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# Industry Career Guide: Mining

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# INDUSTRY CAREER GUIDE: Mining[1]

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## EXECUTIVE SUMMARY

The mining industry in the Philippines plays a very significant role in the pursuit of industrial development because of the sector's ability to provide mineral resources that serve as raw materials for manufacturing, construction, the utilities as well as the transportation and communications sector. It is also a major contributor of foreign currency through the exports of mineral ore and other processed mineral products and provides employment to communities in far flung areas where the only source of economic activity is mining operations. The extraction of copper, gold, silver, nickel, coal, gas, oil, stone and gravel as well as finding other new mineral deposits is the primary function of the mining industry.

The Philippines has rich mineral resources and has one of the largest reserves of gold, copper, nickel, chromium, iron, bauxite, marble and limestone among others (Rovillos, Ramo and Corpus, 2003). Nickel is currently the country's most economically important mineral resource with the Philippines accounting for 5 percent of global production in 2007, based on the US Geological Survey Report. Because of its complex geologic history and diverse rock types, the country is also characterized by an equally diverse group of mineral deposits (Tujan and Guzman, 2002). The country also possesses abundant deposits of other metallic minerals such as iron, lead, zinc, platinum, manganese, molybdenum, cobalt, aluminum and mercury. The non-metallic minerals of economic significance are gypsum, salt, sand and gravel, marble, clay, limestone, feldspar, dolomite, magnesite, phosphate rock, guano and sulfur (Chamber of Mines in the Philippines, 1991). Since 2004, the government has been promoting over 60 mining, exploration and processing projects which collectively can bring up to $14.8 billion in investments until 2013 (DENR - Mines and Geosciences Bureau (MGB) Report, 2009).

The Philippine mining industry's output measured in terms of gross value added for the year 2010, was estimated at P143.4 billion. The sector's contribution to the economy was roughly 1.7 percent of gross domestic product (GDP). For the same year, the mining industry also significantly contributed to foreign currency receipts, with total minerals and mineral

product exports at $1.870 billion. This makes up approximately 3.7 percent of total exports in the Philippines.

Minerals and mineral product export grew by 27.2 percent in 2010 from the 2009 level of $1.470 billion. Although there was growth in 2010, these levels are way below those recorded in 2007 and 2008 which were at $2.605 and $2.498 billion respectively. In 2009, minerals and mineral product exports contributed 3.9 percent of total exports while non-metallic mineral manufactures contributed 0.4 percent (Bangko Sentral ng Pilipinas).

Between 2003 and 2008, direct employment in the mining industry increased from 104,000 (0.3 percent of the national workforce) to 158,000 (0.5 percent), or 54,000 mining jobs generated in five years (Ramos, 2010 ). The contribution of the mining and quarrying sector to total employment has remained stable at 0.5 percent during the last three years. Based on the estimates from the Department of Labor and Employment (DOLE), the 158,000 workers employed in this sector in 2008, had grown to 169,000 in 2009 and 197,000 by 2010. These figures include workers directly employed by the mining and quarrying firms which are all involved in the four stages namely: 1) exploration; 2) development and construction; 3) utilization and commercial operation and ; 4) decommissioning, final mining stage and rehabilitation. In addition, the employment estimates also include those involved in the processing of mineral raw materials and other downstream activities. Government estimates that for every job generated in the mining industry, roughly four to six more jobs are indirectly generated in the upstream and downstream sectors. (DENR - Mines and Geosciences Bureau (MGB) Report, 2009).

The demand for manpower in the metallic mining industry depends on the number of active exploration activities being undertaken all over the country, the expansion of operations by existing firms, the planned operation of new enterprises as well as the re-operation of companies that had closed down during the previous decade. In the non-metallic sector, the performance of the construction industry serves as a leading indicator because of the demand for cement, gravel, sand, limestone and other mineral products used for residential and non-residential construction (Halcon, 2005)

The global economic crisis in 2008 and the concomitant fall in demand for metals had a negative impact on the Philippine mining industry. However, prospects for employment expansion for 2011 and beyond, are moderately good considering that mining output is expected to grow at an annual average rate of 2.57 percent along with increasing investments (Wood, 2010). The increase in the number of operating mines from fourteen in 2003 to twenty eight in 2010 shows the continuing efforts of expansion being undertaken by the private sector (along with government support) that is expected to boost output and employment growth. The increase in the production volume of the country's top three minerals namely: gold, copper and nickel provides a good indication of prospects within the medium term. The operation of new mines, higher mineral product demand and favorable prices have raised copper and nickel production to over 49,000 and 137,000 metric tons respectively, during the year 2009. The scale of untapped natural resources in the country (with an estimated value of over $ 1 trillion) should be making the country a key target for foreign mining concerns over the long term. (Business Monitor International, 2011).

The mining industry holds a lot of potential and performs a complementary role in industrial development. It will be necessary to use this potential if the country wants to attain its economic development goals within the next decade, but at the same time remain prudent in the use of these natural mineral resources, so that succeeding generations may still benefit from it. Responsible mining should protect the environment, and restore mine sites to their original condition through reforestation efforts, alongside sustainable livelihood activities for communities that will be left behind. A good compromise between sound environmental protection and effective regulation of mining activities should reduce the hostility coming from anti-mining advocates and promote efforts to tap the country's unused mineral potential. Such efforts should continue encouraging investment into mining along with job creation and the development of both upstream and downstream mineral processing activities.

## I. Nature of the Industry

### a. Mining and its role in the Philippine Economy

The mining industry in the Philippines plays a very significant role in the pursuit of industrial development because of the sector's ability to provide mineral resources that serve as raw materials for manufacturing, construction, the utilities as well as the transportation and communications sector. It is also a major contributor of foreign currency through the exports of mineral ore and other processed mineral products and provides employment to communities in far flung areas where the only source of economic activity is mining operations. The extraction of copper, gold, silver, nickel, coal, gas, oil, stone and gravel as well as finding other new mineral deposits is the primary function of the mining industry.

Mining is defined as the exploration, extraction, and processing of minerals such as coal, ores, crude, petroleum and natural gas. Quarrying on the other hand is the extraction of building and monumental stone, clay, sand and gravel, guano gathering and salt evaporation (NSO, 2008). The industry is composed of four stages namely: 1) exploration; 2) development and construction; 3) utilization and commercial operation and ; 4) decommissioning and final mining stage and rehabilitation (Mines and Geosciences Bureau, 2008)

The Philippines has rich mineral resources and has one of the largest reserves of gold, copper, nickel, chromium, iron, bauxite, marble and limestone among others (Rovillos, Ramo and Corpus, 2003). Nickel is currently the country's most economically important mineral resource with the Philippines accounting for 5 percent of global production in 2007, based on the US Geological Survey Report. Because of its complex geologic history and diverse rock types, the country is also characterized by an equally diverse group of mineral deposits (Tujan and Guzman, 2002). The country also possesses abundant deposits of other metallic minerals such as iron, lead, zinc, platinum, manganese, molybdenum, cobalt, aluminum and mercury. The non-metallic minerals of economic significance are gypsum, salt, sand and gravel, marble, clay, limestone, feldspar, dolomite, magnesite, phosphate rock, guano and sulfur (Chamber of Mines in the

Philippines, 1991). Since 2004, the government has been promoting over 60 mining, exploration and processing projects which collectively can bring up to $14.8 billion in investments until 2013 (DENR - Mines and Geosciences Bureau (MGB) Report, 2009).

Metallic mining involves the extraction of metal ores such as gold, silver, iron, copper, lead and zinc. Gold and silver are mainly used in jewelry and high end electronics. Iron is used to produce steel while copper is the main component for electrical wiring. Lead is used for batteries, while zinc is used to coat iron and steel to reduce corrosion and as an alloy in the making of bronze and brass. On the other hand, the non-metallic mining and quarrying operations include the production of crushed stone, sand and gravel for use in the construction of roads and buildings. Surface mining for stone is also known as "quarrying" wherein workers use machines to extract stone such as marble or granite. Oil and gas extraction activities particularly refer to the production of crude petroleum and natural gas which are inputs to the transportation and electric power generating industries. Petroleum products are also the raw materials for plastics, chemicals, medicines, fertilizers, and synthetic fibers. Petroleum or crude oil as well as natural gas are found in underground pockets beneath layers of impermeable rock and these are extracted using a variety of methods using sophisticated equipment and highly specialized workers . (Mining Industry, US Bureau of Labor Statistics 2010).

### a.1 Methods for extracting mineral deposits

Finding mineral reserves requires exploration activities involving prospectors and geologists looking for natural concentrations of minerals by using maps and taking samples of rock for examination. Areas with mineral potential are studied by geophysicists by sending electro-magnetic signals into the ground and reading the signals that bounce back up. These signals can provide indications if there are metallic minerals found in underground layers of rock (Department of Education Culture and Employment, Northwest Territories)

The extraction of minerals may be done using two methods and these are: 1) surface mining/strip mining/open pit mining and; 2) underground mining. Surface mining uses a method

called strip mining wherein workers use huge earth moving equipment such as power shovels and or draglines to scoop off the layers of soil and rock to uncover the mineral deposits. Large open pit mining is used if the minerals are close to the surface, or a shaft for an underground mine is built when resources are further down. Huge holes are made in the ground and are mined by blasting rock from the sides and bottom with explosives, carrying out the broken up material in trucks and repeating the process. A mill is built for the rock to be crushed and sorted by large machines. Large rocks with minerals are broken up using explosives or crushed into powder and washed so that the heavier material sinks and is taken to the bottom, or if it is light mineral, it is mixed with chemicals so that it will rise to the top where it is taken off (Department of Education Culture and Employment, Northwest Territories). Mining companies are required by law to restore the mined land after all operations are completed. This includes putting back the top soil and replanting the native vegetation (Mining Industry, US Bureau of Labor Statistics 2010).

Underground mining requires digging tunnels deep into the earth near the place where the mineral deposits can be found. Various types of equipment are used for digging as well as fortifying tunnels so that they do not cave in. Underground mining does not require as extensive a reclamation process as surface mining however, after the full completion of all mining operations, mine operators and environmental engineers still must ensure that ground water remains uncontaminated and that abandoned mines do not collapse. (Mining Industry, US Bureau of Labor Statistics 2010).

