives or barriers this prioritisation may help to eliminate some of the opportunistic foreign development of mining, much of which is essentially plundering Lao resources at the present time.

A1.2. Discussion of opportunities

A. Metals

i) Gold – Category A opportunity

Developing countries accounted for 72% of global output in 2004. Most of this came from low-income or lower-middle-income countries that together accounted for two thirds of global output. The largest increase in output has been seen in Heavily Indebted Poor Countries (HIPCs), where gold production rose by 84% between 1994 and 2004. Of the 38 HIPC countries, 14 are significant gold producers with lesser or minor production in at least another 14 countries. There is potential for substantial additional production in several other countries and these include Laos.

The rise in HIPCs' output has been accompanied by rising export dependence on gold. In 2003, gold accounted for 13% of goods (merchandise) exports of the 14 significant producers and 10% of their exports of goods and services. It is one of the most important exports for HIPCs. For example, Gold is the leading export for Mali (59% of goods exports in 2003), Tanzania (44%), Ghana (32%), Guyana (26%) and the second most important for Guinea (23%).

Native gold is mined from placer deposits in Laos. There is evidence that much of the gold from artisanal operations is sold to cross-border traders who smuggle it out of Laos. Although there is some conversion of gold within Laos for sale as jewellery to Tourists this is a small informal industry. Today, consumer demand for gold jewellery is growing by over 20% per annum, demonstrating the confidence that women around the world have in gold. Also, in many cultures gold in any form is seen as a way of saving and a measure of wealth. The present level of demand far outstrips the supply for gold that mines can produce.

There is an opportunity here to develop a more sophisticated Lao jewellery sector focused on producing high quality designer and craft jewellery and converting the metal into quality jewellery ‘findings’ (chains, rings, small components, gold wire and sheet) for the international market. This activity adds value, would create a local market for gold metal, benefiting the miners and also creating a demand for skills training. Capital requirements are not significant with a need only to fund secure workshops, light tooling and initial marketing costs.
ii) Gold – Category B opportunity

Over time the activity may be developed to produce gold products for more sophisticated technical applications, such as gold contacts for electronic circuitry switches. This will require more investment, higher skill levels and ‘clean room’ manufacturing technology.

iii) Silver - Category A opportunity

Demand for silver is built on three main pillars; industrial and decorative uses, photography and jewellery & silverware. Together, these three categories represent more than 95 percent of annual silver consumption. In 2003, 351 million ounces of silver were used for industrial applications, while over 196 million ounces of silver were committed to the photographic sector, and 266 million ounces were consumed in the jewellery and silverware markets.

Silver has a number of unique properties including its strength, malleability and ductility, its electrical and thermal conductivity, its sensitivity to and high reflectance of light and the ability to endure extreme temperature ranges. Silver’s unique properties restrict its substitution in most applications.

Silver possesses working qualities similar to gold but enjoys greater reflectivity and can achieve the most brilliant polish of any metal. In Laos it occurs within copper and gold deposits and also in conjunction with lead/zinc mineralization. It has many industrial applications due to its electrical conductivity, reflectivity and capacity to absorb oxygen.

Silver is also used extensively in jewellery manufacture but to make it durable for jewellery pure silver (999 fineness) is often alloyed with small quantities of copper. In many countries, Sterling Silver (92.5% silver, 7.5% copper) is the standard for silverware and has been since the 14th century.

Silver rarely occurs in the native state but as a second step in the development of a robust jewellery sector in Laos, silver will need to be converted into metal ‘in country’ and then sold as silver bullion externally or converted into silver bar, wire, plate and solder for jewellery manufacturing. The conversion to a workable product will also require the use of some of Lao’s copper which is today produced as cathode.

Silver and its salts are used extensively in the chemical, plastics, optical, plate glass and electronics industries and in time facilities may established to convert local silver for use in some of these applications. This is not pursued in this report.

As with Gold, Silver may be produced in country for use in the developing jewellery industry.

iv) Silver - Category B Opportunity

In this case more advanced alloys of silver may be made in Laos to prepare silver and silver solders for manufacturing products used in the electronics industry.
v) Tin - Category B. Opportunity

The largest single application of tin is in manufacture of tin-plate (steel sheet coated with tin), which accounts for about 40% of total world tin consumption. Solders account for the second largest use of tin. Tin is an important constituent in solders because it wets and adheres to many common base metals at temperatures considerably below their melting points. Tin is alloyed with lead to produce solders with melting points lower than those of either tin or lead. Small amounts of antimony and silver may be added to tin-lead solders to increase their strength. These solders can be used for joints in high or even subzero service temperatures.

