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# Skills trends for green jobs in the cement industry in Indonesia

Regional Office for Asia and the Pacific

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# Foreword

The Government of Indonesia views the reduction of greenhouse gas (GHG) emissions from the cement industry as a national priority, while at the same time recognizing the need to continue promoting job creation in the regulated economy. This creates the conditions to create more green jobs in the economy that can bring productivity gains to industry, be compliant with safe and sustainable working conditions and contribute to the global movement towards producing low carbon, environmentally friendly products.

The national Climate Change Action Plan that targets eight industrial sectors in Indonesia aims to abate 70 per cent of greenhouse gases emissions by 2020, in particular through the introduction of green technologies and green techniques.[1] In this context, cement production is a priority target as it accounts for 41 per cent of all GHG emissions coming from industry.[2] Over the same period, demand for cement is expected to grow by more than 55 per cent while the direct labour force in this sector also is expected to expand by more than 33 per cent with a sizable increase in productivity. Very significantly, the indirect manpower supporting the production and distribution of cement is expected to rise from 0.6 million in 2005 to almost 1 million in 2020.[3]

A critical factor to achieve these ambitious production targets while complying with national environmental commitments will be to tackle the skills challenge for the growing direct and indirect labour force. Different skills sets can be anticipated for the new green jobs and the greening of existing jobs that a transformation of cement production will bring. Consequently, there is a pressing need to improve sector understanding on existing skills gaps and shortages, the main trends in skills development as green technologies are progressively introduced and on ways to develop a responsive system for the delivery of skilled workers that match the changing needs of industry and in particular in energy intensive sectors.

In this context, the International Labour Organization (ILO) Regional Office for Asia and the Pacific in collaboration with the Korea Research Institute for Vocational Education and Training (KRIVET) has implemented a project to promote green jobs and decent work in the cement sector in Indonesia. Under the umbrella of the ILO/Korea Partnership Programme, KRIVET has completed a study on the global green technologies available for the cement industry.[4] Based on a previous study by KRIVET and supported by other inputs, this present study identifies four clusters of green technologies that will impact the productivity of cement companies, the skill map of the workforce and the conditions of work of the cement industry in Indonesia by 2020.

The purpose of this report is therefore to review in a systematic manner the skills available and required for the introduction and deployment of different clusters of green technologies. To facilitate the gap analysis, the report also provides a general description of the concept of green

[1] D. Suroso et al.: *Indonesia climate change sectoral road map* (Jakarta, BAPPENAS, 2009).
[2] *Ibid*.
[3] See table 9 in Section 2.2 of this document.
[4] G. Hwang et al.: *Implementation of green jobs activities – Green jobs study in energy intensive industries in Asia* (Seoul, KRIVET, 2010).

jobs and the greening of existing jobs as applicable to the cement sector in Indonesia. It reviews the existing systems in place for bringing to the labour market the skilled labour force in demand by industry and proposes some specific recommendations on how to adapt such systems to evolving demands, in particular through a higher level of public-private collaboration.

This report must be considered in the context of the efforts made by the ILO in reviewing needs for green skills and greener skills and the development of sector-based analyses that can advance this global research work on promoting decent work. Therefore, it should be read in conjunction with the ILO report *Skills for green jobs: A global view* (ILO, 2011). It is further hoped that this report can contribute to the facilitation and operationalization of an integrated approach to the implementation of climate change and labour policies in Indonesia with the creation of decent, productive work, in particular in energy intensive sectors.

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# Executive summary

In this study we have analyzed the present scenario regarding manpower skills in the Indonesian cement sector and have projected anticipated changes to the sector caused by the introduction of green technologies. Our recommendations for making the required changes to the Indonesian cement sector have been made in two separate sections; direct manpower and indirect manpower, as explained below.

### Direct manpower

This study concludes that the direct specific man-hours per tonne in the Indonesian cement industry is expected to be reduced with the introduction of modern, more efficient, automated green technologies. Therefore, cement production in Indonesia will see both a sizable increase in productivity as well as a marginal increase in the absolute direct manpower by 2020. Of the 116.5 million labour strength of Indonesia in 2010, the direct manpower deployed by the cement sector was estimated at around 9,500 in 2005 which is expected to reach 12,500 by 2020.

**Concise recommendations** are given to hasten the implementation of the system. These include:

**i. Training for the implementers of Government programmes.** It is vital that the groups implementing the designed systems are trained to understand and appreciate the systems developed, so as to ensure proper implementation and returns.

**ii. Skills development strategy.** It is critical that a skills development strategy for the cement industry is incorporated in to the Climate Change Action Plan of Indonesia and other programmes.

**iii. Capacity building for training needs assessments (TNA) and modifying the curricula.** Training should be provided on how to conduct a training needs assessment and how to adjust the system to ensure that the gaps observed are incorporated in the curricula in a time bound period.

**iv. National level programmes** should be strategically re-engineered to ensure that the general jobseeker group has a higher basic education than primary level and the skilled workforce has a secondary level education.

**v. Improving the contracts management skills of the plant workforce.** The subject of contracts management should be added to all branches of polytechnic and graduate schools along with a provision for short-term executive courses in contracts management for working professionals.

**vi. Graduate and polytechnic-based executive programmes for skilled workers and supervisors.** Graduate and polytechnic-based programmes like those described in the report (refer to the case study of Holcim in Annex I) should be replicated in all the graduate and

polytechnic institutes. This should be done through a public-private partnership between the Government institutes at vocational, polytechnic and graduate level and the cement industry.

**A future system** covers the recommendations made to prepare the system to provide for future jobseekers with skills for green technologies in the cement sector over the coming decade:

**i. Recommended actions to be taken with the implementation of energy efficiency technologies (Cluster A).** Every cement plant should cooperate with the Human Resource Department, to inform the engineering, process, laboratory and operating staff at the cement plants about the developments in energy efficient technologies, equipment with their valuations and economics. This would help them to bring in these technologies not only when the new energy efficient plants are installed but also during maintenance of the equipment.

**ii. Recommended actions to be taken with the implementation of the technologies for alternative fuels and raw materials (AFR) (Cluster B).** With the help of international experts, training programmes should be organized to improve the AFR operational skills of the identified AFR group of managers, engineers and workers at Indonesian cement plants.

In addition, specialized skills training should be provided to drivers and their helpers who handle hazardous waste, as is being done already at lead cement companies in Indonesia.

**iii. Recommended actions to be taken with the implementation of the technologies for blended cement (Cluster C).** The study indicates that there is a need for skills, knowledge and technology (SKT) transfer of blended cement from other countries.

In particular, the report recommends that:

a. **The Indonesian Cement Association** and the progressive managements of Indonesian cement plants, with the help of experts from other countries, should conduct training programmes on blended cement manufacturing and marketing, targeted at the managers, engineers and workers at the Indonesian cement plants, and for the Indonesian end users, architects, masons, and governmental agencies.

b. **The Indonesian cement sector to organize education and marketing initiatives** among the users, such as architects, masons, and governmental agencies, to mitigate any adverse public perception of the blended cement quality.

c. **The Indonesian cement sector to organize** training programmes for managers, engineers and workers of the cement plants on the economic viability of investing in new facilities for preparation, storage, handling, transportation, and grinding to make blended cements.

**iv. Recommended actions to be taken with the implementation of Cluster D technologies (progressive technologies, PT).** The report recommends that the following actions be taken in this decade to prepare an adequate workforce for the implementation of these Cluster D technologies in Indonesia once they are commercialized.

In particular, the report recommends that:

**a. Skills, knowledge and technology group.** The report recommends **t**he following steps to formulate this skills, knowledge and technology group.

**Step 1.** A task team to be established composed of the Indonesian Cement Association, the Ministry of Manpower and Transmigration, the Ministry of Industry, the Ministry of Science and Technology, with the Ministry of Science and Technology acting as the nodal point for implementation.

**Step 2.** Two groups with members from the Indonesian research and development (R&D) centres to be formed:

- **A Technology Management Group** that will track the development of various Cluster D technologies and identify new emerging technologies, while simultaneously keeping the cement plants updated on the progress through leaflets/seminars and workshops.
- **A Skills and Knowledge Management Group** that will track and keep the plants updated on the development of the skills and knowledge for adopting these Cluster D technologies into the plants. Their work shall start when the technologies are on pilot scale trial.

**b. Transparency in the local R&D groups.** The Ministry of Manpower and Transmigration (MOMT), the Ministry of Education and Industry and the Ministry of Science and Technology should start proceedings for the required legislation, guidelines or directions to the local R&D groups to take proactive steps to share their knowledge on these Cluster D technologies with the Indonesian cement industry.

**c. Continual upgrading of knowledge of trainers in the country.** The MOMT, the Ministry of Education and the cement industry should start proceedings to incorporate in their training systems additional sections through which the knowledge of the trainers in the vocational training institutes (VTI), polytechnic and graduate colleges is continually upgraded with the new skills required for these progressive Cluster D technologies under development globally.