As for crude oil and natural gas, the extraction process is done by drilling wells from an appropriate surface configuration into the oil reservoirs. Wells are designed to contain and control all crude oil flow at all times throughout drilling and producing operations. The number of wells required is dependent on the combination of technical and economic factors used to determine the most likely range of recoverable reserves relative to a range of potential investment alternatives (World of Earth Science, 2010)

### a.2 Mining sector administration

The mining sector is publicly administered by the Department of Environment and Natural Resources (DENR) through its Mines and Geosciences Bureau (MGB). The overall function of the DENR related to mining is the conservation, management, development and proper use of the state's mineral resources including those in reservations, watershed areas, and lands of the public domain. The MGB on the other hand is directly in charge of the administration and disposition of mineral lands and mineral resources and undertakes geological, mining, metallurgical, chemical and other researches as well as geological and mineral exploration surveys (Israel, 2010). The Department of Energy (DOE) on the other hand, is responsible for the development of the various sources of energy which come from the extraction of crude oil, natural gas, coal and geothermal reserves.

**b. Recent developments during the past three years**

The Philippine mining industry's output measured in terms of gross value added for the year 2010, was estimated at P143.4 billion. The sector's contribution to the economy was roughly 1.7 percent of gross domestic product (GDP). For the same year, the mining industry also significantly contributed to foreign currency receipts, with total minerals and mineral product exports at $1.870 billion. This makes up approximately 3.7 percent of total exports in the Philippines.

Minerals and mineral product export grew by 27.2 percent in 2010 from the 2009 level of $1.470 billion. Although there was growth in 2010, these levels are way below those recorded in 2007 and 2008 which were at $2.605 and $2.498 billion respectively. In 2009, minerals and mineral product exports contributed 3.9 percent of total exports while non-metallic mineral manufactures contributed 0.4 percent (Bangko Sentral ng Pilipinas).

Higher prices for metallic minerals in 2007 encouraged more production for export, while the global economic slowdown which began in 2008, contributed to its decline. Rising prices for copper, gold, silver and nickel in 2010 contributed to a recovery and consequently faster export growth. Recent performance covering the 2007 to 2010 period is presented below.

**Table 1. Investment, Gross Value Added (GVA) and Exports of Minerals and Mineral Products in the Mining Industry as of May 2011**

| Year | Total Mining Investment in millions of $ | GVA in Mining in billions of pesos | % share in GDP | Total Exports of Minerals and Mineral Products in millions of $ | % share in total exports |
|---|---|---|---|---|---|
| 2007 | $708.4 | P90.5 | 1.4 | $2,605 | 5.3 |
| 2008 | 604.2 | 89.5 | 1.2 | 2,498 | 5.2 |
| 2009 | 740.4 | 97.1 | 1.3 | 1,470 | 3.9 |
| 2010 | 604.4 | 143.4 | 1.7 | 1,870 | 3.7 |

**Source: Mines and Geosciences Bureau, Bangko Sentral ng Pilipinas**

### b.1 Large Scale and Small Scale Metallic Mining Operations

Large scale metallic mining accounted for P42.8 billion in 2009, followed by small scale gold mining at P36.8 billion and non metallic mining at P26.5 billion. Preliminary estimates for 2010 indicate an increase in the gross production value in mining to P111.1 billion with a significant expansion in output for large scale metallic mining at P68.2 billion followed by small scale gold mining at P42.9 billion. The final estimate for gross production value in mining for 2010 will be larger than P111.1 billion once output production updates are obtained from the non-metallic mining sector (Mines and Geosciences Bureau). If the trend from 2007 to 2009 is to be followed, the non-metallic mining sector gross production value should be at least P20 billion for 2010, raising the total gross production value in mining to over P130 billion.

**Table 2. Gross Production Value in Mining (as of May 2011)**

| Year | Large Scale Metallic Mining in billions of pesos | Small Scale Gold Mining in billions of pesos | Non-metallic Mining in billions of pesos | Total |
|---|---|---|---|---|
| 2007 | P49.2 | P32.2 | P20.8 | P102.2 |

| | | | | |
|---|---|---|---|---|
| **2008** | **29.5** | **33.9** | **23.5** | **86.9** |
| **2009** | **42.8** | **36.8** | **26.5** | **106.1** |
| **2010** | **68.2** | **42.9** | **not yet available** | **111.1** |
| **2011 1st quarter** | **16.0** | **13.2** | **not yet available** | **29.2** |

**Source: Mines and Geosciences Bureau, Bangko Sentral ng Pilipinas, National Statistical Coordination Board**

Large scale mining operations in the Philippines have at least $50 million worth of investments (or its peso equivalent for a local firm), and is granted 81,000 hectares of land for mineral extraction for a period of 25 years per contract, renewable for another maximum of 25 years. These firms are asked by government to enter into a Financial or Technical Assistance Agreement (FTAA) with either a Filipino or foreign corporation on a 60-40 basis wherein at least 60 percent of the firm is Filipino owned while 40 percent or less is foreign owned. This is expected to provide the necessary financial and technical support required for large scale exploration, development and utilization of mineral resources (National Economic Research and Business Assistance Center Industry Report 2011).

Small scale mining on the other hand, relies heavily on manual labor using implements and methods which do not involve explosives or heavy mining equipment. Small scale miners employ physical separation methods in the extraction of minerals or metals from the ore. Small scale mining takes place in over 30 provinces and involves as many as 200,000 people. (National Economic Research and Business Assistance Center Industry Report 2011).

Improving the competitiveness of the Philippine mining sector will be necessary in order to boost industrial growth because of its role as a source of raw materials for the metals and metal products manufacturing sectors and at the same time enhance its ability to create jobs not just in mining and quarrying but in both the upstream and downstream industries linked to it.

### b.2 Number of operating metallic mines

For the year 2010, there were 28 operating metallic mines in the country with 3 producing copper (with gold and silver), 1 producing copper (with gold and zinc), 8 producing gold (with silver), 1 producing metallurgical chromite (ore and concentrate) and 15 producing nickel. The Philippines currently has 1 copper smelting plant and 1 nickel processing plant. There are 13 operating mines that have completed their expansion projects, 12 mining companies that have finished its construction and development projects, 4 mines in the advanced exploration phase and three (3) Philippine Mining Development Corporation (PMDC) projects. (Bureau of Mines and Geosciences Report 2011).

**Table 3. Number of Operating Metallic Mines (As of May 6, 2011)**

| Description | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|
| Copper (with gold &silver) | 1 | 2 | 3 | 3 |
| Copper (with gold, silver and zinc) | 1 | 1 | 1 | 1 |
| Gold (with silver) | 7 | 8 | 8 | 8 |
| Metallurgical Chromite (ore & concentrate) | 2 | 1 | 1 | 1 |
| Refractory Chromite | 1 | none | none | none |
| Chemical Grade Chromite | 1 | 1 | none | none |
| Nickel | 11 | 10 | 10 | 15 |
| **Total Operating Metallic Mines** | 24 | 23 | 23 | 28 |

**Source: Mines and Geosciences Bureau**

### b.3 Number of operating non-metallic mines

For the year 2009, there were 2,358 operating non-metallic mines. Approximately 1,820 of these were in sand and gravel production, 15 were in cement and 523 in other non-metallic mineral operations. The increase in the number of non-

metallic mines primarily occurred in 2008 for sand and gravel operations which had grown from 1,784 in 2007 to 1,820 mines by 2008. The same number was also observed for sand and gravel mines in 2009. On the other hand, a significant decline was observed from the other non-metallic mines which was initially at 626 in 2007 and decreased to 523 by 2008. The same number of mines for this category was also observed for 2009. The number of cement mines had remained relatively steady at 16 over the 2007 to 2010 period (Mines and Geosciences Bureau, 2010). Figures for all operating non metallic mines from 2007 to 2010 are presented below

**Table 4. Number of Operating Non-Metallic Mines (As of May 6, 2011)**

| Description | 2007 | 2008 | 2009 |
|---|---|---|---|
| Sand and Gravel | 1,784 | 1,820 | 1,820 |
| Cement | 16 | 16 | 15 |
| Other Non-metallics | 626 | 523 | 523 |
| **Total Operating Non-metallic Mines** | 2,426 | 2,359 | 2,358 |

**Source: Mines and Geosciences Bureau**
**Note: The actual number of non-metallic mines for 2010 have not been released by the Mines and Geosciences Bureau**

### c. Regional Distribution

The Mines and Geosciences Bureau provides a description of the distribution of mineral resources across the various regions of the country which includes metallic and non metallic minerals as well as natural gas and petroleum. Mining operations in the Philippines are scattered throughout the archipelago. Metallic mining, which contributes the largest share of output in the entire mining industry can be found in seven established mining districts namely: the Benguet Mineral District, the Zambales Mineral District, the Paracale Gold District , the Central Visayas Mineral District , the Surigao

Mineral District , the Palawan Chromite Nickel Area and the Davao Mineral District ( Mining Journal, Philippines 2009)..

Gold deposits are concentrated in the five recognized gold mining districts namely: the Baguio gold district, the Paracale gold district, the Masbate gold district; the Surigao gold district and the Masara, Davao gold district. Silver deposits are usually found alongside gold reserves, and the average silver to gold ratio is 2:1 based on ore assays and the current production of primary gold mines in the Philippines. Copper deposits are also widely distributed throughout the country and most copper deposits contain variable amounts of gold and silver. Philippine copper mines have been contributing substantially to gold production over the past several years. Chromite deposits are found in the eastern and western belts of the archipelago and in Northern Mindano, while nickel deposits are also found in the eastern and western margins of the archipelago and in northeastern Mindanao. Coal deposits are located in the Cagayan Valley, Polilo-Batan-Catanduanes, Southern Mindanao, Semirara, Samar Leyte, Negros, Cebu, Surigao, Agusan-Davao, Cotabato and Zamboanga del Sur. Natural gas deposits on the other hand are in Palawan particularly in San Antonio and Malampaya. Petroleum reserves are also located in Palawan particularly in the areas of El Nido, Matinloc, North Matinloc, West Linapacan and Malampaya (Mines and Geosciences Bureau).

In terms of the actual number of operating mines, the Philippines currently has four (4) medium to large scale gold mines namely: 1) the Victoria/Teresa Gold Project by Lepanto Mining Inc.; 2) the Maco Gold Mine by Apex Mining; 3) the Banahaw Gold Project by PhilSaga Mining and; 4) the Masbate Gold Project by Filimera/CGA (Bureau of Mines and Geosciences Report 2011).

There are also three (3) large scale copper mines namely: 1) the Padcal Copper Mine by Philex; 2) the Carmen Copper Project by Atlas/CCC; and; 3) the Canatual Sulphide Phase Project by TVI. In addition, there is one (1) major poly-metallic mine known as the Rapu-Rapu Mine and one (1) major chromite mine known as the Redondo Project by Krominco Inc. (Bureau of Mines and Geosciences Report 2011).