Both solder compositions and applications of joining by soldering are many and varied. Commercially pure tin is used for soldering side seams of cans for special food products and aerosol sprays. The electronics and electrical industries employ solders containing 40 to 70% tin, which provide strong and reliable joints under a variety of environmental conditions. General-purpose solders (50Sn-50Pb and 40Sn-60Pb) are used for light engineering applications, plumbing and sheet metal work. Lower-tin solders (20 to 35% Sn, remainder Pb) are used in joining cable and in production of automobile radiators and heat exchangers. Low-tin solders are used in large amounts to fill crevices at seams and welds in automotive bodies, thereby providing smooth joints and contours. Solders containing about 2% tin (remainder lead) are used for can side seams to provide hermetic seals. Tin-zinc solders are used to join aluminium, while tin-antimony and tin-silver solders are employed in applications requiring joints with high creep resistance.

Over the last five years Laos has produced (officially) some 400 tons of tin in concentrates all of which have been shipped abroad. (It is likely that the total annual production is considerably greater than this as much of the mining is informal with sales to cross-border traders). Whilst tin plate manufacturing is complex and large scale, establishing a trading partnership with a smelter in which tin concentrate is shipped, smelted and then returned to Laos for conversion into solders is feasible. As Lao communications and construction industry grows tin solders will find domestic and regional markets.

Small batches of tin may be smelted in Laos to feed a solder manufacturing industry. It is unlikely that a tin plate industry could be established in Laos as this typically requires rolled steel plate manufacture, which it would be uneconomic to consider at this time.

vi) Copper - Category B/C opportunity

Copper is the best non-precious metal conductor of electricity. It sets the standard to which other conductors are compared. Copper's exceptional strength, ductility, and resistance to creeping and corrosion make it the preferred and safest conductor for building wiring and use in power transmission and cables, either insulated or uninsulated, for high, medium and low voltage applications. It is an essential component of motors, generators and transformers.

The introduction of optical fibre in communication networks displaces copper on the main axes of the distribution system but has led to increased demand as more communities are connected. Copper is the preferred conductor for final distribution to all consumers and is also used for domestic subscriber lines, wide and local area networks. Computing hardware uses copper and copper alloys extensively for
connectors. In the construction industry copper is used for roofing, as copper pipes in plumbing and as an alloy with zinc to make brass for taps, valves and fittings. (Copper pipes also help protect water systems from potentially lethal bacteria such as legionella)

An average size passenger vehicle contains about 27.6 kilograms of copper. Its thermal conductivity, strength, corrosion resistance, and recyclability make it ideal for automotive and truck radiators. Vessels, tanks, and piping exposed to seawater, propellers, oil platforms and coastal power stations, all depend on copper's corrosion resistance for protection.

Laos now has the capacity to produce over 100,000 tons of copper per year which is exported as cathode, most being sold regionally.

Copper cathodes may be prepared in a form suitable for wire manufacturing (drawing). Initially simple unsheathed copper wire may be manufactured in country. Subsequently this wire may be prepared for sheathing and then a range of sheathed, insulated products may be manufactured. Unsheathed wire may be used for manufacturing motor armatures and sheathed products may be used in manufacturing products such as vehicle cable looms.

vii) Zinc - Category B/C Opportunity

The largest use of zinc is as a protective coating for iron. The process is called galvanizing with reference to the cathodic protection the zinc offers to the iron. Zinc protects the iron since it is higher on the electrochemical scale than iron and will sacrifice itself to protect the iron, reducing it to the metal and eliminating rust.

The life of galvanized steel depends on the thickness of the coating and the environment. A coating of 1 ounce per square foot, giving a film 0.0018" thick, has a life of about 25 years in rural locations, 10-15 years in an urban environment.

Closely following this use, and perhaps exceeding it at times, is the use of zinc to make die castings. The most common process is pressure die casting, in which the molten zinc is forced into steel dies that make the mold. Zinc expands on cooling, so it fills the mold exactly, like type metal, and can make precision castings requiring very little machining. The low melting point of zinc gives long die life. In mass production, die castings are much cheaper than machined parts, since the large cost of the dies can be amortized over the numerous products. Die castings required the production of extremely pure zinc, since the usual impurities caused the castings to swell and "crystallize" in a short time.

After mining the zinc ore it may be processed to produce pure zinc metal. This may then be used to make high quality die alloy castings for vehicles and consumer products, such as white goods.

viii) Lead - Category B. Opportunity

Lead based products have a number of industrial uses. Its used in alloy form with tin to make solders, in glass to prevent the passage of radiation. Some 75% of lead is used to manufacture lead-acid automotive batteries but today 50% of all lead used in manufacturing comes from recycled sources. As car
manufacturers develop hybrid vehicles and fully electric vehicles lead demand may increase because of its use in batteries.