**Indirect manpower**

The following steps are desirable to be taken in Indonesia to provide an enabling environment for the generation of the proper trained indirect skilled manpower of truck drivers, riggers and construction workers:

**a.** Specific courses to be started in vocational institutes to train the driver trainers, so that they can become small time entrepreneurs and start new motor training institutes.

**b.** Specific subsidized microfinance schemes should be started by the banks to support these trained entrepreneurs in their endeavours.

**c.** The motor vehicle driving licensing system needs to be enhanced and made stricter to ensure the drivers have safe and efficient driving skills.

**d.** The Government and private training institutes can establish a new multi-tasking construction workers course for the indirect manpower requirement for handling the increased cement.

# Abbreviations

| | |
|---|---|
| ACert | AFR certification |
| AFR | alternative fuels and raw materials |
| APEC | Asia Pacific Economic Co-operation |
| ASEAN | Association of Southeast Asian Nations |
| BAP | best available performance |
| BAPPENAS | Badan Perencanaan Pembangunan Nasional, National Development Planning Agency of Indonesia |
| BAT | best available technology |
| BAU | business as usual |
| CCR | central control room |
| CCS | carbon capture and storage |
| CDM | clean development mechanism |
| CEDEFOP | European Centre for the Development of Vocational Training |
| CEREST | Centre for Vocational Training and Skills Upgrading |
| CFC | chlorofluorocarbon |
| CNG | compressed natural gas |
| $CO_2$ | carbon Dioxide |
| CPEE | cleaner production and energy efficiency |
| CPP | captive power plants |
| CSI | cement sustainability initiative |
| DNA | Designated National Authority |
| EIA | Environment Impact Assessment (AMDAL in Indonesia) |
| EMS | environment management systems |

| | |
|---|---|
| EVE | enterprise-based vocational education |
| FMCG | fast moving consumer goods |
| GDP | gross domestic product |
| GHG | greenhouse gas |
| GNP | gross national product |
| HR | human resources |
| IDR | Indonesian Rupiah |
| IEA | International Energy Agency |
| ILO | International Labour Organization |
| IOE | International Organization of Employers |
| IPCC | Intergovernmental Panel on Climate Change |
| ISBI | Indonesian Cement and Concrete Institute |
| ISO | International Organization for Standardization |
| ITUC | International Trade Union Confederation |
| KLH | Kementrian Lingkungan Hidup (Ministry of Environment) |
| KPI | key performance indicators |
| KRIVET | Korea Research Institute for Vocational Education and Training |
| KWH | kilowatt-hour |
| LRC | low rank coal |
| Mi/Tonne | million per tonne |
| MOMT | Ministry of Manpower and Transmigration |
| MPTA | million tonnes per annum |
| MSW | municipal solid waste |
| MTPA | million tonnes per annum |

| | |
|---|---|
| NCS | national competency standards |
| NGO | non-governmental organization |
| O&M | operations and maintenance |
| OEM | original equipment manufacturer |
| OFT | oxy fuel technology |
| OHS | occupational health and safety |
| OPC | ordinary Portland cement |
| PPP | public-private partnership |
| PROPER | Programme Penilaian Kinerja Perusahaan (Programme Assessment Rating Company Performance) |
| PT | progressive technologies |
| R&D | research and development |
| RAN | Rencangan Aksi National (National Action Plan) |
| SKT | skills, knowledge and technology |
| SME | small and medium-sized enterprises |
| SNI | Standar National Indonesia (Indonesia's National Standard) |
| SRKLI | Standar dan egistrasi Kompetensi Lingkungan Indonesia (Indonesian Standard & Registration for Environmental Competency) |
| TNA | training needs assessments |
| TOT | training of trainers |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| VRS | voluntary retirement scheme |
| VTI | vocational training institutes |
| WBCSD | World Business Council for Sustainable Development |

| | |
|---|---|
| WHRS | waste heat recovery systems |
| WMC | waste management company |

# 1. Study methodology

The ILO Regional Office for Asia and the Pacific in collaboration with the KRIVET implemented a project to promote green jobs and decent work in the cement sector in Indonesia. Under the umbrella of the ILO/Korea Partnership Programme, KRIVET completed a study on the global green technologies available for the cement industry.

Concurrently, an international expert and the senior members of the KRIVET team visited Indonesia and met the officers of the ILO Country Office for Indonesia, Indonesian Ministries of Manpower and Transmigration, Industry (Directorate of Energy Efficiency), the Centre for Vocational Training and Skills Upgrading (CEREST), the Indonesian Cement Association, and visited Holcim Cement Plant in Narogong, Bogor, and discussed with the human resource, environment, vocational training institute and AFR officers and engineers (see Annex XV for the list).

A series of discussions were held at all levels with the cement sector in Indonesia, as well as with the various training institutes at the polytechnic, vocational training and vocational training centres. The discussions mainly centered on the quality of engineers, skilled artisans and the semi-skilled workforce who graduated from the various training institutes. There was almost a consensus that all possible efforts are made by the institutes to build the required skills in the workforce, but they always fall short of the basic requirements of the cement sector and the industry in general. In this study the complete system of skills development, evaluation, training and certification was reviewed, including its implementation. Detailed discussions were held with the group implementing the systems on the ground level to identify any gaps in the system, which are leading to these gaps in the skilled workforce requirement and availability.

This present study was compiled based on the study report by KRIVET, inputs of the Indonesian Government, the visit and discussions in Indonesia, along with the experience of the international expert.

## 2. Background information on the cement sector in Indonesia

Indonesia is the world's third largest GHG emitter at 2.2 billion tonnes per annum. The Indonesian Government has announced a target of a 26 per cent reduction of GHG emissions by 2020, and 41 per cent in case international assistance is provided. To realize this goal, the Government has put in place 90 action plans across eight industrial sectors including cement, with which it is proposed to abate 70 per cent of the GHG emissions from the industry by 2020. The cement industry alone accounts for 41 per cent of the total GHG emissions from industry in Indonesia. In this context, the Government of Indonesia views the reduction of GHG emissions from the cement industry as a high priority for Indonesia's sustainable industrial development over the next 20 years.

**Table 1. Projected GHG emissions from the cement sector in Indonesia on a business as usual (BAU) basis**

| Year | Cement design capacity MTPA | Emissions calcinations in MTPA $CO_2$ | Emissions fossil fuel in MTPA $CO_2$ | Emissions grid electricity in MTPA $CO_2$ | Total emissions in MTPA $CO_2$ |
|---|---|---|---|---|---|
| 2005 | 46.090 | 17.814 | 12.864 | 0.946 | 31.624 |
| 2008 | 44.890 | 20.150 | 14.138 | 1.077 | 35.365 |
| 2014 | 55.246 | 27.679 | 19.462 | 1.498 | 48.639 |
| 2020 | 74.036 | 36.557 | 25.730 | 1.991 | 64.278 |
| Cumulative MTPA | | 102.200 | 72.194 | 5.512 | 179.906 |

Source: D. Suroso et al., 2009.

In Indonesia the cement industry contributed 0.77 per cent to the gross domestic product (GDP) of US$561 billion in the year 2009.[5] The manpower strength of Indonesia was placed at 116.5 million in 2010. The direct manpower deployed by the cement sector was low at around 9,500 in 2005, which is expected to reach 12,500 in 2020. However, the indirect manpower supporting this production, distribution and consumption is expected to rise from 0.6 million in 2005 to 0.987 million in 2020. The skills profile of the manpower required in the cement production shall go through a drastic change because of the new green and energy efficient technologies. It is necessary to train new staff and retrain the old staff to reap the benefits of the technologies. Though the skills required for the indirect manpower would not be new, arrangements shall have to be made to provide this large trained manpower to support the use of the additional cement

[5] Ministry of Industry of the Republic of Indonesia: *Industry for better life – Facts and figures* (Jakarta, MIRI, 2010), http://www.Kemenperin.go.id/Ind/Publikasi/MajalahFACTFIGURES/File/201007.pdf [accessed 7 June 2013].

production. In the subsequent sections we shall discuss these aspects of skills identification and training for both the direct and indirect manpower.

In 2010, the installed production capacity of the Indonesian cement sector of the nine cement companies was 48 million tonnes per annum (MTPA) of cement, which is projected to increase by 55 per cent to 74 MTPA by 2020. The baseline emission intensity of cement production in Indonesia is 0.833 tonnes $CO_2$/tonne of cement which, on a business as usual (BAU) basis, is expected to be maintained until 2020. At this emission intensity, the GHG emissions from the cement industry are expected to more than double from 31 MTPA to 64 MTPA by 2020. The actual and estimated GHG emission trend from the cement industry in Indonesia until 2020, on a BAU basis, is enumerated in table 1.[6]

The GHG emissions in the cement industry projected in table 1 are generated from four areas of the business:

a. the process of cement manufacturing;
b. the use of fossil fuels for producing cement;
c. the use of electricity for producing cement; and
d. the fuel used for transportation of raw materials and the finished product.