The country is also a major producer of nickel ore and nickel concentrate and output primarily comes from 10 medium scale nickel mines namely: (1) Sta. Cruz Nickel Project in Zambales; (2) Bering Nickel Project in Quezon, Palawan; (3) Rio-tuba Nickel Mining Corporation n Bataraga, Palawan; (4) Cagdianao Mining in Dinagat Province; (5) Hinaluan Mining Taganaan Project in Surigao del Norte; (6) CTP Construction and Mining Corporation ACT Project in Surigao del Sur; (7) Taganito Mining Corporation in Claver Surigao Norte; (9) SR Metals Inc.- Tubay Nickel Project in Agusann del Norte and (10) CTP/CWC Carrascal Project in Surigao Sur.

There is also one (1) nickel processing plant in Palawan, one (1) copper smelting plant in Leyte, sixteen (16) cement plants and quarries, over a thousand gold and metallic small scale mines and more than 2,000 non-metallic mines and quarries (National Economic Research and Business Assistance Center Industry Report 2011).

### c.1 Industry Revenue Shares Across Regions

In terms of revenues from mining and quarrying operations, the region which generates the largest share at 66.65 percent is Region IV – B composed of Mindoro, Marinduque, Romblon and Palawan. This is followed by the combined revenues of the NCR, CAR and the Ilocos Region at 16.95 percent and the collective revenues of Region VI – Western Visayas and Region VII Central Visayas at 10.6 percent. Industry revenue shares for the rest of the other regions are presented below:

**Table 5. Mining and Quarrying Percentage Shares in Revenue and Employment Across Regions for the year 2005**

| Region | Mining and Quarrying Industry Revenue Shares (in percent) | Mining and Quarrying Industry Employment Shares (in percent) |
|---|---|---|
| **NCR<br>CAR<br>Region I- Ilocos** | **16.95** | **50.87** |

| | | |
|---|---|---|
| **Region III – Central Luzon**<br>**Region IV - A CALABARZON** | **.2588** | **2.45** |
| **Region IV - B MIMAROPA** | **66.65** | **6.43** |
| **Region V - Bicol** | **.1015** | **1.22** |
| **Region VI - Western Visayas**<br>**Region VII - Central Visayas** | **10.60** | **4.37** |
| **Region IX - Zamboanga Peninsula**<br>**Region XI - Davao**<br>**Region XII - Soccsksargen** | **1.23** | **12.91** |
| **Region XIII – Caraga** | **4.21** | **21.75** |
| **Total** | **100.00** | **100.00** |

**Source: 2005 Annual Survey of Philippine Business and Industry National Statistics Office**

**Additional note: mining and quarrying establishments with an average total employment of 20 or more workers were used in the survey**

### c.2 Large Scale Corporate Mining Operations

The firm with the largest operations in the industry is Philex mining which produces copper, gold and silver. This is followed by Japan's Sumitomo Metal Mining and Norway's Intex Resources. Despite the global recession, prospects are bright with the presence of six new mines established in 2009 namely: the Carmen Copper Project in Cebu, the Masbate Gold Project, the Palawan HPAL Line 2 Nickel Project, the TVI Base Metal Project in Zamboanga del Norte, the Philsaga CO-O Gold Project in Agusan del Norte and the CTP Carrascal Nickel Project in Surigao del Sur. Sagitarius Mines is expected to generate the biggest investment in the sector through its Xtrata Copper Tampakan Project with a cost

of approximately $5.2 billion (DENR - Mines and Geosciences Bureau (MGB) Report, 2009).

For coal production, the Philippine government through the Department of Energy has been undertaking extensive coal exploration activities in the Visayas and Mindanao. The Philippines owns a potential 350 mm tones of recoverable coal reserves, however, the country's only significant coal mine is the Panian mine on Semirara, Caluya and Sibay islands in western Visayas which had produced a total of 4.8 mm tonnes of coal in 2009 (The Economist, The Economic Intelligence Unit Energy Briefing and Forecasts, September 6, 2010). Semirara Mining Corporation is the only large scale coal producer in the Philippines and is engaged in surface open cut mining of thermal coal in its Panian mine (MBendi Information Services, 2005). After natural gas, coal is the country's main source of power, accounting for 27 percent of gross power generation in 2009. Imported coal makes up 75 percent of total coal consumption in the country. Several new coal fired plants are expected to become operational in the next ten years and the government will have to make more use of domestic coal if it is to achieve its target of reducing the country's dependence on imports.

For crude oil and natural gas, exploration underneath the Malampaya gas field in October 2001, revealed an estimated 85 million barrels of oil. Shell Philippines exploration has committed about $2 billion to the upstream components of the combined oil and natural gas project currently operating the joint venture with partners Texaco Philippines and the Philippine National Oil Company. Offshore exploration projects have commenced in the Malampaya basin led by Nido Petroleum, Philippine National Oil Company Exploration Corporation, Trans Asia Oil, Unocal Corporation., and Philodril Corporation. The Philippine government continues to encourage other investors which may be interested in developing the reserve (MBendi Information Services, 2005).

The extraction and use of geothermal energy is another area which involves mining operations and after the development of the first geothermal energy facility in 1971, development initiatives progressed significantly over the years, with the current generation from geothermal facilities now reaching 1,978 megawatts. Geothermal energy in the Philippines

already provides 27 percent of the country's total electricity production in power plants located in the islands of Luzon, Negros, Mindanao and Leyte.

The Philippines is currently the world's second largest geothermal energy producer, next to the United States, and given its resource potential, experts noted that the country has the opportunity to take the lead in geothermal energy production, usage and its continued development (Bayrante, Lauro F. President, National Geothermal Association of the Philippines (NGAP) April 10, 2008). Philippine Geothermal Incorporated is the leading firm in geothermal energy production in the country.

### d. Industry Organizations

Presented below are the industry organizations responsible for strengthening the linkages between the private sector and the appropriate government agencies involved in managing the country's mineral resources, as well as the professional organizations which focus on developing the mining and metallurgical engineering profession.

### d.1 Government Agencies

**The Mines and Geosciences Bureau (MGB),** is the steward of the country's mineral resources and is committed to the promotion of sustainable mineral resources development, aware of its contribution to national economic growth and countryside community development. It fully recognizes that the development of a responsive policy framework in partnership with stakeholders to govern mineral exploration, mining and investment decisions and an effective institutional structure, are fundamental requisites for the sustainable utilization of the country's mineral resources.

**The Minerals Development Council (MDC)** was created in October 2005, for the purpose of advancing the government policy of responsible and sustainable development of the country's mineral resources. It is empowered to enlist the assistance of any agency or instrumentality of the government including government owned or controlled corporations, to harmonize requirements and procedures that would facilitate the inflows of investments into the mining industry

### d.2 Non-Government Organizations (NGOs)

**The Chamber of Mines of the Philippines** is an association advancing the interest of mining, quarrying and mineral processing companies for the efficient exploration, development and utilization of minerals in consonance with sound economic, environmental and social policies.

**Philippine Society of Mining Engineering** serves as a professional organization for the advancement of the practice and education of mining engineering. Through its members, it promotes and actively engages in research writing, publishing and dissemination of knowledge within the field, and works and cooperates with government agencies and other accredited organizations and federations for the promotion, advancement and protection of the interest of mining engineers and the mining engineering profession.

**Society of Metallurgical Engineers of the Philippines** is an organization which aims to advance the practice and education of metallurgical engineering and to promote and actively engage its members on research, writing, publishing and dissemination of knowledge within the field of metallurgical engineering.

**Monark Foundation Incorporated (MFI) -** is an NGO which offers opportunities to determined less privileged youth by providing them knowledge, skills and values that would enable them to become responsible citizens making a difference in society. The MFI adopts the Dual Training System of education where scholars acquire sufficient and quality technical knowledge in school and practical competencies in the industry.

**Geological Society of the Philippines** is a global geological community and the only accredited professional organization for geology professionals by the Professional Regulations Commission. Its objectives are to promote the science of geology and allied earth sciences, foster the spirit of scientific research, disseminate knowledge concerning the geology of the Philippines and the regions immediately surrounding it and protect and maintain a high professional and ethical standard in the practice of geology among its members.

**Philippine Business for the Environment** - is an NGO which assists Philippine business to fulfill its social responsibility to protect the environment by being an intermediary between business, government and the community, encourages cooperation between industry and the community towards sustainable development and responsible resource management and establishing reasonable standards and policies that reflect a balance between the country' economic goals and environmental concerns. It is an advocate of sound corporate environmental values and promotes the search for sufficient and affordable environmental technology.

## II. Industry Sub-sectors

The are seven mining industry sub-sectors which contribute to total mining output in the Philippines. These mining sub-sector operations are: 1) gold ore mining; 2) copper ore mining; 3) other metallic ore mining; 4) crude petroleum and natural gas; 5) Stone quarrying, clay and sand pits; 5) other non-metallic mining operations; 6) Chromite ore mining and; 7) coal mining. Most of the production and employment data generated from the Annual Survey of Philippine Business and Industry conducted by the National Statistics Office are taken primarily from the first five sectors mentioned above. The sub-sectors of chromite ore mining and coal mining have production and employment figures which remain suppressed (or unreleased, upon the firm's request) for purposes avoiding disclosure of individual establishment's data.

The top three mining sub-sectors in terms of output production were: 1) the extraction and production of crude petroleum and natural gas at P45.6 billion (or 55.7 percent of the total output of the mining sector); 2) copper ore mining at P13.8 billion (or 16.9 percent) and other metallic ore mining at P7.3 billion (or 8.9 percent).

Gold ore mining is the fourth largest producer at P2.27 billion, followed by stone quarrying and clay pits at P1.48 billion and other non-metallic mining and quarrying at P36.55 million. All other mining operations (such as chromite, coal and the others combined) produced P11.366 billion worth of output.

**Table 6. Value of Mining Output (for the year 2008)**

| Industry Description | Value of output in billions of pesos | % distribution of output |
|---|---|---|
| **Mining and Quarrying** | P81.892 | 100 |
| Gold ore mining | 2.269 | 2.8 |
| Copper ore mining | 13.829 | 16.9 |
| Metallic ore mining | 7.274 | 8.9 |
| Extraction and production of crude petroleum and natural gas | 45.635 | 55.7 |
| Stone quarrying, clay and sandpits | 1.483 | 1.8 |
| Non-metallic mining and quarrying | .036 | .044 |
| All other mining operations (including chromite ore mining, coal mining and others) | 11.366 | 13.9 |

**Source: 2008 Annual Survey of Philippine Business and Industry National Statistics Office**

**s: suppressed data to avoid disclosure of individual establishment's data**

### a. Type of Establishments

Based on the **Annual Survey of Philippine Business and Industry for 2009**, a total of 100 mining and quarrying establishments were surveyed and approximately 35 percent (or 35 firms) of the total establishments in the mining and quarrying sector were involved in stone quarrying, clay and sandpit operations. Roughly 18 percent (or 18 firms) were in other non-metallic mining activities, 17 percent (or 17 firms) were in gold ore mining, 13 percent were involved in other metallic ore (13 firms), 9 percent were in copper ore (9 firms), 4 percent were in crude petroleum and natural gas (4 firms), and 4 percent for all other mining activities (4 firms). Presented below are the actual number of establishments, and their percentage distribution across all the sub-sectors in the mining and quarrying industry.