Although lead is poisonous, because of its high density, capability and availability, it is an outstanding material for radiation shielding. Major progress in the medical field's use of radiation for imaging diagnostics such as CAT scans can be directly attributed to the use of sophisticated lead shielding to protect patients and healthcare professionals.

Other uses include its use for manufacturing high quality 'crystal' glass and its suitability for the construction of giant lead-acid load levelling batteries for use by power generators seeking to deliver enough power consistently during the daily load "peaks" eliminating the need for new power plants. Historically it was also used to roof large buildings and to support the small panes of glass making up large windows. Also, Japanese and U.S. engineers are now placing lead in building foundations to absorb earthquake shock. Buildings are mounted on platforms supported by giant springs and a series of strategically placed lead blocks that ‘dampen’ the building movement.

Laotian lead may be combined with tin (see above) to manufacture speciality solders.

B. Industrial minerals

i) Clays – Category A opportunity

Laos has occurrences of clay suitable for making (terra cotta) bricks and already there is a small scale brick industry near Vientiane. The bricks made are small and decorative and it might be possible to market these in Europe and North America for use internally in homes to make feature chimney breasts and rustic walls. We saw no evidence of terra cotta floor tile making but these are also very marketable in rich industrialised countries and with some adaptation these could also be manufactured in Laos.

There are also occurrences of Kaolin and after processing and refining this too may be used to make porcelain articles.

The advantage of the clay materials is that the means to add value to these may be progressed from category A small scale through to category C industrial scale, by growing ‘organically’ as international markets are penetrated. Furthermore, as Laos has need for construction materials there would be local markets in a growing economy and the effect of import substitution by making these articles domestically.

ii) Clay – Category A/B/C opportunity

Progressing through three stages the present artisanal brick making activity (A) may be developed to a more elaborate mechanised business making both hand made and machine made products including extruded hollow fired blocks for the construction industry.(B). At this stage, further design, automation and product improvement may be considered to increase volume and subsequently to manufacture decorated and glazed floor and wall tiles for sale in regional and international markets through marketing partners. (C).
iii) Aggregates – A category opportunity.

Aggregates (and crushed rock) are essential products for the building industry. Also, combined with tar or cement and sand they are the best material for road construction. They are not high value products but without sufficient aggregates development of infrastructure is impaired. Small scale automated aggregate sizing plants are mobile and can be electrically or diesel powered. Aggregate products are also be mixed with cement and sand in small scale batch mix concrete manufacturing plants to supply local construction needs.

iv) Aggregates with Coal – B/C category opportunity

As Lao appears to have abundant deposits of coal it should be possible to establish a coking plant (coke is much in demand for metallurgical purposes in China) and to use the by-product from coke making, tar, for use in road network development.

A coking plant would be a B/C category development but sales of coke to China would permit an early ROI. This is therefore an attractive opportunity as it would encourage development in two product sectors, coal and aggregates. In the case of both products grading, washing and quality control will be essential if efficient manufacture and an appropriate quality of road surfacing material is to be produced.

v) Coal – B/C opportunity

Although coal is an important resource in Laos it may be better to use it as a raw material for chemicals, coke and tar manufacture rather than to burn it in power stations. Lao has enormous hydro power potential and today, coal burning brings environmental issues with carbon emissions and the complexities of carbon trading. Thus coal should not necessarily be considered as a priority for mining development. However, there is possibly one exception to this: Currently rural communities in Laos burn charcoal for cooking purposes. This adds to the damage done to the Lao ecology by deforestation. By substituting washed coal as fuel for charcoal in cooking until such time as electricity is available in all rural communities it would be possible to have a two stage national project to eliminate charcoal (and thus some tree) use.

Stage 1. Establish coal mine, washery and distribution network to sell coal as a household fuel. – has the advantage of stopping local tree cutting for charcoal

Stage 2. Build the electricity supply network for domestic users to encompass all but the most remote communities. – has the advantage of providing emission free fuel to all households and potential to replace the washed coal as a cooking fuel, eliminating carbon emissions (as the power is hydro generated)

Stage 3. Incentives all households to switch to electrically heated hygienic stoves in order to implement the carbon savings.

This whole project will be large scale, expensive and should be considered as a category C project. It would need to be coordinated by the government working according to specific plans with regional
authorities and both mining and power generation companies. There are many issues involved here but ultimately this would have many benefits, reducing deforestation, resulting in electricity supply to most communities and lowering carbon emissions form first charcoal and then coal. At the individual level it is likely that many household burns injuries especially to young children, often the result of using open fires and unprotected cooking pots, would be avoided by introducing electric stoves. The greatest benefit of the project may well be the electrification of the whole country and thus the increment in living and working standards throughout Laos.