Processes and fossil fuel use in the process and power generation comprise 90 per cent of the GHGs emitted by cement plants.

So as to mitigate the projected emissions from the cement industry by 2020, we shall examine the various green technologies available globally for cement manufacturing, use of fuel and electricity for producing cement and study the barriers to their implementation in Indonesia from a human development perspective that have to be addressed by the Government, so as to facilitate their implementation and accomplish results.

## 2.1 Green technologies for cement industry in the Indonesian context

According to the United Nations Framework Convention on Climate Change (UNFCCC), there are over 60 individual technologies currently available to reduce GHG emissions from the cement industry. They can be broadly grouped under four clusters:

**Cluster A – Technologies for improving energy efficiency.** A variety of technological innovations are available internationally to reduce the energy required for operating a cement plant. These technologies can be adopted while installing new capacity and also while changing the old equipment when it has served its normal life. All the technologies that lead to energy savings are grouped together, and the major technologies are detailed. Efforts can also be made to reduce energy consumption from non-kiln activities such as lighting, motor efficiencies, air-conditioning and fuel in machinery including trucks – these have not been covered in this paper.

[6] Based on BAU emission intensity and the projected cement growth rate.

A1. Installation of 5 and 6 stage preheaters and calciners

A2. Installation of waste heat recovery systems

A3. Use of high efficiency grinding mills

A4. Use of energy efficient fans

A5. Installation of captive power plants (CPP) to save on transmission losses

A6. Use of low energy and high momentum burners for lower fuel consumption

A7. Replacement of old plants with high capacity energy efficient plants

**Cluster B – Technologies for use of alternative fuels and raw materials.** Industrial hazardous and non-hazardous waste, agricultural waste and municipal solid waste, all have some inherent calorific value. These wastes with calorific value have to be disposed of by burning them in incinerators, consuming more fuel and increasing emissions over and above that from the waste burning itself. Using these wastes to replace the fuels and raw materials in the cement plants ensures their proper disposal, since they are incinerated at the high temperatures of 1400$^{\circ}$C in the cement kiln. It also in turn reduces the emissions both through the elimination of the fuel required to incinerate them in incinerators and that from the fuel its calorific value replaces in the kiln. These initiatives are detailed here:

B1. Use of agricultural waste

B2. Use of industrial and municipal solid waste

B3. Use of discarded tyres

B4. Use of waste oil and solvents

B5. Use of waste plastic, textiles and waste residue

B6. Use of industrial waste, market rejects, expired medicines and products

B7. Use of alternative raw materials like lime, iron, alumina and silica rich industrial waste to replace raw materials and additives

As these technologies are relatively new and the process by which they ensure reductions of GHG and natural resources requires a little detailed explanation, we shall discuss how their use affects GHG emissions technology-wise below:

i. **B1 Technology: Agricultural waste** is considered $CO_2$ neutral under the Kyoto Protocol, there is reduction of GHGs.

ii. **B2 Technology: Municipal solid waste (MSW)** is normally disposed of in incinerators where additional fuel is used for the incineration. There is a valid generation of $CO_2$ while disposing of the MSW through incineration. One from the fuel used for incineration and another from the calorific value of the MSW. This is the BAU scenario. When MSW is used to replace fossil fuels in the cement plant, the $CO_2$ from the fuel used in the incinerator and the fossil fuel replaced in the cement plant by the MSW, is avoided.

iii. **B3 Technology: Discarded tyres** are also normally disposed of in incinerators where additional fuel is used for the incineration. There is a valid generation of $CO_2$ while disposing of the discarded tyres through incineration. One from the fuel used for incineration and another from the calorific value of the tyres. This is the BAU scenario. When discarded tyres are used to replace fossil fuel in the cement plant, the valid $CO_2$, from the fuel used in the incinerator and the fossil fuel replaced in the cement plant by the discarded tyres, is avoided.

iv. **B4 Technology: Waste oils and solvents** are also normally disposed of in incinerators where additional fuel is used for the incineration. When waste oils and solvents are used to replace fossil fuel in the cement plant, $CO_2$ emissions are reduced.

v. **B5 Technology: Waste plastics, textiles and waste residue.** There is a valid generation of $CO_2$ while disposing of waste plastics, textiles and waste residue through incineration. Using them to replace fossil fuels in the kilns can reduce $CO_2$ emissions.

vi. **B6 Technology: Industrial off-specification waste, market rejects, expired medicines and products** are also normally disposed of in incinerators where additional fuel is used for the incineration, unless they can be recycled within the plant. The law may not require for the market rejects and off-specification products to be disposed of through incineration. But the manufacturers always take the incineration route for total destruction rather than sending to landfill, so as to avoid clandestine recycling of these products into the market again, and to protect their brand image. There is a valid generation of $CO_2$ while disposing of them, one from the fuel used for incineration and another from the calorific value. When industrial off-specification waste, market rejects, expired medicines and products are used to replace fossil fuels in the cement plant, $CO_2$ emissions are reduced.

vii. **B7 Technology: Alternative raw materials lime, iron, alumina, silica rich industrial waste to replace raw materials and additives at the cement plants.** When we replace limestone with lime we reduce direct $CO_2$ emissions, which come from the calcination of limestone, which is calcium carbonate and in this process gets converted to lime i.e. calcium oxide and $CO_2$. For every 1 tonne of limestone which is replaced with lime, 1 tonne of $CO_2$ emissions are saved. Use of other alternative additives from industrial waste results in the reduction of the $CO_2$, which is emitted from the mining equipment and during transportation. It also results in saving finite natural resources.

**Cluster C – Technologies for producing blended cements.** Regular cement requires clinker and gypsum to be ground up to make Portland cement. There are additives like fly ash, steel slag and naturally occurring pozzolona which can be added to the mix to reduce the amount of clinker used. These are known as pozzolonic materials. The pozzolonic materials have the property of generating hydraulic strength in the presence of clinker. Depending on the blended cement standards and the quality of clinker made in the plant, pozzolonic materials can be added at the grinding stage to the clinker and gypsum mix. These are known as blended cements. The requirement of clinker per unit cement is reduced to the extent the pozzolonic additives are

added, thus saving the specific fuel and natural resources like limestone, iron ore, alumina, silica needed to produce the clinker. These savings in the fossil fuel and natural resources results in reductions of GHGs per unit of cement produced. The technologies to produce various blended cements and reduce GHG emissions are listed below:

C1. Use of granulated blast furnace slag as pozzolonic material to make slag cement

C2. Use of fly ash from coal-based power plants as pozzolonic material to produce pozzolona cement

C3. Use of naturally occurring pozzolona for making pozzolona cement

C4. Use of limestone as an additive in cement

C5. Use of recycled concrete as a cement additive after processing

**Cluster D – Use the progressive technologies (PT) under development in the world to reduce GHG emissions.** There are technologies which are in the developmental stage, and which can, when commercialized, reduce GHG emissions. These initiatives when adopted would reduce emissions in the cement plants. Some of these are detailed below:

D1. Use of the energy efficient fluidized bed technology

D2. Use of carbon capture and storage (CCS) application in power plants and cement plants

D3. Use of oxy fuel technology (OFT) to reduce energy consumption and increase plant capacities of the present kilns

D4. Use of algal technologies to recycle $CO_2$ as fuel for cement and power plants

D5. Use of alternative green cements

## 2.2 Main barriers related to green technologies in the cement sector

**Cluster A – Technologies for improving energy efficiency.** These are expected to address 10 per cent of the GHG emission reductions, as the companies have already taken most of the technological advantages of the energy efficient technologies in their present plants, and the new plants are already highly energy efficient. Barriers to the implementation of these technologies are due to:

a. lack of knowledge of the plant managers and the maintenance staff about the new energy efficient equipment, spares and control systems which are to be inducted through a continual improvement programme; and

b. competing investment strategies, where investments are made for reliability and new capacity rather than for energy efficiency.