**Table 7. Number of Establishments and Employment (for the year 2009)**

| Industry Description | Number of Establishments | % distribution of establishments | Total employment | % distribution of employment |
|---|---|---|---|---|
| **Mining and Quarrying** | 100 | 100 | 24,113 | 100 |
| Gold ore mining | 17 | 17 | 7,912 | 32.81 |
| Copper ore mining | 9 | 9 | 7,454 | 30.91 |
| Chromite ore mining | s | s | s | s |
| Metallic ore mining | 13 | 13 | 2,997 | 12.43 |
| Coal mining | s | s | s | s |
| Extraction and production of crude petroleum and natural gas | 4 | 4 | 453 | 1.88 |
| Stone quarrying, clay and sandpits | 35 | 35 | 1,437 | 5.96 |
| Non-metallic mining and quarrying | 18 | 18 | 952 | 3.95 |

**Source: 2009 Annual Survey of Philippine Business and Industry National Statistics Office**

**s: suppressed data to avoid disclosure of individual establishment's data**

### b. Distribution of Employment

The above mentioned table also provides the actual employment for the establishments under each sub-sector in the mining and quarrying industry. For the year 2009, the establishments which had provided the largest contribution to total employment were under the sub-sectors of gold ore mining, copper ore mining, and other metallic ore mining at 32.81 percent, 30.91 percent and 12.43 percent respectively. The fourth largest contributor to employment were stone quarrying, clay and sandpit establishments at 5.96 percent, followed by non-metallic mining and quarrying operations at 3.95 percent and lastly by crude petroleum and natural gas establishments at 1.88 percent.

## III. Working Conditions

### a. Nature of Employment

General conditions for hiring workers in the mining industry are based on the employment provisions of the Philippine Mining Act of 1995. The act requires that a contractor shall give preference to Filipino citizens in all types of mining employment within the country as long as these citizens are qualified to perform the corresponding work with reasonable efficiency and without hazard to the safety of the operations.

In addition to this, mining contractors shall not be hindered from hiring employees of their choice, subject to the provisions of the Commonwealth Act No. 613 as amended for technical and specialized work which in the contractor's judgment and with the approval of the Department of Labor and Employment, requires highly specialized training or long experience in exploration, development or utilization of mineral resources.

Hiring of foreigners in this situation is subject to the condition that there shall be no case where each employment exceeds five (5) years or the payback period as represented in the original project study, whichever is longer, and that each foreigner, employed as manager, vice president for operations or in an equivalent managerial position in charge of mining,

milling, quarrying or drilling operation shall: 1) present evidence of his qualification and work experience; or 2) shall pass the appropriate government licensure examination; or 3) in special cases, may be permitted to work by the Department of Labor and Employment for a period not exceeding one (1) year, provided however that, the reciprocal privileges are extended to Filipino nationals in the country of domicile, and that the Department of Labor and Employment may grant waivers or exemptions (Republic Act No. 7942).

No persons under sixteen (16) years or age shall be employed in any phase of mining operations and no person under eighteen (18) years of age shall be employed in underground mining (Republic Act No. 7942).

The main provision for mine supervision requires that all mining and quarrying operations that employ more than fifty (50) workers shall have at least one (1) licensed mining engineer with at least five (5) years of experience in mining operations and one (1) registered foreman.

Work in the mining industry requires competence in engineering jobs and skills as applied to mining operations. Preference is given to applicants with actual work experience in mining operations, but new graduates are also hired, subject to the passing of the licensure/board examination and their willingness to undergo a training program required by the firms (Halcon, 2005 ).

Full time employment, which is granted on a contractual basis usually applies to occupations which require a university degree (for professional jobs such as geologists, engineers and general managers), a college diploma or technology program (for semi professional and highly technical jobs such as electrical foreman, mill foreman and mine foreman ) and a technical college diploma (for technical jobs such as mining technician, engineering technician and environmental technician) (Department of Education, Culture and Employment Northwest Territories) . Full time employment on a contractual basis may also be granted for skilled jobs( which require the ability to read and have previous mining experience such as drillers, blast hole drillers and blasters ). Regular employment status, or permanent positions may be granted to professional, semi professional and highly technical

workers depending on the firm's needs, the extent of exploration activities, the yield from existing mining sites, the identification of new sources of mineral reserves and the long term financial viability of the company's mining operations.

Part-time employment granted on a contractual, or in extreme cases a casual basis generally applies to occupations which require lesser educational attainment (completion of primary or secondary education) with or without training and with or without work experience. This refers to laborers, helpers, miners' and drillers' assistants and equipment operators.

The extent of the proliferation of contractual and seasonal employment should be studied and thoroughly examined by the DOLE because of its major implications on worker welfare and the ability of the industry to attract skilled manpower. Contractual and seasonal employees have constituted a bigger portion of company employees who are not entitled to the conventional cash and non-cash benefits which regular employees avail of. Labor unions are prevalent in the mining industry, and regular employees benefit from collective bargaining agreements (Halcon, 2005) However, contractualization has been a way by which firms have been able to reduce labor union membership and cut down on labor cost because of the non payment of other benefits which are only given to regular employees (Halcon, 2005).

**b. Occupations in the Industry**

A list of occupations in the mining industry is presented below alongside their respective job descriptions as well as the educational attainment required.

**b.1 Table 8. Professional (jobs that require a university degree)**

| Industry/ Occupation | Job Description |
|---|---|
| Geologists | Conducts exploration activities in search of mineral ore reserves and provides advice on whether to mine and where ore deposits are likely to be found |
| Geodetic Engineers | Performs engineering duties in planning designing and overseeing construction and maintenance of building structures and |

| | |
|---|---|
| | facilities in mining sites |
| Mining Engineers and Metallurgists | Determines the best way to extract mineral ore out of the ground, and designs systems for the entire mining operation |
| Metallurgists | Metallurgists are involved in the extraction of metals from ores and study metal corrosion and fatigue, monitor the behavior of metals under stress and temperature changes, shape and join metals and select the best metals for use |

**b.2 Table 9. Semi-Professional (jobs that require a college diploma or a technology program and supplemented with extensive work experience )**

| Industry/ Occupation | Job Description |
|---|---|
| Production Supervisors and General Foremen | Ensures that equipment is well maintained and in good working condition, supervises mine workers, makes daily work plans and trains workers. Sets safety rules and ensures healthy working conditions |
| Warehouse Supervisor | Keeps the warehouse in order, maintains records of materials stocked |

**b.3 Table 10. Technical Jobs (jobs that require the completion of a technical program)**

| | |
|---|---|
| Mining and Metallurgical Engineering Technicians | Helps mining and metallurgical engineers with underground surveys, assists in formulating plans on where to mine, provides estimates on how much mineral reserves remain, assists in the drawings of machines, buildings, and systems, and helps keep systems functioning |
| Environmental Technician | Makes sure environmental rules are followed |

**b.4 Table 11. Skilled Jobs (functionally literate with previous mining experience)**

| | |
|---|---|
| Miners | Extracts mineral ore through blasting, using pick or by operating cutting machines. Operates mounted or un-mounted power drill to bore, installs timbering, roof bolts or cribs to support walls and roof and lays tracks to accommodate mine cars or track mounted equipment |
| Miners and Quarry Workers | Extracts building and monumental stone such as marble and granite, clay, sand and gravel using heavy equipment and machinery, or through more labor intensive methods |
| Stone Processing and Plant Operators | Transforms the extracted stone into more directly usable materials and facilitates the continuing production of output for both processing and distribution |
| Well Drillers, Borers and Related Workers | Assemble and operate drilling machinery and related equipment to sink wells, extract ore, liquids and gases |
| Shotfirers and Blasters | Decides how many holes and how deep to drill, pack explosives into holes, makes sure everything is safe before blasting, drills holes into rock for blasting |
| Mining Plant Operators | Operates equipment and machinery that loads extracted mineral ore for transfer to processing plants or distribution facilities |
| Mineral Ore Processing Plant Operators | Operates equipment and machinery which transforms mineral ore into more immediately usable materials for industry |

**b.5 Table 12. Office Workers (jobs which require the completion of secondary education, training and experience)**

| | |
|---|---|
| Accounting and Bookkeeping Clerks<br>Mine Clerk | Keeps financial records<br>Works in payroll and costing<br>Keeps mine records, time sheets, |

| | |
|---|---|
| | etc.<br>Does word processing, records mail, files, makes appointments |

**c. Working Environment**

The working environment in the mining industry varies depending on the type of occupations required for a particular function within the company or firm. Scientists and technicians in the field of metallurgical engineering for example will spend more time in laboratories examining and testing the quality of minerals, and doing research on mineral processing and materials development. Executives, administrators, support staff and clerical workers are expected to maintain regular working hours in office buildings.

Engineers and managers of mine operations will be in the field or mine site for a longer period of time while reporting occasionally to head office executives to provide updates and recent developments on output production and the on going progress of extraction activities in recently explored mining sites. Geologists are expected to spend most of the time in the field conducting exploration activities.

Mining and quarrying workers, responsible for extracting minerals from the earth are expected to be prepared for rugged outdoor conditions, including all kinds of weather, are required to adjust to dark, damp, hot, noisy underground mines and tunnels, and must have the physical strength and stamina for lifting heavy objects and for climbing and stooping in tunnels with tools covered in dirt and oil. Miners are expected to work in eight to twelve hour shifts usually around large and noisy equipment. Heavy machine operators working inside enclosed equipment are needed at the mine site during mineral extraction and processing activities.

Halcon (2005), explains that although age is an important consideration, physical fitness is essential, particularly when it comes to adjusting to the physical demands of actual mining operations. Gender does not pose problems, although most mining companies prefer males over females in view of the physical demands of the job.

Under the training and development provision of the Philippine Mining Act of 1995**,** contractors are required to maintain an effective program of manpower training and development throughout the term of the mineral agreement and shall encourage and train Filipinos to participate in all aspects of mining operations including the management thereof. For highly technical and specialized mining operations, the contractor, may subject to the necessary government clearances, employ qualified foreigners.