Rural electrification should be one of the Lao Government’s long term planning objectives and using an ‘environmental’ hook to stimulate its acceleration should underscore its position as a key economic priority.

vi) Sapphires – Category A opportunity

Sapphires are mined in Huay Xai. There are also established cutting facilities in Vientiane. Once gold and silver jewellery manufacturing is fully established these stones may be set in metal locally allowing Laos to export completed jewellery rather than loose stones.

A.1.3 Downstream activities, added value, and investment strategies

A Quantitative estimate will be made to estimate the economic value of identified added value opportunities created by down stream activities. The skills needed to develop each of the down stream activities will also be evaluated.

Several issues become clear from this exercise.

- Initially skills training in many disciplines will need to be imported. At an early stage of some of the simpler projects selected candidates, capable of being trained to train, may be trained abroad. All of the training for each project will need to be incorporated into a training strategy which should consider what facilities already exist within Laos but need further investment or reinforcement.

- In order to provide some metals for local industry it is clear that Laos needs to develop some metal smelting facility. A project will be required to plan and construct a small scale metals refinery capable of smelting several types of metal (copper, tin, lead, zinc, gold, silver etc.) Laos has the energy but if downstream use of metals is to be pursued a polymetallic refinery is essential.

- In the mining sector the need to develop deposits will require a much more assertive policy with respect to foreign investment. The Investment promotion office will need to be strengthened and wherever possible the focus should be on joint venture development of deposits which will encourage Laotian investors to participate.

With regard to downstream activities involving metals, a copper wire project has been launched with funding from Vietnam. Laos produces copper ingots and bars, but other metals are presently being
imported, and technological and ingot surveys have indicated that they are not suitable for investment at this time. However, in the case of gold, there is traditional small-scale production at the artisan level, and it my be worthwhile to consider projects that utilize the technical prowess of Laotian goldsmiths.

Regarding the utilization of industrial metals, markets are expanding in both Laos and neighbouring countries. There is already continuous small-scale production of primary products such as gypsum, but if these can be utilized as industrial minerals and the level of processing raised, it could help to develop the domestic market for these materials in Laos. SWOT analysis was used to determine the advantages and disadvantages of investing in the industrial use of industrial minerals. The results are shown below.

Table 14   Advantages and disadvantages of investing in the industrial use of industrial minerals

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• There is resource potential (albeit mostly undeveloped)</td>
<td>• Lack of resource data</td>
</tr>
<tr>
<td>• There are large markets in neighbouring countries</td>
<td>• Lack of technology and skills</td>
</tr>
<tr>
<td>• New markets can be created in Laos</td>
<td>• Development from the exploration stage</td>
</tr>
<tr>
<td>• Laws, regulations and systems</td>
<td>• Capital procurement within Laos</td>
</tr>
<tr>
<td>• Effect of monsoon season on production</td>
<td>• Laws, regulations and systems</td>
</tr>
<tr>
<td>• Implementation of suitable laws, regulations and systems</td>
<td>• Effect of monsoon season on production</td>
</tr>
<tr>
<td>• Removal of unexploded mines</td>
<td></td>
</tr>
<tr>
<td>• Establishment of finance system</td>
<td></td>
</tr>
<tr>
<td>• Technology transfers</td>
<td></td>
</tr>
<tr>
<td>• Infrastructure development (to deal with monsoon season)</td>
<td></td>
</tr>
<tr>
<td>• Surveys promoted by MEM (DGM)</td>
<td></td>
</tr>
</tbody>
</table>

Table 15   Advantages and disadvantages of investments as viewed from the perspectives of companies in Laos and neighbouring countries:

<table>
<thead>
<tr>
<th>Companies in neighbouring countries</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies in neighbouring countries</td>
<td>• Markets can be expanded to neighbouring areas</td>
<td>• Exploration risks</td>
</tr>
<tr>
<td></td>
<td>• Projects can be expanded and greater value added</td>
<td>• Unexploded mines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Technology transfers and technical guidance</td>
</tr>
</tbody>
</table>
From the above analytical results, we can say that at the present time, it would be difficult to Laotian companies, by themselves, to make the investments needed to turn industrial minerals into industrial products. In order to eliminate the disadvantages, the present strategy of MEM (DGM) is to promote surveys, develop an investment environment, and encourage joint ventures with neighbouring countries. Joint ventures can provide a means for acquiring and accumulating technology, nurturing technicians, and increasing the skill level of the labour force.