**Cluster B – Technologies for using of alternative fuels and raw materials.** These are expected to take care of 40 per cent of the GHG emission reductions, as the technologies are still at the infancy stage in the cement sector in Indonesia, and there is a good opportunity to take advantage of the technology. Barriers to their implementation are:

a. lack of trained manpower at all levels to effectively identify, procure, and use the AFRs in the cement plants;

b. lack of knowledge with the managers, engineers and workers of the cement plants of the matching availability of waste to the fuel or raw material to be replaced. These have to be gained from countries using these technologies as in Belgium, Chile, India, Norway and the United States;

c. non-availability of the waste in sufficient quantities to replace the fuel or raw materials;

d. lack of knowledge of the managers, engineers and workers about the technology to use in the cement process. These have to be gained from other countries;

e. lack of understanding of the economic viability of the use of AFRs against the use of traditional fuels with additional investments in handling, storage, feeding and control systems;

f. unreliability of supply both in quantity and quality of the waste, since it is a waste and not a product;

g. legal limitations as the use of AFRs sometimes may result in lower specific outputs at the kiln. But the licence requirement of the state-owned plants is that they have to meet the production output before their income can be retained for reinvestment. This is currently a barrier to innovation and abatement activities for state-owned cement plants in Indonesia;

h. legal limitations, since Indonesia has laws governing the waste in waste disposal units but there are no laws for its disposal in cement and power plants;

i. internal stakeholder apprehension regarding using AFRs in cement plants, that its use would adversely affect reliability and production; and

j. lack of trained and knowledgeable staff at the cement plant and government ministries who make and enforce laws that govern waste utilization in cement and power plants.

**Cluster C – Technologies for producing blended cements.** These are expected to take care of the remaining 50 per cent of the GHG emission reductions, as the technologies are proven, and opportunities abundant to implement them in Indonesia. The barriers to their implementation are:

a. Indonesian hazardous waste law, which prescribes powerhouse fly ash and steel slag as hazardous waste, even though it is not classified as hazardous waste in Europe and many other Asian countries;

b. adverse public perception of the cement quality when made from waste raw materials and fuel, which needs to be addressed through educational and marketing initiatives;

c. economic viability of investing in new facilities of preparation, storage, handling, transportation, and grinding to make blended cements;

d. lack of adequate knowledge with the staff of the ministries approving the use of these wastes like fly ash and steel slag as pozzolonic additives to make cement;

e. lack of knowledge of the cement plant managers and supporting staff to produce the right blend of the clinker and pozzolona to make market acceptable pozzolona blended cement; and

f. lack of knowledge of the cement marketing force to project the qualities of the pozzolona cement and allay the adverse public perception of the quality of the pozzolona cement. Here the marketing personnel and those from the quality control of the plant have to work together to remove the perception through mason meets, architect meets, public meetings, etc. It would be a great public relation effort, and the initiatives taken by other countries like India and China have to be considered by the people heading this public relations initiative. The experience of these countries has to be drawn upon and capitalized to achieve success. The clinker to cement ratio for the three major cement players in Indonesia is given in table 2 below. The large gap between their performance and that of the best global projects highlights the great opportunity that exists to increase blended cement market share and to reduce GHG emissions in Indonesia.

**Table 2. Clinker to cement ratio for 2008**

| Company | Clinker to cement ratio |
|---|---|
| PT. Holcim Indonesia | 0.809 |
| PT. Indo-cement | 0.825 |
| PT. Semen Gresik | 0.830 |
| Best performance globally | 0.64 |

Source: D. Suroso et al., 2009.

**Cluster D – Use of progressive technologies under development in the world to reduce GHG emissions.** These comprise of technologies under development and trial runs, and require the government and industry to keep a tab on their development or better still to be a part of the development itself. They should then adopt them as soon as they become technically or commercially viable. The barriers to their implementation are specified below:

a. lack of knowledge of the top management of the cement plants and the decision-makers in the industries ministries, regarding the new technologies under development and their developmental progress. This is because little effort is made to keep abreast of new technologies till they become technically or commercially available;

b. lack of transparency on behalf of the R&D groups working on the technologies; and

c. lack of trained workers to operate these technologies when they become commercially available. This is because skill development is a continuous process and the skill density is the highest where the technologies are developed. Transfer of skills requires plans and strategies to be put in place much before the technologies are adopted.

## 2.3 National options for reducing carbon emissions in the cement sector in Indonesia

The Indonesian Government has taken proactive steps by incorporating the above four Clusters A to D of green technology groups into its plans to reduce GHG emissions from the cement industry. They have identified the players and have planned to enter into specific Climate Change Cooperative Agreements (2010–14) with clear key performance indicators (KPIs) for the implementation of the induction of the new technologies by the players with clear time lines. This shall be supported by financing arrangements through the Government and loans from the Asian Development Bank under their schemes for $CO_2$ mitigation. The details of skills required to implement the technology induction plans, and the training of manpower to man these and support the additional cement in the market on expansion, shall be discussed in the following sections.

In accordance with the national plans to overcome the barriers to the implementation of these plans, and with their proper implementation as per time lines drawn up, the emission intensity of the cement industry is likely to be reduced by 11 per cent from the present 0.833 t $CO_2$/t clinker to 0.774 t $CO_2$/t clinker in 2014 and 0.737 t $CO_2$/t clinker in 2020. In this scenario, the Government has estimated a cumulative reduction of 43 MTPA (24 per cent) of the 179.906 MTPA of GHG emissions expected from the cement industry in the period 2010-20. (See tables 1 and 3).

**Table 3. Matrix of the GHG emission mitigation actions feasible for the Indonesian cement industry**

| Cluster | Period | Cumulative emission reduction Mt $CO_2$ | Total mitigation cost million US$ | Abatement costs US$/t $CO_2$ | Emission reduction compared to BAU per cent |
|---|---|---|---|---|---|
| Cluster A – Technologies for improving energy efficiency. | 2010–20 | 7.16 | 115.65 | 16.16 | 1.27 |
| | 2010–20 (w/o fuel savings) | 7.16 | 216.56 | - | - |
| Cluster B – Technologies for use of alternative fuels and raw materials. | 2010–20 | 17.45 | 10.74 | 0.62 | 3.10 |
| | 2010–20 (w/o fuel savings) | 17.45 | 24.22 | - | - |
| Cluster C – Technologies for producing blended cements. | 2010–20 | 18.50 | (20.48) | (1.11) | 3.29 |
| | 2010–20 (w/o fuel savings) | 18.50 | 35.92 | - | - |
| Cluster D – Use the progressive technologies under development in the world to reduce GHG emissions. | Their effect cannot be estimated as these technologies are under development | | | | |
| Total | 2010–20 | 43.11 | 105.91 | 2.46 | |
| | 2010–20 (w/o fuel savings) | 43.11 | 276.70 | 6.42 | |

Source: D. Suroso et al., 2009.

In this report we shall assess the feasibility of incorporating these four groups of technologies in the Indonesian cement industry and propose plans required for developing the workforce to man these technologies. These plans for the trained workforce would be necessary so as to fruitfully incorporate these technologies into the cement industry in Indonesia and reap their benefits both on cement sector efficiency and GHG emission reductions, as envisaged by the Indonesian Government.

# 3. Mapping of green jobs in the cement sector in Indonesia

The present study that focuses exclusively on the Indonesian cement sector must be considered in the light of the global research produced by an expert team from KRIVET on cement (2010–11). In this research, the main green technologies for the cement sector have been listed and studied on a global scenario including the technological, manpower and skill requirements for their implementation. Information is available in the report *Implementation of green jobs activities* (Hwang et al., 2010). The main clusters of green technologies developed in the KRIVET report and information collected have then largely been used to conduct the analysis of the present report as applicable to the Indonesian context.

The present report provides a general description of the concept of green jobs and the greening of existing jobs as applicable to the cement sector in Indonesia. On that basis, the skills required for each of the technologies in each green technological cluster are studied in more detail. The teams are identified for the skilled manpower prevalent in the cement plants, which shall be affected by the implementation of each of the technologies in all selected four clusters of green technologies. Then, based on the KRIVET study and other inputs, the skills required for the introduction and use of these green technologies are reviewed. On that basis, the gap in the skills available and those required for implementation of the technologies of each cluster can be assessed in a more systematic manner. The required actions to fill up the identified gap are thus discussed later in the report.

The evolution in the direct and indirect manpower of the cement sector in Indonesia till 2020 are studied separately as well as the cement production capacity in the sector. Indirect manpower is then studied to identify the manpower and skills before and after implementation of green technologies and capacity building. Actions required to be taken to take care of the gaps identified in the manpower and skills are discussed later in the report.

## 3.1 Green jobs and greening of blue- and white-collar jobs

Since industrialization there have been two categories of jobs: white- and blue-collar jobs. With the efforts to reduce GHG emissions, through the induction of new technologies, a new category of green-collar jobs and workers has surfaced and their numbers are increasing, opening up new job sectors. These white- and blue-collar workers are learning new skills to be able to implement the green technologies and reduce GHG emissions, what has become known as the greening of jobs. In this report all new jobs created as a result of the greening initiative to reduce GHG emissions are designated as green jobs, irrespective of whether it needs new skills or not. The greening of jobs is the process of inducting new skills into the skill map of the workforce already in place in the cement sector.