Large scale mining firms have provided on the job training to its employees in various aspects of mining, milling, mine safety, occupational health, environmental protection and productivity improvement. Supervisory and managerial level employees are sent to training and mine visits abroad. Apart from this, companies also provide in-house training for human resource development and skills enhancement. Training programs are conducted in close collaboration with government agencies such as the Technical Skills Development Authority (TESDA), (Hubo, 2004).

**d. Working Hours**

Full time employment requires working in between eight to twelve hours shifts in mining operations. Administration from the executive to managerial up to the staff functions are generally required to maintain a forty hour work week as a major requirement under a full time employment contract. Based on the data obtained from the labor force survey from 2001 to 2009, the average number of working hours ranged from a minimum of 38.7 hours per week in 2009 to a maximum of 42.7 hours per week during the year 2004. It is interesting to note that the average weekly hours worked dropped in 2006 (39.3 hours) and 2009 (38.7 hours) which may be attributed to a decline in mining operations. The production of gold, copper and nickel reached their peak in 2007 and decreased in 2008 (Israel, 2010). In addition, the drop in total paid up investments and local investments after 2005 and 2007 and the decrease in foreign equity investments after 2007 as well as the decline in the number of mining establishments in 2006 (Israel, 2010), may have contributed to the retrenchment of mining workers and the use of more part-time contractual employees as a response to the slow down in mining production and investment. Granting part-time

contracts to workers will have the effect of reducing the average weekly hours worked and at the same time cut down on labor cost since firms will not be obliged to grant other benefits which is normally associated with full time employment

The average daily basic pay for mining and quarrying workers had generally increased from the year 2004 (at P185.64 per day) to 2010 (at P217.62 per day). Upward adjustments in minimum wages by the regional wage boards to cover the rising cost of living over time as well as rising demand for mining workers induced by investment growth ( are factors responsible for the increase in average daily basic pay. The decline in average daily basic pay from 2002 to 2004 on the other hand may be attributed to the reduced demand for mining workers caused by the decline in the number of establishments which began in the year 2000 (with 376 establishments) up to 2003 (with 187 establishments) (Annual Survey of Establishments (ASE), Annual Survey of Philippine Business and Industry (ASPBI), Census of Philippine Business and Industry (CPBI), Industry Trade Statistics Department (NSO)). Total paid up investments, and in particular, local investments had declined from 1999 to 2003 (from over P3.6 billion to P81.24 million over the four year period) (Securities and Exchange Commission (SEC))

**e. Fringe Benefits**

Because of the occupational hazards that exist in mining operations, employed workers with full-time contracts are being paid at least 20 percent to 30 percent more than the legally prescribed minimum wage in the country (Hubo, Lewis and Warner, 2004). Mining engineers, geologists, metallurgists and other related professions employed in the mining industry receive relatively higher compensation in view of the dangers associated with the performance of their jobs. In addition, a majority of the highly skilled well trained and experienced professionals employed on a full time basis receive non-cash benefits such as housing, electricity and water, healthcare and employee stock options (Halcon, 2005,).

In particular, full time employees are extended both cash and non-cash fringe benefits equivalent to at least 80 percent of

their basic salary. Cash benefits include the following: **1) overtime pay/premium; 2) night shift differential; 3) rest day work pay; 4) holiday pay/ premium; 5) regular cost of living allowance; 6) rest day allowance; 7) 13th month pay; 8) Canao bonus (IP fiesta); 9) annual vacation leave pay; 10) annual sick leave pay; 11) medical assistance; 12) miners bonuses; 13) meterage bonus; 14) core bonus; 15) timbering bonus; 16) polygraph bonus; 17) hi-packing/ bouldering bonus** (Hubo, Lewis and Warner, 2004).

On the other hand, the non-cash benefits include: **1) free housing; 2) free domestic water services; 3) free power and lighting; 4) sanitation and fire protection; 5) medical and dental services; 6) police protection; 7) recreation and facilities; 8) church expenses; 9) free education of children (public schools constructed and located and maintained by the company from primary to secondary levels); 10) service buses; 11) safety expenses; 12) company share to the Social Security System, Pag-Ibig Fund and Union Welfare Fund; 13) raincoat supply; 14) rubber boots supply; 15) library expenses and; 16) a rice subsidy** (Hubo, Lewis and Warner, 2004).

Most mining workers are unionized with the rank and file employees affiliated with the National Mines and Allied Workers Union-MIF, while supervisory or management personnel are members of the Associated Professional, Supervisory, Office and Technical Employees Union of the Trade Union of the Philippines (Hubo, Lewis and Warner, 2002).

**f. Occupational Health Hazards**

Workers in mining operations are always exposed to major occupational hazards and this is the primary reason why compensation is relatively higher as compared to other industries. The most common cccupational health hazards posed by mining to workers are exposure to intense heat, poor ventilation, vibration, dust, fumes, repetitive stress injury, intense noise, manual handling (such as lifting) of heavy machinery and equipment and biological and chemical hazards. Due to the nature of underground mining, workers

on the site are constantly exposed to the dangers of cave-in, mine fire, explosion, exposure to harmful gases and intense heat while hydration is very limited. Miners usually have fluid and salt deficiency due to constant sweating, increased stress on the heart, heat stroke, opacity of the lens, and reduced fertility due to high heat. (Institute for Occupational Health and Safety Development, 2006).

Poor ventilation robs the body of needed oxygen causing the brain to malfunction and leads to many deaths in underground operations. Vibration causes permanent damage to bones and vibration syndrome or “dead finger syndrome” which can lead to gangrene in the hands and fingers. It can also cause digestive problems due to the constant shaking of the internal organs, heart problems and disruption of the nervous system (Institute for Occupational Health and Safety Development, 2006).

Mines expose workers to different types of airborne particulates making them vulnerable to systemic toxic effects due to the absorption of lead, manganese, cadmium, zinc and other toxic material. Fumes are emitted by chemicals being used, or by the machines being employed during mining operations. Coupled with poor ventilation, this can trigger accidents and cause death to workers. Noise or irritating and hazardous sound can cause hearing impairment and/or disrupt body functions like blood circulation and hormone imbalance. Deafness and hearing loss can become irreversible and other non-auditory effects are increased blood pressure and peptic ulcer due to increased gastrointestinal motility (Institute for Occupational Health and Safety Development, 2006).

Because most mines in the Philippines extract gold, the use of sodium cyanide for leaching gold from finely ground ore is frequent. The use of liquid mercury to create gold-amalgam is also wide spread. Cyanide blocks the transfer of oxygen from the blood to the body tissues. Signs of acute poisoning include rapid breathing, gasping, tremors, convulsions and death. Effects of sub-lethal poisoning include headache, dizziness and thyroid enlargement (Institute for Occupational Health and Safety Development, 2006).

This is the main reason why adequate health benefits are necessary alongside very strict safety regulations in order to

protect the welfare of workers. Most large scale mining companies today have integrated health and safety policies into work procedures to lessen occupational accidents and diseases. Personal protective equipment are provided to the workforce including trainings and seminars on safety and health. Companies have also created a safety department which constantly monitors and implement safety programs in coordination with appropriate agencies like the Philippine Mineral Safety Environment Association (PMSEA), the Safety Organization of the Philippines, the Department of Environment and Natural Resources (DENR), the Bureau of Working Conditions, the Department of Labor (DOLE) Regional Offices, the Occupational Safety and Health Center, the Bureau of Fire Protection-Department of the Interior and Local Government, the Department of Health (DOH) and the workers unions among others (Hubo, Lewis and Warner, 2004)

## IV. Total Mining and Quarrying Employment in the Philippines

Between 2003 and 2008, direct employment in the mining industry increased from 104,000 (0.3 percent of the national workforce) to 158,000 (0.5 percent), or 54,000 mining jobs generated in five years (Ramos, 2010 ). The contribution of the mining and quarrying sector to total employment has remained stable at 0.5 percent during the last three years. Based on the estimates from the Department of Labor and Employment (DOLE), the 158,000 workers employed in this sector in 2008, had grown to 169,000 in 2009 and 197,000 by 2010. These figures include workers directly employed by the mining and quarrying firms which are all involved in the four stages namely: 1) exploration; 2) development and construction; 3) utilization and commercial operation and ; 4) decommissioning, final mining stage and rehabilitation. In addition, the employment estimates also include those involved in the processing of mineral raw materials and other downstream activities. Government estimates that for every job generated in the mining industry, roughly four to six more jobs are indirectly generated in the upstream and downstream sectors. (DENR - Mines and Geosciences Bureau (MGB) Report, 2009).

**Table 13. Employment in Mining and Quarrying as of May 2011**

| Year | Employment in Mining and Quarrying | % share in total employment |
|---|---|---|
| 2003 | 104,000 | 0.4 |
| 2007 | 149,000 | 0.4 |
| 2008 | 158,000 | 0.5 |
| 2009 | 169,000 | 0.5 |
| 2010 | 197,000 | 0.5 |

**Source: Department of Labor and Employment**

The demand for manpower in the metallic mining industry depends on the number of active exploration activities being undertaken all over the country, the expansion of operations by existing firms, the planned operation of new enterprises as well as the re-operation of companies that had closed down during the previous decade. In the non-metallic sector, the performance of the construction industry serves as a leading indicator because of the demand for cement, gravel, sand, limestone and other mineral products used for residential and non-residential construction (Halcon, 2005)

Based on the Annual Survey of Philippine Business and Industry for 2009, 30.91 percent of the mining and quarrying workforce is employed in copper ore mining, 32.81 percent are in gold ore mining, and 12.43 percent in other metallic ore mining. Approximately 5.96 percent were in the stone quarrying, clay and sand pit operations, 3.95 percent were in other non-metallic mining, 1.88 percent in the crude petroleum and natural gas establishments and 12.06 percent were in all other mining activities.

**Table 14. Percentage Distribution of Employment (for the year 2009)**

| Industry Description | % distribution of employment |
|---|---|
| Mining and Quarrying | 100 |
| Gold ore mining | 32.81 |
| Copper ore mining | 30.91 |
| Chromite ore mining | s |
| Metallic ore mining | 12.43 |
| Coal mining | s |
| Extraction and production of | 1.88 |

| | |
|---|---|
| crude petroleum and natural gas | |
| Stone quarrying, clay and sandpits | 5.96 |
| Non-metallic mining and quarrying | 3.95 |

**Source:** 2009 **Annual Survey of Philippine Business and Industry National Statistics Office**

**s: suppressed data to avoid disclosure of individual establishment's data**

## V. Average Monthly Wage Rates for Industry Occupations

### a. Average monthly wage rates for occupations in the metallic ore mining industry

For July 2008, the highest average monthly wage rate for occupations in the **metallic ore** mining sector was for geologists at P26,795. This was followed by mining engineers and metallurgists at P23,965, geodetic engineers at P22,931, and production supervisors and general foremen at P19,716. Mining and metallurgical engineering technicians received P16,372, miners were paid P12,265, shot firers and blasters at P11,965 , mining plant operators at P11,748 and mineral ore processing plant operators at P11,086. Accounting and bookkeeping clerks received P10,904 while unskilled workers excluding janitors, messengers and freight handlers were paid P6,407. Overall the average monthly wage rates had increased from 2006 to 2008 for a majority of the occupations except for production supervisors and general foremen, accounting and bookkeeping clerks and mineral ore processing plant operators.

By August 2010, higher average monthly wage rates were recorded for mining engineers and metallurgists at P34,255 followed by geologists at P33,514, production supervisors and general foremen at P24,043 and mining and metallurgical engineering technicians at P17,839.

A comparison of the August 2006 July 2008 and August 2010 average monthly wage rates for occupations under the metallic ore mining sector are provided below:

**Table 15. Average Monthly Wage Rates of Time-Rate Workers on**

**Full-Time Basis in the Metallic Ore Mining Industry**

| 1994 PSIC as amended/ PSOC 2002 update | Industry/ Occupation | Average Monthly Wage Rate August 2006 | Average Monthly Wage Rate July 2008 | Average Monthly Wage Rate August 2010 |
|---|---|---|---|---|
| C10 | Metallic Ore Mining | | | |
| 1430 | Production Supervisors and General Foremen | 19,983 | 19,716 | 24,043 |
| 2114 | Geologists | a | 26,795 | 33,514 |
| 2156 | Geodetic Engineers | 20,890 | 22,931 | 16,346 |
| 2159 | Mining Engineers and Metallurgists | 22,199 | 23,965 | 34,255 |
| 3117 | Mining and Metallurgical Engineering Technicians | 11,942 | 16,372 | 17,839 |
| 4121 | Accounting and Bookkeeping Clerks | 13,582 | 10,904 | 13,841 |
| 7111 | Miners | 11,478 | 12,265 | 11,500 |
| 7112 | Shotfirers and Blasters | a | 11,965 | 8,418 |
| 8111 | Mining Plant Operators | 10,630 | 11,748 | 7,115 |
| 8112 | Mineral Ore Processing Plant Operators | 12,406 | 11,086 | 11,344 |
| 9400 | Unskilled Workers Except Janitors, Messengers and Freight | 5,556 | 6,407 | 10,235 |

| | | | | |
|---|---|---|---|---|
| | Handlers | | | |

**Source: Bureau of Labor and Employment Statistics August 2006, July 2008 and August 2010**
**a: no report**

### b. Average monthly wage rates for occupations in the non-metallic mining and quarrying industry

The highest average monthly wage rate for the **non-metallic mining and quarrying** sector for July 2008 is paid to production supervisors and general foremen at P32,588 followed closely by mining engineers at P31,349. The third highest paid occupation is for geodetic engineers at P22,931 followed by geologists at P20,000, mining plant operators at P16,490, accounting and bookkeeping clerks at P13,078 , miners and quarry workers at P12,313 and well drillers, borers and related workers at P10,433. The last two occupations with the lowest average monthly wage rates are stone processing plant operators who are paid P9,940 and unskilled workers excluding janitors, messengers and freight handlers at P7,053. No report was given for the average monthly wage rate for mining engineering technicians in July 2008, but based on the August 2006 estimates, workers in this occupation received P7,303 per month.

For August 2010, the average monthly wage rates have substantially increased particularly for geologists at P64,889, followed by mining engineers at P55,638, production supervisors and general foremen at P36,133, well drillers and borers and related workers at P20,275 and mining engineering technicians at P12,896.

Estimated monthly wage rates for all occupations under the non-metallic mining and quarrying industry for 2006, 2008 and 2010 are presented below on the following table :

**Table 16. Average Monthly Wage Rates of Time-Rate Workers on Full-Time Basis in the Non-Metallic Mining and Quarrying Industry**

| 1994 PSIC as | Industry/ Occupation | Average Monthly | Average Monthly | Average Monthly |
|---|---|---|---|---|

| amended/ PSOC 2002 update | | Wage Rate August 2006 | Wage Rate July 2008 | Wage Rate August 2010 |
|---|---|---|---|---|
| C11 | Non-Metallic Mining and Quarrying | | | |
| 1430 | Production Supervisors and General Foremen | P23,941 | 32,588 | 36,133 |
| 2114 | Geologists | a | 20,000 | 64,889 |
| 2156 | Geodetic Engineers | 20,890 | 22,931 | 16,346 |
| 2159 | Mining Engineers | 24,583 | 31,349 | 55,638 |
| 3117 | Mining Engineering Technicians | 7,303 | a | 12,896 |
| 4121 | Accounting and Bookkeeping Clerks | 9,505 | 13,078 | 12,189 |
| 7111 | Miners and Quarry Workers | 6,243 | 12,313 | 8,515 |
| 8111 | Mining Plant Operators | 7,533 | 16,490 | 10,288 |
| 8112 | Stone Processing Plant Operators | 10,609 | 9,940 | 9,707 |
| 8113 | Well Drillers and Borers and Related Workers | 9,871 | 10,433 | 20,275 |
| 9400 | Unskilled Workers Except Janitors, Messengers and Freight Handlers | 7,022 | 7,053 | 6,380 |

**Source: Bureau of Labor and Employment Statistics**

**a: no report**

**** Estimates for 2010 were based on the annual average increase of 5.6 percent in minimum wage rates.**

For both the metallic mining and non-metallic mining sectors, average monthly wage rates for 2008 are significantly higher than the minimum wage in the National Capital Region (NCR). Based on the 2008 NCR minimum wage rate of P362 per day, or roughly P7,240 per month (based on a five day work week at four weeks per month), almost all occupations in both sub-sectors of the mining industry are substantially higher than the minimum wage. The average monthly wage rate of production supervisors and general foremen are 4.5 times higher than the minimum wage, while miners and quarry workers are larger by 1.7 times as much. The only occupations which have average monthly wage rates below the minimum wage is for unskilled workers excluding janitors, messengers and freight handlers, which are lower by a minimum of 3 percent to a maximum of 11 percent.

## VI. Educational Requirements, Training and Advancement

### a. Mining Industry Professionals

Mining industry professionals are those who have finished a four year course and are required to take a board exam given by the Professional Regulation Commission. This includes: 1) Mining Engineers; 2) Metallurgical Engineers; 3) Geodetic Engineers and; 4) Geologists.

Professionals coming from these four mining programs are currently in short supply in the Philippines. Mining firms have been experiencing difficulty in the recruitment of graduates particularly those with adequate work experience. Schools offering training in these academic disciplines have decreased. Among the proprietary type of schools, the academic departments offering these disciplines have become cost centers with not enough enrollees. Very often, proprietary schools offer these courses out of the stockholders' sense of social responsibility to maintain a pool of mining professionals in the country.

The shortage of mining professionals has affected both the private and public sectors. Optimism bolstered by the Supreme Court decision allowing foreign ownership in the industry has fueled the increase in mining investments. The Mines and Geosciences Bureau has been hit by an exodus of geologists to private companies offering higher pay. Some 70 positions have become vacant during the last few years. (Ramos, H. Business World, 2008).

At present, there are not enough mining engineering graduates being produced by the remaining schools offering the programs. Executives from the large scale mining corporations in the Philippines revealed that "poaching" of mining professionals was rampant in the industry (Martinez, 2011 and De Jesus, 2011). Officials of licensed overseas labor recruiters also attested to the difficulties of recruiting mining professionals. They were unable to provide their clients abroad with mining engineers due to the lack of qualified applicants who had the experience required by the principal (Lavado, 2011).

### a.1 Mining Engineers

The Philippine Statistical Occupational Code (PSOC) describes mining engineers and metallurgists as "workers that conduct research and training as well as develop and maintain commercial scale methods of extracting metals from their ores or minerals, water, oil or gas from the earth. They also develop new alloys, ceramics and other materials as well as study and provide advice on the technological aspects of particular materials products or processes. (PSOC 1994)

There are schools in the Philippines offering college courses to produce these professionals but there are very few enrollees and some of these programs have closed down due to the lack of students.

There are eight schools in the Philippines which offer a Bachelor's degree in Mining Engineering. Three of these institutions are in Metro Manila, namely: the University of the Philippines; Adamson University and; the Mapua Institute of Technology. The Mapua Institute has ceased offering its mining engineering course, but has developed engineering courses related to energy development and management.

Most of the faculty teaching courses in the field come from the Mines and Geo-sciences Bureau as well as the private large scale mining corporations (Halcon, 2005).

The remaining five institutions are in Baguio, Cebu, Negros, Butuan and Davao City. Two of these schools offer a Bachelors degree in Geothermal Engineering namely: the Negros Oriental State University and the Bicol University in Legazi, Albay. Both of these schools are near existing geothermal plants, Negros has its Palimpinon Geothermal Plant and Bicol has its Bacon Manito Geothermal Plant in Albay.

Mining professionals perform a very important role in the extraction of geothermal energy through the drilling of wells. Along with the use of heavy equipment and machinery, natural pressure and the hot water coming from the geothermal wells is converted into hot steam, channeled into pipelines and brought to power plants where steam is used to turn turbines and generate electricity.

Geothermal Engineering is a promising field to pursue considering that there is an increasing number of geothermal installations in the Philippines today. The Philippines is the largest consumer of geothermal energy in Asia and is the world's second-largest producer, behind the United States. The Philippines has almost 2,000 MW of geothermal capacity linked to regional grids. Geothermal energy represents about 27% of the country's total electricity production and has the potential to produce at least another 600 MW (Industrial Information Resources, 2010).

The total number of graduates in the Mining Engineering field has declined during the last ten years. There were only a total of 142 graduates of the program from 1999 to 2009 and the number of Board Examinees and passers have also decreased during the same period.

A total of 193 passed the Board Exams for Mining Engineering from 1999 to 2008. An average of 19 examinees passed the exam every year, one of the fields with smallest number among all professions. It is still dominated largely by males as in the other professions related to the mining industry.

The shortage of mining engineers has been complicated further by their search for employment outside of the Philippines. From 1999 to 2008, a total of 25 mining engineers left the country to find work overseas (Philippine Overseas Employment Administration (POEA) statistics, 2009). Many of the graduates found work with better compensation in Saudi Arabia, Australia Brazil, India, Laos, New Zealand, Quatar, Mozambique, Malaysia, Papua New Guinea, Tanzania and the United Arab Emirates.