## 3.2 Mapping of green jobs technology-wise and cluster-wise in the cement sector

Mapping the distribution of the workforce in the cement sector provides four main teams, which are affected by the introduction of the four Clusters A to D of green technologies in the sector. The four teams are listed:

Team1. Input material procurement team
Team2. Plant production team
Team3. Product distribution team
Team4. The marketing and knowledge transfer team

There are also other support teams such as finance, costing, management, administrative, and human resources, etc., the skills of which are not affected directly by the introduction of these four Clusters A to D of green technologies. These teams thus do not figure in the mapping exercise of this paper.

The impact of green technologies on the skills of each of these four teams forms the basis of the mapping exercise of green jobs in this paper. The implementation of the four clusters of technologies in the cement sector for producing the low carbon cement requires a change in the composition of the workforce and their skills. New skills and a trained workforce is required mainly in teams 1 and 2 and retraining of the existing skilled manpower is desirable in almost all the four teams to ensure the success of inducting these four Clusters A to D of green technologies into the cement sector. The broad effect on each of the teams caused by the introduction of the green technologies is given in table 4.

**Table 4. Effect on each manpower deployment area**

| Cluster details | Initiative | Input material procurement area | The plant production area | Product distribution area | Market and knowledge transfer area |
|---|---|---|---|---|---|
| Cluster A | Technologies for improving energy efficiency | Yes | Yes | Minor | Minor |
| Cluster B | Technologies for using alternative fuels and raw materials. | Yes | Yes | Minor | Minor |
| Cluster C | Technologies for producing blended cements | Yes | Yes | Yes | Yes |
| Cluster D | Progressive technologies under development in the world to reduce GHG emissions | Yes | Yes | Yes | Yes |

Source: This is based on data of Indonesian plants, experience and discussions with the cement professionals in India and Indonesia.

**Cluster A – Technologies for improving energy efficiency**

**Green jobs and greener jobs related to energy efficiency technologies.** Energy efficiency in the cement plants can be improved through the introduction of the Cluster A technologies, thereby reducing GHG emissions. Here its effect on the skills map of the four identified teams 1 to 4 of the cement sector has been mapped. The Cluster A technological measures A1 to A7, through which energy efficiency can possibly be realized are catalogued in Section 2 of this report. The generation of green jobs and greening of the present jobs identified for each of the measures, in each of the four identified teams 1 to 4 of the cement sector are highlighted in table 5.

**Table 5. Cluster A: Technologies for improving energy efficiency – Details of green and greening of jobs in the cement sector technology-wise in Cluster A**

| Cluster A: Technologies for improving energy efficiency | | Green jobs | | | | Greening of jobs | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Team1:Input material procurement team | Team2: The plant production team | Team3: Product distribution team | Team4:Market and knowledge transfer team | Team1:Input material procurement team | Team2:The plant production team | Team3:Product distribution team | Team4:Market and knowledge transfer team |
| A1. | Installation of 5 and 6 stage preheaters and calciners | None, as the materials required shall not change. | None, as the present operating and lab staff should be able to handle it. | None, as the final product shall still be cement. | None, as the final product shall still be cement. | None as the materials required shall not change. | Process engineers, Control room operators and the cement laboratory staff need minor retraining to use this technology. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |
| A2 | Installation of waste heat recovery systems (WHRS) | None as the present staff should be able to handle the procurement. | All the operating, maintenance, laboratory and supervisory staff shall be required to be run with the waste heat recovery system. | None, as the final product shall still be cement. | None, as the final product shall still be cement. | The support staff shall need to be retrained to include procurement of spares for the new equipment. | Process engineers, control room operators and the cement laboratory staff need minor retraining to use this technology. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |
| A3 | Use of high efficiency grinding mills | None as the present staff should be able to handle the procurement. | None, as all operating, maintenance, laboratory and supervisory staff from the cement manufacturing setup should be able to handle this with some retraining support. | None, as the final product shall still be cement. | None, as the final product shall still be cement. | The support staff shall need to be retrained to include procurement of spares for the new equipment. | Process engineers, control room operators and the cement laboratory staff need minor retraining to use this technology. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |
| A4 | Use of energy efficient fans | None, as the equipment is similar to those already installed in the plant. | None, as the equipment is similar to those already installed in the plant. | None, as the final product shall still be cement. | None, as the final product shall still be cement. | None, as the equipment is similar to those already installed in the plant. | None, as the equipment is similar to those already installed in the plant. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A5 | Installation of captive power plants (CPP) to save on transmission losses | None as the present staff should be able to handle the procurement. | All operating, maintenance, laboratory and supervisory staff shall be new as the technology is totally different than that of cement. | None, as the final product shall still be cement. | None, as the final product shall still be cement. | The support staff shall need to be retrained to include procurement of spares for the new equipment. | Support staff in maintenance, workshop and laboratory shall need to be retrained to provide support for this department. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |
| A6 | Use of Low energy and high momentum burners for lower fuel consumption. | None, as the equipment is similar to those already installed in the plant. | None, as the equipment is similar to those already installed in the plant. | None, as the final product shall still be cement. | None, as the final product shall still be cement. | None, as the equipment is similar to those already installed in the plant. | Process engineers and CCR operators need training to use these new burners. No training needed for others as the equipment is similar to those already installed in the plant. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |
| A7 | Replacement of old plants by high capacity energy efficient plants | None, as the team from the old plant shall be able to handle the new ones. | None, as the team from the old plant shall be able to handle the new ones. | None, as the final product shall still be cement. | None, as the final product shall still be cement. | None, as the team from the old plant shall be able to handle the new ones. | None, as the team from the old plant shall be able to handle the new ones. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |

Source: This is based on data of Indonesian plants, experience and discussions with the cement professionals in India and Indonesia.

### Cluster B – Technologies for using of alternative fuels and raw materials

**Green jobs and greener jobs related to AFR technologies and techniques.** The natural resources and fossil fuels used in the cement sector can be saved through the use of Cluster B technologies, thereby reducing GHG emissions. Here its effect on the skills map of the four identified teams 1 to 4 of the cement sector has been mapped. The Cluster B technological measures B1 to B7, through which fossil fuels and natural resources can be saved, are catalogued in Section 3 of this report. The percentage use of AFRs in Indonesia compared to their use in other developed countries is low. It shows the lack of initiative, both at the level of the authorities and industry, for skill, knowledge and technology transfer from the countries where AFR percentage usage is high. The generation of green jobs and the greening of the present jobs identified for each of the measures, in each of the four identified teams 1 to 4 of the cement sector, is highlighted in table 6.

**Table 6. Cluster B: Technologies for using of alternative fuels and raw materials – Details of green and greening of jobs in the cement sector technology-wise in Cluster B**

| Cluster B: Technologies for using of alternative fuels and raw materials. | | Green jobs | | | | Greening of jobs | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Team1:Input material procurement team | Team 2:The plant production team | Team3:Product distribution team | Team4:Market and knowledge transfer team | Team1:Input material procurement team | Team2:The plant production team | Team3:Product distribution team | Team4:Market and knowledge transfer team |
| B1. | Use of Agricultural waste | Pre-processing plant O&M staff. Market mapping and contracting staff. | Material acceptance, Storage, handling and AFR laboratory staff. | None, as the final product shall still be cement. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores staff. | Process engineers, control room operators and the cement laboratory staff. | None, as the final product shall still be cement. | None as these are totally new jobs. |
| B2. | Use of industrial and municipal solid waste | Pre-processing plant O&M staff. Market mapping and contracting staff. | Material acceptance, Storage, handling and AFR laboratory staff. | None, as the final product shall still be cement. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores staff | Process engineers, control room operators and the cement laboratory staff. | None, as the final product shall still be cement. | None as these are totally new jobs. |
| B3. | Use of discarded tires | Market mapping and contracting staff. | Material acceptance, storage, handling and AFR laboratory staff. | None, as the final product shall still be cement. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores staff | Process engineers, control room operators and the cement laboratory staff. | None, as the final product shall still be cement. | None as these are totally new jobs. |
| B4. | Use of waste oil and solvents | Market mapping and contracting staff. | Material acceptance, storage, handling and AFR laboratory staff. | None, as the final product shall still be cement. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores staff | Process engineers, Control room operators and the cement laboratory staff. | None, as the final product shall still be cement. | None as these are totally new jobs. |
| B5. | Use of waste plastic, textiles and waste residue | Market mapping and contracting staff. | Material acceptance, storage, handling and AFR laboratory staff. | None, as the final product shall still be cement. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores staff | Process engineers, Control room operators and the cement laboratory staff. | None, as the final product shall still be cement. | None as these are totally new jobs. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| B6. | Use of industrial off-specification waste, market rejects, expired medicines and products | Market mapping and contracting staff. | Material acceptance, storage, handling and AFR laboratory staff. | None, as the final product shall still be cement. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores staff | Process engineers, control room operators and the cement laboratory staff. | None, as the final product shall still be cement. | None as these are totally new jobs. |
| B7. | Use of alternative raw materials lime, iron, alumina, silica rich industrial waste | Market mapping and contracting staff. | Material acceptance, storage, handling and AFR laboratory staff. | None, as the final product shall still be cement. | Skill, Knowledge and Technology mapping, its transfer and implementation staff. | Stores staff | Process engineers, control room operators and the cement laboratory staff. | None, as the final product shall still be cement. | None as these are totally new jobs. |

Source: This is based on data of Indonesian plants, experience and discussions with the cement professionals in India and Indonesia.

## Cluster C – Technologies for producing blended cements

**Green jobs and greener jobs related to blended cement technologies and techniques.** Natural resources and fossil fuels are saved in the cement sector by changing the product from ordinary Portland cement (OPC) to a mix of OPC and blended cements. As the market share of blended cement increases in the product mix, the GHG emissions per unit of cement manufactured is reduced. Though theoretically all the cement produced can be blended cement, except for some special applications, its contribution to the product mix is not only limited by the lack of technical knowhow and availability of the pozzolonic materials but also by the fact that this new product has to be marketed to the end users, architects, masons, governmental agencies through dedicated marketing and selling initiative in the country.

Great pains have to be taken to market the blended cement against the historically available OPC. Skills, knowledge and planning are essential to increase the market share of blended cement to the levels that have been achieved in other countries. The generation of green jobs and the greening of jobs linked with each of the technological measures C1 to C5, in each of the four identified teams 1 to 4, of the cement sector, are highlighted in table 7. Many of the jobs created would have overlapping responsibilities for multiple materials identified. This initiative would require related technology-based skills training in addition to the occupational-based training. The jobs in the other areas would need retraining and/or additional technology-based training. The combination of the occupational and technology-based training would ensure that performance can reach the Best Available Global Performance levels and a high market share of the blended cement in Indonesia.

**Table 7. Cluster C: Technologies for producing blended cements – Details of green jobs and greening of jobs in the cement sector technology-wise in Cluster C**

| **Cluster C: Technologies for producing blended cements (BF)** | | **Green jobs** | | | | **Greening of jobs** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Team1:Input material procurement team | Team2:The plant production Team | Team3:Product distribution team | Team4:Market and knowledge transfer team | Team1:Input material procurement team | Team2:The plant production team | Team3:Product distribution team | Team4:Market and knowledge transfer team |
| C1. | Use of Granulated Blast Furnace slag as pozzolonic material to make slag cement | Market mapping and contracting staff. | Material acceptance, storage, handling and laboratory staff. | None as this would be done by the present workforce with some additional training. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores and the laboratory staff looking after raw material inventory and quality. | Process engineers, control room operators of cement mills and the cement laboratory staff. | The marketing and sales persons as well as the customer service personnel. | None as these are totally new jobs. |
| C2. | Use of fly ash from coal-based power plants as pozzolonic material to produce pozzolona cement. | Market mapping and contracting staff. | Material acceptance, storage, handling and laboratory staff. | None as this would be done by the present workforce with some additional training. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores and the laboratory staff looking after raw material inventory and quality. | Process engineers, control room operators of cement mills and the cement laboratory staff. | The marketing and sales persons as well as the customer service personnel. | None as these are totally new jobs. |
| C3. | Use of naturally occurring pozzolona for making pozzolona cement | Market mapping and contracting staff. | Material acceptance, storage, handling and laboratory staff. | None as this would be done by the present workforce with some additional training. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores and the laboratory staff looking after raw material inventory and quality. | Process engineers, control room operators of cement mills and the cement laboratory staff. | The marketing and sales persons as well as the customer service personnel. | None as these are totally new jobs. |
| C4. | Use of limestone as an additive in cement. | None. | None. | None. | The SKT mapping and transfer staff. | Cement laboratory. | Cement Laboratory staff. | None. | None. |
| C5. | Use of recycled concrete as a cement additive after processing. | Market mapping and contracting staff. | Material acceptance, storage, handling and laboratory staff. | None as this would be done by the present workforce with some additional training. | Skill, knowledge and technology mapping, its transfer and implementation staff. | Stores and the laboratory staff looking after raw material inventory and quality. | Process engineers, control room operators of cement mills and the cement laboratory staff. | The marketing and sales persons as well as the customer service personnel. | None as these are totally new jobs. |

Source: This is based on data of Indonesian plants, experience and discussions with the cement professionals in India and Indonesia.

**Cluster D – Use of progressive green technologies under development globally to reduce GHG emissions**

**Green jobs related to the use of progressive green technologies.** One of the most appropriate and important progressive technologies which can help the world reach its international reduction targets of GHG emissions is CCS. It is understood that the Indonesian authorities are considering to start with 10 per cent of the power plants applying CCS by 2012 and continuously increasing its application to 100 per cent of the power plants using it by 2025. This would require further development and importation of $CO_2$ capturing, refining, transport, underground storage, and utilization technologies. These would require personnel with masters degrees or higher in chemical engineering, mechanical engineering, environmental engineering, civil engineering and geology. As this would create demand for a new workforce, subjects in these engineering lines in the present engineering colleges would need to be developed. As experience was gained by the application of CCS to power plants, it could be applied to cement plants also, as the nature of the stack is not much different. This would be true for all the new technologies that are being developed and would be imported into Indonesia over a period of time. The known Cluster D progressive green technologies from D1 to D5, which are at different stages of development from R&D to commercial application, are listed in Section 2.

**Skills, knowledge and technology management group.** As these Cluster D progressive green technologies are in various stages of development from R&D to the commercial application, it is vital to form a skill, knowledge and technology management group supported by the Government and the power and cement sector to keep a tab on the global developments in these and other progressive green technologies. This group has to first and foremost form a strategy and generate a global information network to identify the progressive green technologies under development. Here the listed Cluster D progressive green technologies D1 to D5 can form the seed list, and others can be logged in, as they are developed. After establishing the supply chain information gateway, the SKT Management Group has to organize seminars and workshops to keep the authorities, the power sector, and the cement sector aware of the developments in these technologies. They should make and present the business case of the application of these technologies, their costs and returns as well as the period when the same shall be available for commercial application. With these efforts, the authorities, power, and cement sector can mobilize the required legislation and capital and dovetail it into their plans to take advantage of the developments as early as possible. This group is identified as the SKT Management Group. This initiative to form the SKT Management Group shall be the nodal point around which the benefits of the new technologies can be accrued by Indonesia. It shall generate new jobs, which shall require technology-based skills training, in addition to the occupational-based training while the jobs in other areas shall need retraining and/or additional technology-based training. The combination of occupational and technology-based training shall ensure that the gains of the international green R&D shall be taken advantage of by the power and cement sector in Indonesia.

The generation of green jobs and the greening of jobs linked with each of the Cluster D progressive green technological measures D1 to D5, in each of the four identified teams 1 to 4, of the cement sector, are highlighted in table 8.

**Table 8. Cluster D: Use the progressive technologies under development in the world to reduce GHG emissions – Details of green jobs and greening of jobs in the cement sector technology-wise in Cluster D**