### a.2 Metallurgical Engineers

Mining companies in the Philippines have also experienced difficulties in recruiting graduates from the Metallurgical Engineering field. Currently, there are five schools offering metallurgical engineering as a discipline but there are only two institutions which offer this program as a five year engineering course namely: the University of the Philippines in Diliman and the Mindanao State University. The University of the Philippines in Diliman is the only institution offering a masters program in Metallurgical Engineering.

Metallurgical engineers are needed not only in mining operations but also in downstream industries such as in the production of metals and in manufacturing. Over the last ten years, a total of 528 students graduated from both the bachelors and masters programs. A total of 217 graduates passed the Board Exam for metallurgical engineering during the period from 1999 to 2008. The profession was dominated by the males who comprised more than half of those who passed the exam. In 2009, there were 30 graduates in the bachelor's program. On the other hand, 22 students completed the masters program in 2008 and there were 21 students who passed the Board Exam during the same year.

Migration has also affected the supply of metallurgical engineers in the country. Over the last ten years, a total of 119 metallurgical engineers or more than half the number of the Board Passers left the county based on statistics from the Philippine Overseas Employment Administration. More than half were employed in Saudi Arabia and the rest were hired by firms located in Quatar, New Caledonia, United Arab Emirates, Nigeria and Algeria to name a few.

### a.3 Geologists

Most of the mining firms in the Philippines are also experiencing difficulty in hiring geologists. Aside from the mining and quarrying industry, graduates in this field are also needed by the construction and real estate development sectors.

Geologists and geophysicists are described by the the Philippine Occupational Statistics Code (PSOC) as “workers which conduct research, improve or develop concept, theories and operational methods or apply scientific knowledge relating to geology and geophysics in such fields as oil, gas, and mineral exploration, water conservation, civil engineering, telecommunications and navigation.” (PSOC 1992)

At present, the schools offering geology programs in the country are namely: The University of the Philippines, Adamson University and the Mapua Institute of Technology (all located in the National Capital Region), Partido State University in Camarines Sur, Negros Oriental State University in the Visayas and the University of South Eastern Philippines in Mindanao.

In addition, the University of the Philippines has a doctoral program, while the Mapua Institute of Technology offers a masters program in Geo-informatics. Over the last ten years, there were 432 graduates in the course at the bachelors and masters level combined. Twenty two (22) of these were from the graduate program. During the past ten years, an average of 30 students pass the board exams. However, this number is perceived to be insufficient given the recruitment difficulties of mining firms.

### a.4 Geodetic Engineers

Geodetic engineering graduates are not only needed by the mining industry but recruitment is also being undertaken by firms in the construction and real estate development sectors. The shortage of professionals in this field was also

exacerbated by the employment of these professionals overseas primarily in the Middle East.

Geodetic engineers provide firms with surveying information and mapping services required to conduct geodetic, topographic, hydrographic and remote sensing surveys. They provide guidance in the setting of a geodetic control in remote areas and prepare topographic and seismic survey maps for geophysical operations. They are also recruited by firms to provide these services in sea mining and oil extraction operations.

Currently, there are forty one (41) higher education institutions which offer Geodetic Engineering. These schools are scattered throughout Luzon, Visayas and Mindanao, but none of them offer masters programs. The number of enrollees and graduates have declined in recent years From a total enrollment of 2,817 students in 1998, the number had declined to 1,423 students by 2009. There was an average of 348 graduates every year from the bachelors program during the 1997 to 2009 period. There were 135 passers in the Board Exam for this profession in 2008.

Over the same twelve year period, there were 3,886 graduates which were employed overseas, hired by firms in the Middle East mostly in Saudi Arabia where many construction projects were being completed.

**b. Recommendations for bridging programs to address the shortages**

The schools which are currently offering programs producing graduates whose skills are badly needed by the mining industry may consider the alternative of offering “bridging courses” to enable graduates of other programs in engineering to take subjects that can be credited as course work for a second degree in either mining engineering, metallurgy, geology or geodetic engineering

Civil engineering is closely related to mining and geodetic engineering. Four semesters and two summer terms may be enough for engineers to take an additional program in geodetic engineering or mining engineering and prepare for the Board Exam. Instead of a

four year program to prepare a student to be a mining engineer, the period could be shortened to two years.

In addition, there are common subjects in Materials Engineering and Metallurgical Engineering programs. Bridging courses may also be offered to train graduates of Materials Engineering to be Metallurgical Engineers and prepare them for work and the Board Exams. There are presently six schools which offer Materials Science Engineering. It is estimated that it will take one school-year for a Materials Engineering graduate to take up courses which will qualify them to become Metallurgical Engineers.

There are mining companies in the Philippines which have provided scholarships for their employees who have college degrees closely related to mining engineering. They were sent back to school in order to take up mining related courses, and consequently earn a mining engineering degree over a two year period (De Jesus, 2011).

**c. Other support staff**

The mining industry also employs other professionals for its support staff. As a response to complaints that mining destroys the environment and that mining accidents are a regular occurrence, several companies have began to employ community development professionals, foresters and environment experts to help the local communities. Some of these are employed on a consultancy basis, but there is a core group of these professionals who work full time with mining companies.

Mining firms are required to restore the land to its original condition when they leave a mining site after its mineral resources have been extracted. Companies are also required to restore the forest areas which may have been destroyed in its operations. Most mining companies also maintain a department which sees to it that operations do not harm the environment.

The firms usually employ social workers as community development specialists, foresters, agriculturists and biologists and chemists . Biologists and chemists manage and supervise the environmental safety efforts of the mining

company. There are several colleges and universities both in the private as well as public sectors which offer undergraduate programs in environmental biology, and chemistry, while there are a selected number of state colleges and universities offering programs involving community development, forestry and agriculture.

Philex Mining Corporation is an example of a firm which has complied with the restoration requirements after the closure of its mining operations. When Philex Mining Corporation decommissioned its Pacdal block caving operations in Benguet (which began in 1958 and generated 356 million tons of ore over a 53 year period), the firm gathered feedback from the host community which enabled it to start projects addressing the health, education, infrastructure and livelihood concerns of the community. Philex reforested the mountains surrounding its mine areas and started a relocation process for its employees. Those who chose to stay were provided entrepreneurial training (Cabreza, 2012). During its 53 years of operation, a total of 2,090 hectares have been planted with approximately 7,000 indigenoous trees, with a 90 percent survival rate, as part of Philex's reforestation program (Ricafort, 2011)

Another firm which restored mined-out areas is the Rio-Tuba Nickel Mining Corp. (RTNMC) in Palawan which restored the top soil of mined-out areas, cultivated local micro-organisms and planted indigenous trees. The firm had to solve the problem left by a nickel mine because the soil could be adverse to plant growth due to the very low zero nitrogen and phosphorous contents prone to erosion alongside a tendency towards acidity. As of March 2011, the RTNMC had planted up to 500,000 trees in over 238 hectares of mined-out land (Jasareno, 2012).

Mine closure plans are a prerequisite for mine licensing processes under the Philippine Mining Act of 1995. Mining firms are also required to post a P5 million rehabilitation trust fund and a P50,000 monitoring fund that must be replenished (Jasareno, 2012)

**d. Mine workers and heavy equipment operators**

Most mine workers do not receive formal training, with a majority of miners learning their skills on the job while others participating in mining related vocational training courses. Most miners start at entry level jobs such as laborers, driller's assistant, blast helpers, assistants to equipment operators, and helper's to mechanics, electricians and surveyors. They begin to perform actual mining work after going through extensive on the job training which may also involve an informal apprenticeship arrangement. There are very few vocational schools offering formal training for actual mining work and in the support services. Most miners have very limited formal education, either having completed primary or at most, the first few years of secondary education. Because of the required skills as well as the major occupational and health hazards which workers have to endure, most miners receive wages which are roughly 20 percent to 60 percent above the minimum wage.

Heavy equipment operators are needed both in open pit and in tunnel mining. The Philippine Standard Industry Code defines heavy equipment operators as workers who drive and operate heavy equipment used in engineering and construction projects. Under general supervision they perform skilled work , facilitate flood control systems, lead maintenance staff as needed, and perform other related duties as required. Among the types of equipment operated are the bulldozers, cranes and pay loaders which are more common in open pit mining operations.

The demand for these operators increased as the construction industry in the Middle East grew. Heavy equipment operators became the primary targets of "head-hunters or poachers" for skilled workers. The situation resulted to the widening gap between the available jobs and the number of skilled personnel to perform the task and the transfer technology in heavy equipment operations. The Department of Labor's "2020 Vision" plan has identified heavy equipment operators as both in-demand and hard-to-fill occupations. Shortages in the supply of the aforementioned workers are in the various equipment operations of cranes, forklifts, and dump trucks which are used in mining, construction, sea-based and port operations.

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### e. Training programs for heavy equipment operators

Interviews with industry executives revealed that most of the heavy equipment operators in the Philippines were trained "on the job." However, the Technical Skills Development Authority (TESDA) also conducts training for heavy equipment operators and preparation for certification exams for those already in the field. Those with TESDA accreditation are easily hired by foreign companies and many of them were consequently employed in the Middle East. At present, not all of the heavy equipment operators working in the Philippines are certified by (TESDA).

The Association of Carriers and Equipment Lessors (ACEL) in the Philippines, is an organization which also participates in training and assessment of workers involved in heavy equipment operations. The ACEL and TESDA have signed a memorandum of agreement that would give ACEL the sole responsibility of implementing a nationwide and unified system of occupational skills assessment and certification in the heavy equipment subsector of the construction industry. In its role as an Accredited Organization (AO), ACEL which has the technical capability and resources to undertake the program will serve as TESDA's partner in strengthening industry-led assessment and certification that will result in developing world class manpower resources and thus, help in increasing the middle manpower's employability both locally and internationally (Association of Carriers and Equipment Lessors (ACEL), 2012).

**Table 17. Numbers of Assessed and Certified HEO Workers 2000-2009**

| Trade Area | Assessed | Certified |
|---|---|---|
| Heavy Equipment Servicing (Mechanical) | 1,957 | 1,204 |
| HEO (Articulated Off-Highway Truck) | 25 | 25 |
| HEO (Backhoe) | 2,272 | 1,635 |

| | | |
|---|---|---|
| HEO (Bulldozer) | 2,372 | 1,511 |
| HEO (Concrete Pump) | 8 | 8 |
| HEO (Crawler Crane) | 310 | 202 |
| HEO (Dump Truck Driver) | 492 | 207 |
| HEO (Earth Moving) | 65 | 46 |
| HEO (Forklift) | 2,264 | 1,594 |
| HEO (Gantry Crane) | 503 | 478 |
| HEO (Hydraulic Excavator) | 1,461 | 1,261 |
| HEO (Lifting Category) | 2 | 2 |
| HEO (Motor Grader) | 1,482 | 946 |
| HEO (Rigid-Off-Highway Dump Truck) | 199 | 178 |
| HEO (Rigid-On-Highway Dump Truck) | 14 | 13 |
| HEO (Pay Loader) | 153 | 72 |
| HEO (Road Roller) | 214 | 181 |
| HEO (Rough Terrain Crane) | 331 | 326 |
| HEO (Tower Crane) | 103 | 102 |
| HEO (Truck Mountain Crane) | 409 | 292 |
| HEO (Wheel Loader) | 6,129 | 3,642 |

**Source: Technical Education and Skills Development Authority (TESDA)**

At present, only sixty percent of the heavy equipment operators who submitted to TESDA certification exams actually qualified. Many of these workers get the certification in order to be employed overseas.

The Monark Foundation Incorporated (MFI) adopts the Dual Training System of education where scholars acquire sufficient and quality technical knowledge in school and practical competencies in the industry. As accredited by the TESDA and a sub-licensee of the CATERPILLAR Institute of Australia, its graduates are highly recognized both locally and abroad. At present, MFI offers scholarships to Filipinos who are between 18 to 25 years old, single, highly motivated to learn and develop skills that the global heavy equipment industry demands. The foundation offers a 24 month course on Heavy Equipment Servicing NC2 (for males), an 18 month course on Industrial Office Management (for females) as well as other heavy equipment operation courses such as forklift operation, loader operation, excavator operation and motor

grader operation. Selected graduates from Monark Foundations's "Technicians for the World Project" who have passed the Caterpillar skills assessment as well as TESDA NC2 assessment for heavy equipment technicians may be deployed to a French CAT dealer with operations in Equatorial Guinea, Africa, or a major Middle East CAT dealer or to the Monark Equipment dealer in the Philippines. The industrial coordinators and the executive director of the MFI create and maintain training and job opportunities by continuing to build partnerships with the industry's leading companies and networking with sponsors and non-government organizations.

### f. Technical / vocational courses for high school graduates

Students able to complete secondary education but are unable to pursue a college course, may improve their chances of getting employed by enrolling in training programs designed to provide them with technical skills needed by the mining industry. In addition, students who have been able to finish only one or two years at the tertiary level may also consider the alternative of completing a technical course to improve their chances of getting employed even without a college degree. Presented below is a list of courses under the Technical Education and Skills Development Authority (TESDA) which may be taken by secondary education graduates who are interested in getting employed in the Philippine mining industry:

**Regular Courses with Competency Based Curriculum Equipment Operations for the following**:

1. Backhoe Loader
2. Bulldozer
3. Concrete Pump NC II
4. Heavy Equipment Operation Crawler Crane NC II
5. Heavy Equipment Operation Gantry Crane NC II
6. Heavy Equipment Operation Rough Terrain Crain NC II
7. Heavy Equipment Operation Screed NC I

8. Heavy Equipment Operation Tower Crane NC II
9. Heavy Equipment Operation Transit Mixer NC II
10. Heavy Equipment Operation Truck Mounted Crane NC II
11. Heavy Equipment Operation Servicing (Mechanical) NC II
12. Highway Dump Truck
13. Hydraulic Excavator

Other Support Service Operations

14. Reinforced Steel Bar Installation NC II
15. Rigging NC I
16. Rigid Off-Highway Dump Truck NC II
17. Electrical Installation & Maintenance NC II, NC III, NC IV
18. Forklift
19. Pipe Fitting NC II
20. Plumbing NC I, NC II, NC III
21. Scaffold Erection NC II
22. Shielded Metal Arc Welding NC II
23. Structural Erection
24. Submerged Arc Welding NC II
25. Transmission Line Installation & Maintenance NC II, NC III
26. Wheel Loader
27. Welding NC I, NC III, NC IV

**g. Entrepreneurial options**

Mining workers with TESDA certified skills and adequate work experience may in the future, move towards setting up their own enterprises which will undertake subcontracting jobs for underground mining and development, tunneling projects, and quarry and drilling operations. Workers with expertise in heavy equipment operations may consider becoming independent service providers which can be subcontracted by large scale firms interested in outsourcing these functions in order to cut down on operational cost. Several owners of small and medium scale enterprises involved in quarrying marble, granite, sand and gravel initially started as heavy equipment operators. After several years of working as employees, they consequently ventured into independent operations after accumulating enough experience in the business and getting access to enough working capital.

Another entrepreneurial option outside of mining and quarrying operations, is the pursuit of livelihood programs involving livestock and processed food production. As part of the firm's corporate social responsibility (CSR) functions, Philex Mining for example, through its Community Business Technology Center (CBTC), promotes livelihood programs such as livestock, aquaculture, meat processing, and coffee and vegetable production among its employees . The company is providing employees and their families free livelihood training to empower them as small scale entrepreneurs or agri-businessmen. The company is also helping employees to establish cooperatives to make their livelihood sustainable (Diso, 2011). A total of 24 scholars completed free training on meat processing, with another 28 scholars expected to participate in the training program for 2012. The meat processing CBTC is in full implementation and currently produces an average of 2,000 kilograms per month of processed meat food being sold to local communities, with the finished products being distributed through marketers who are mostly dependents of Philex Mining employees (Camacho, 2011). Under the coffee CBTC, a total of 1,200 robusta coffee and 300 golden shower seedlings have already been planted and currently being maintained by the local residents, while the aquaculture CBTC has construction of the aquaculture and sedimentation ponds which are both on-going (Philex Mining Corporation, 2012).

## VII. Job Outlook and Prospects

The global economic crisis in 2008 and the concomitant fall in demand for metals had a negative impact on the Philippine mining industry. However, prospects for employment expansion for 2011 and beyond, are moderately good considering that mining output is expected to grow at an annual average rate of 2.57 percent along with increasing investments (Wood, 2010). The increase in the number of operating mines from fourteen in 2003 to twenty eight in 2010 shows the continuing efforts of expansion being undertaken by the private sector (along with government support) that is expected to boost output and employment growth. The increase in the production volume of the country's top three minerals namely: gold, copper and nickel provides a good indication of prospects within the medium term. The operation of new mines, higher mineral product demand and

favorable prices have raised copper and nickel production to over 49,000 and 137,000 metric tons respectively, during the year 2009. The scale of untapped natural resources in the country (with an estimated value of over $ 1 trillion) should be making the country a key target for foreign mining concerns over the long term. (Business Monitor International, 2011). Lepanto Consolidated Mining Company operates the Victoria Gold Mine in Benguet which has production capacity of 875,000 tonnes. Philex Mining Company has the Pacdal Copper Mine in Benguet which can generate 37.6 million pounds of copper, and 171,092 ounces of both gold and silver. Benguet Corporation can produce 1 million metric tons of refractory chromite and 57,000 metric tons of metallurgical chromite. While the production capacity for nickel ore is largest for the Rio Tuba Nickel Mining Corporation, at 867,403 metric tons, the Cagdianao Mining Corporation at 500,000 metric tons, the Hinatuan Mining Corporation at 220,000 metric tons and the Taganito Mining Corporation at 150,000 metric tons (Mines and Geosciences Bureau, 2011).

Because of the number of projects currently being developed, along with ongoing exploration activities, gold and copper output is expected to further increase within the next three to four years (Ramos, 2010). The country has seen an upsurge in foreign mining investment since 2005, when the Supreme Court upheld the constitutionality of the Financial or Technical Assistance Agreement and the Mining Act of 1995 which allows 100 percent foreign ownership in Philippine mining companies. Over 30 foreign companies have investments in the Philippine mining sector and some 24 flagship projects are expected to be operational before 2016 (Mining Journal 2009). Government's efforts to revitalize the mining industry should continue to encourage more investment which is expected to boost the demand for both professionals and productions workers (Halcon, 2005).

However, it is also important to consider the issues raised by special interest groups which have been campaigning against mining operations because of environmental concerns and the social costs to communities which are going to be displaced. Several local governments have banned open pit mining operations because of the environmental damage it creates

and its negative spill over effects on the agricultural sector. Open pit mining operations may create damaging effects on water resources, water supply and its quality which further worsens living conditions for residents of downstream communities. The South Cotabato Environment Code for example, contains a provision to ban the use of open pit mining in the province, which runs counter to the Philippine Mining Act of 1995. The Regional Development Council believes that the passage of the code with the above mentioned provision will derail efforts towards the implementation of the Tampakan Copper Gold Project (to be operated by Sagittarius Mines Inc.) which happens to be the flagship minerals development project for Mindanao. The South Cotabato provincial government stands firm in its position to require Sagittarius Mines Inc. to present a water management plan that will prevent the negative effects of possible open pit mining operations (Regional Development Council XII, 2009). In addition to this, are the activities of communist rebels which raid mine sites and damage equipment as part of their response to stop unregulated mining operations or in some cases, extort payments from the mining firms. In October 2011, police reports revealed that roughly 200 New People's Army (NPA) guerillas attacked the compound of the Taganito Mining Corporation in Claver town, Surigao del Norte, briefly taking several employees hostage and burning trucks, excavators and a guest house. The mine is owned by Nickel Asia Corporation, the Philippines largest producer. An affiliate, Taganito HPAL Nickel Corporation and the nearby Platinum Metals Group were also attacked in what NPA rebels claimed as "payback" for years of alleged environmental damage and abuse by firms. Approximately P3 billion pesos worth of equipment and facilities were damaged which included the burning of a smelting plant, guest house, 132 dump trucks, 22 backhoes, nine barges, two cranes, two bulldozers a compactor and a grader. Surigao del Norte is home to 10 of the country's 30 metallic mines (Philippine Star, 2011, Guitierrez, 2011). These issues should be immediately addressed by government so that a reasonable compromise may be arrived at, which will meet environmental protection goals, and at the same time achieve environmentally sound and acceptable mining practices.

The mining industry holds a lot of potential and performs a complementary role in industrial development. It will be

necessary to use this potential if the country wants to attain its economic development goals within the next decade, but at the same time remain prudent in the use of these natural mineral resources, so that succeeding generations may still benefit from it. Responsible mining should protect the environment, and restore mine sites to their original condition through reforestation efforts. A good compromise between sound environmental protection and effective regulation of mining activities should reduce the hostility coming from anti-mining advocates and promote efforts to tap the country's unused mineral potential. Such efforts should continue encouraging investment into mining along with job creation and the development of both upstream and downstream mineral processing activities.

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