| **Cluster D: Use the progressive technologies under development in the world to reduce GHG emissions** | | **Green jobs** | | | | **Greening of jobs** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Team1:Input material procurement team | Team2:The plant production Team | Team3: product distribution team | Team4: Market and knowledge transfer team | Team1: Input material procurement team | Team2:The plant production team | Team3: Product distribution team | Team4: Market and knowledge transfer team |
| D1. | Use of the energy efficient fluidized bed technology | None, as the materials required shall not change. | A section has to keep track on the SKT management by the country. None, as the present operating and lab staff should be able to get retrained. | None, as the final product shall still be cement. | None, as the final product shall still be cement. | None as the materials required shall not change | Process engineers, control room operators and the cement laboratory staff need retraining to use this technology. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |
| D2. | Use of CCS application in Power plants and cement plants. | New staff shall be required for vendor development for the new equipment spares, tools and tackles required for the new equipment and their | A section has to keep track on the SKT management by the country. All operating, maintenance, laboratory and supervisory staff for this department shall be new | None, as the final product shall still be cement. | None, as the final product shall still be cement. | The support staff shall need to be retrained to include procurement of spares for the new equipment. | Support staff in maintenance, workshop and laboratory shall need to be retrained to provide support for this department. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | procurement. | as the technology is very different than the cement manufacturing process. | | | | | | |
| D3. | Use of Oxy Fuel Technology to reduce the energy consumption and increase plant capacities of the present kilns. | Staff required for vendor development for the new equipment spares, tools and tackles, and their procurement. | A section has to keep track on the SKT management by the country. All operating, maintenance, laboratory and supervisory staff shall be new for the manufacture of oxygen and its handling as the technology is totally different from that of the cement manufacturing process. | None, as the final product shall still be cement. | None, as the final product shall still be cement. | The support staff shall need to be retrained to include procurement of spares for the new equipment. | Most of the operating, maintenance, laboratory and supervisory staff for the kiln section shall need retraining as the clinker manufacturing process with oxy fuel shall be new and quite different from that of the air fuel clinker manufacturing process. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |
| D4. | Use of Algal technologies to recycle CO2 as fuel for cement and power plants. | New staff shall be required for vendor development for the new equipment spares, tools and tackles, and their procurement. | A section has to keep track on the SKT management by the country. All operating, maintenance, laboratory and supervisory staff shall be | None, as the final product shall still be cement. | None, as the final product shall still be cement. | The support staff shall need to be retrained to include procurement of spares for the new equipment. | Support staff in maintenance, workshop and laboratory shall need to be retrained to provide support for this department. | None, as the final product shall still be cement. | None, as the final product shall still be cement. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | new as the technology is totally different than the cement manufacturing process. | | | | | | |
| D5. | Use of alternative green cements | New staff shall be required for vendor development for the new equipment spares, tools and tackles, and their procurement. | A section has to keep track on the SKT management by the country. All operating, maintenance, laboratory and supervisory staff shall be new as the technology is totally different than the cement manufacturing process. | None as this would be done by the present workforce with some additional training. | Skill, Knowledge and Technology mapping, its transfer and implementation staff | The support staff shall need to be retrained to include procurement of spares for the new equipment. | Support staff in maintenance, workshop and laboratory shall need to be retrained to provide support for this department. | The marketing and sales persons as well as the customer service personnel | None as these are totally new jobs, since the product shall change. But some section of the workforce can be retrained. |

Source: This is based on data of Indonesian plants, experience and discussions with the cement professionals in India and Indonesia.

## 3.3 Direct and indirect manpower in the Indonesian cement sector

The specific manpower in the cement sector is identified by a ratio of man-hours per tonne of cement. The higher the man-hours per tonne of cement, the higher the manpower required to make cement. The manpower used directly in the cement plant to make cement is direct manpower and specific direct manpower is identified by direct man-hours per tonne of cement. The manpower used for other associated jobs for ensuring an incoming supply of materials and services, outgoing products right from delivery from the plant till its use in construction and other associated jobs is known as indirect manpower and is identified by indirect man-hours per tonne of cement.

## Direct manpower in cement sector

With the implementation of automation in the cement sector and the commissioning of higher capacity automated cement plants the direct man-hours per tonne of cement has been continuously decreasing. From around twenty man hours/tonne of cement in the low capacity wet process plant scenario, devoid of automation and remote controls, it has slowly stabilized at 0.5 man-hours per tonne with the automation levels and capacities now accepted in Indonesia.[7] With the best available technology (BAT), the man-hours per tonne can be reduced further to 0.25. If the projected capacity increase is implemented with the BAT, 25 man-hours per tonne can be assumed for the new projected capacity until 2020. Based on these assumptions and the projected cement design capacity the direct manpower position in the cement sector in Indonesia has been projected in table 9.

**Table 9. Manpower estimates for the cement sector in Indonesia until 2020**

| Year | Cement design capacity MTPA | Direct manpower |
|---|---|---|
| 2005 | 46.090 | 9 600 |
| 2008 | 44.890 | 9 350 |
| 2014 | 55.246 | 10 700 |
| 2020 | 74.036 | 12 650 |

Source: Based on data of Indonesian plants, experience and discussions with the cement professionals in India and Indonesia.

The national numbers for the direct jobs for cement production are small. Based on the assessments of the skills map in the scenario of the implementation of Cluster A to Cluster D technologies, it is estimated that at least 25 per cent of the jobs which will increase in the coming decade in the cement plants shall be green jobs. These green jobs would require additional skills and a different attitude towards work. The remaining 75 per cent of the jobs shall become greener, since the jobseekers would have to learn the intricacies of operating the more efficient, complex and greener plants and technology. Almost all the present jobs shall also become greener wherever green technology is dovetailed into the present plants via optimization initiatives. The increase in capacity and the influx of more energy efficient plants and green technologies would definitely result in an increase in the direct skilled manpower required for operating these plants, but the indirect skilled workforce required to foster the growth and distribute the cement would be far greater. This increase in the indirect skilled manpower has to be closely watched and provided for so as to ensure that the growth plans of the cement sector are realized without problems.

[7] Estimated from the Indian experience.

## Indirect manpower in the cement sector

The importance of indirect employment in the cement sector must be appreciated. Although cement is a low cost, high volume product and requires little manpower for production, its indirect manpower requirement is enormous. Indirect manpower is required in the areas of procurement and transportation of the raw materials, additives, like iron ore, bauxite, clay, fly ash, performance enhancers, coal, diesel, etc., as well as for bags, stores and spares, and the marketing and distribution of the final product cement over long distances around the country. Marketing of new low carbon products also require new skills to ensure the acceptance of these products by the community alongside the more traditional Portland cement, which they are comfortable with. The growth of these indirect green jobs is also to be taken into account while mapping the sector. A very conservative tracking of the movement of the raw materials, stores and spares and cement shows that, on an average, indirect man-power over the life cycle of the cement production till its use, is around 32 man-hrs per tonne of cement. The direct and indirect manpower estimates of the cement sector are enumerated in tables 9 and 10 respectively.[8]

**Table 10. Indirect manpower estimates for the cement sector in Indonesia until 2020**

| Year | Cement design capacity MTPA | Indirect manpower |
|---|---|---|
| 2005 | 46.090 | 614 550 |
| 2008 | 44.890 | 598 550 |
| 2014 | 55.246 | 736 600 |
| 2020 | 74.036 | 987 150 |

Source: Based on discussions with authorities, unions & plant personnel.

**Manpower distribution skill-wise for the indirect manpower in the cement sector.** The distribution of the skilled labour required to satisfy the demand for the indirect manpower for the cement sector is listed in table 11 including an estimate of the numbers required for each skill from the year 2005 till the year 2020. These are large figures, for which an enabling environment has to be generated through proper incentives for private coaching institutes by the government, as most of these are trained either on the job or through private institutes. The various steps to be taken for meeting these requirements are discussed in detail in other sections in the later part of this report.

[8] This is based on discussions with the advisors, authorities, unions, procurement people and the plant. No detailed study has been done, but such a study should be made to assess the numbers and the skill needs of these categories of the very important set of indirect workforce.

**Table 11. Skilled labour required to meet the indirect labour demand until 2020**

| | | **Skilled labour description:** | **Truck driver** | **Truck helper** | **Rigger supervisor** | **Rigger helper** | **Construction workers** | Total |
|---|---|---|---|---|---|---|---|---|
| | Annual cement production<br>MTPA | Man-hours/tonne of cement: | 3.4 | 3.4 | 1.0 | 8.2 | 16 | **32** |
| Manpower required in 2005 | 46.090 | | 65 300 | 65 300 | 19 200 | 157 500 | 307 250 | **614 550** |
| Manpower required in 2008 | 44.890 | | 63 600 | 63 600 | 18700 | 153 350 | 299 250 | **598 500** |
| Manpower required in 2014 | 55.246 | | 78 250 | 78 250 | 23 000 | 188 750 | 368 300 | **736 550** |
| Manpower required in 2020 | 74.036 | | 104 900 | 104 900 | 30 850 | 253 000 | 493 600 | **987 250** |

Source: Based on discussions with the advisors, authorities, unions, procurement people and the plant.

# 4. Skills for green jobs requirements at the national level in the cement sector in Indonesia

The four Clusters A to D of green technologies were comprehensively described in Section 2, and the green jobs which evolve from the introduction of these technologies in the cement sector were discussed in Section 3. In this section we shall first give a broad background of the importance of knowledge and skills for the proper performance of these green technologies which shall be followed by particulars of the skills required as the four Clusters A to D of green technologies are gradually introduced in to the Indonesian cement sector. This shall be done for each of the technologies covered by each of the four Clusters A to D of green technologies. Some of the green jobs and the associated knowledge and skills shall be common for a particular cluster. These shall be covered under the shared green jobs section within the table made for the particular cluster.

## 4.1 Background of the skills preparation in Indonesia to accept the green technologies in the cement sector

Globally, access to commercially available green technologies and the capital required to implement them is uncomplicated. However, the introduction of technology and capital alone cannot ensure the right environmental and commercial returns for the industry. To ensure the proper commercial and environmental success of the introduction of green technologies, their skill and knowledge requirements have also to be acquired. Lack of knowledge and a weak skilled workforce could sometimes result in the rejection of the technology itself. To enable a continued sustainable technology transfer efforts have to be made well in advance to create the right skilled workforce to properly implement the technologies and ensure rightful returns both on environmental and commercial fronts.

In Indonesia, the Government is cognizant of the importance of the need for skills training for the new green technologies introduced into the cement and other industrial sectors. Attention is being given to provide better base level education for the new workforce (high school and vocational schools) followed by specific occupation-based job training to ensure their value to the industry. The Government is updating its labour and educational policies to incorporate the provision of these specific occupation-based trainings and improved basic education for the new workforce. New sectors are emerging because of the greening of the economy in Indonesia, and have been identified by the Indonesian Standards and Registration for Environmental Competency (Standar dan egistrasi Kompetensi Lingkungan Indonesia, SRKLI). These are given in tables A10, A11 and A12 in Annex III. In this section, we shall concentrate on the cement sector only, vis-a-vis the introduction of the four Clusters A to D of green technologies.

## 4.2 Mapping of Green skills technology-wise and cluster-wise in the cement sector

Green skills should not be mistaken as totally new skills, which come about when green technologies are introduced in the cement sector. These are basically existing skills for management, engineering, chemists, administrative, semi-skilled and skilled artisans like that of fitters, welders, riggers, drivers, heavy equipment drivers, blasters, mechanics, central control room (CCR) operators, laboratory assistants, testers, millers, machine tool operators, patrollers, electricians, instrument mechanics, semi-skilled helpers for the skilled artisans, etc. But when they are required for enabling the green technologies in the cement sector, we designate them as green skills for the purpose of this paper so as to differentiate them from the skills and skilled artisans and engineers required for the normal operation of the cement plant. Some skills may be totally new for the cement sector, but they may not necessarily be new for the industry or Indonesia.

In the subsequent sub-sections we shall elaborate on the green skills required for each of the green technologies in the four Clusters A to D and wherever the skills required are common for all the technologies of the cluster, it shall be elaborated under shared green skills and knowledge group for each of the four Clusters A to D.

**Cluster A – Technologies for improving energy efficiency.** The technologies that comprise Cluster A, from A1 to A7 as elaborated in Section 2, are listed below. These technologies will require new skills, knowledge, skilled artisans and engineers. But each one shall be dealt with separately for greater clarity. Of the various teams working in the cement plants, there are four teams, which are prominently involved in introducing these technologies in the cement plant. These are listed below. The details of the green jobs, skills and knowledge considered necessary for each of the technologies A1 to A7 are given in table 12.[9]

**Cluster A technologies:**

A1. Installation of 5 and 6 stage preheaters and calciners

A2. Installation of waste heat recovery systems

A3. Use of high efficiency grinding mills

A4. Use of energy efficient fans

A5. Installation of captive power plants (CPP) to save on transmission losses

A6. Use of low energy and high momentum burners for lower fuel consumption

A7. Replacement of old plants by high capacity energy efficient plants

[9] This is based on discussions with the advisors, authorities, unions, procurement people and the plant.

**The skilled teams that shall work in the cement plants for introducing these technologies are:**

Team1. Input material procurement team
Team2. The plant production team
Team3. Product distribution team
Team4. The marketing and knowledge transfer team

**Table 12. Cluster A – Technologies for improving energy efficiency**

| | Green(ing) jobs | Required skills and knowledge | Related teams from 1 to 4 |
|---|---|---|---|
| A1. Installation of 5 and 6 stage preheaters and calciners | | | |
| New green jobs | None | Not applicable. | Not applicable |
| Greening of existing jobs | Process engineer | Chemical engineering graduate.<br>Knowledge of operating and controlling the kilns with 5/6 stage preheaters and calciners. | Team 2 |
| | CCR kiln operator | Science graduate with kiln operations experience.<br>Knowledge and skills of operating and controlling the kilns with 5/6 stage preheaters and calciners. | Team 2 |
| | Chemists and quality control officers | Graduates and postgraduates in chemistry.<br>Knowledge of providing the right raw mix and control sample testing of the kilns with 5/6 stage preheaters and calciners, to get the clinker of the right specifications. | Team 2 |
| | Laboratory operating staff | Science graduates.<br>Knowledge and skill of providing the right raw mix and control sample testing for the kilns with 5/6 stage preheaters and calciners to get the right clinker. | Team 2 |
| A2. Installation of waste heat recovery systems | | | |
| New green jobs | Power house engineers | Knowledge of operating the powerhouse installed with the waste heat recovery system. | Team 2 |
| | Power house CCR operators | Knowledge and skills of operating the CCR of the powerhouse installed with the waste heat recovery system. | Team 2 |
| | Other power house support artisans of Electricians/fitters/ riggers/turbine maintenance staff | Knowledge and skills of maintaining the powerhouse installed with the waste heat recovery system. | Team 2 |
| Greening of existing | Procurement engineers | Knowledge to arrange for vendor development and specifications for the new stores and spares required | Team 1 |

| | | | |
|---|---|---|---|
| jobs | | for the power house. | |
| | Procurement support staff | Knowledge to arrange for the procurement of the stores and spares of the right specifications for the powerhouse. | Team 1 |
| | Stores stock and issue staff | Knowledge and skill to properly accept, stock, identify and issue the stores and spares of the right specifications for the powerhouse. | Team 1 |
| | Process engineers | Knowledge of operating the kilns along with the waste heat recovery systems installed in the circuit. | Team 2 |
| | CCR kiln operators | Knowledge and skills of operating the kilns along with the Waste Heat recovery systems installed in the circuit. | Team 2 |
| | Chemists and quality control officers | Knowledge of providing the right raw mix and control sample testing for the high efficiency grinding mills to get the right raw mix for getting the clinker of the right specifications. Also if these mills are used for cement grinding, they shall need the knowledge of these mills for getting the right cement. | Team 2 |
| | Laboratory operating staff | Knowledge and skill of providing the right raw mix and control sample testing for the kilns along with the Waste Heat recovery systems installed in the circuit to get the right clinker. | Team 2 |

A3. Use of high efficiency grinding mills

| | | | |
|---|---|---|---|
| New green jobs | None | Not applicable. | Not applicable |
| Greening of existing jobs | Process engineer | Knowledge of operating the high efficiency grinding mills. | Team 2 |
| | CCR kiln operator | Knowledge and skills of operating the high efficiency grinding mills. | Team 2 |
| | Chemists and quality control officers | Knowledge of providing the right raw mix and control sample testing for the high efficiency grinding mills to get the right raw mix for getting the clinker of the right specifications. Also if these mills are used for cement grinding, they shall need the knowledge of these mills for getting the right cement. | |
| | Laboratory operating staff | Knowledge and skill of providing the right raw mix and control sample testing for the high efficiency grinding mills to get the right raw mix for getting the clinker of the right specifications. Also if these mills are used for cement grinding, they shall need the knowledge and skills for getting the right cement. | Team 2 |

A4. Use of energy efficient fans

| | | | |
|---|---|---|---|
| New green jobs | None as the present skills would suffice. | Not applicable | Not applicable |
| Greening of existing jobs | None as the present skills would suffice. | Not applicable | Not applicable |

A5. Installation of captive power plants (CPP) to save on transmission losses

| | | | |
|---|---|---|---|
| New green jobs | Power house Engineers. | Knowledge of operating the powerhouse installed. | Team 2 |
| | Power house CCR operators. | Knowledge and skills of operating the CCR of the powerhouse installed. | Team 2 |
| | Other power house support artisans of Electricians/fitters/ riggers/turbine maintenance staff | Knowledge and skills of maintaining the powerhouse installed. | Team 2 |
| Greening of existing jobs | Procurement engineers. | Knowledge to arrange for vendor development and specifications for the new stores and spares required for the power house. | Team 1 |
| | Procurement support staff | Knowledge to arrange for the procurement of the stores and spares of the right specifications for the powerhouse. | Team 1 |
| | Stores stock and issue staff | Knowledge and skill to properly accept, stock, identify and issue the stores and spares of the right specifications for the powerhouse. | Team 1 |
| | Process engineers. | Knowledge of operating the Power House and its other requirements of process optimization. | Team 2 |
| | Chemists and quality control officers | Knowledge of providing the right water and other controls for the power house. | Team 2 |

A6. Use of low energy and high momentum burners for lower fuel consumption

| | | | |
|---|---|---|---|
| New green jobs | None as the present skills would suffice. | Not applicable | Not applicable |
| Greening of existing jobs | Process engineers. | Knowledge of operating the kiln with the new burners is required, as well as details of monitoring the high efficiency burners. | Team 2 |
| | CCR kiln operators. | Knowledge and skills of operating the kiln with the new burners. | Team 2 |

A7. Replacement of old plants with high capacity energy efficient plants

| | | | |
|---|---|---|---|
| New green jobs | None as the present skills would suffice. | Not applicable | Not applicable |
| Greening of existing jobs | Process engineers. | Knowledge of operating and controlling the new kilns. | Team 2 |
| | CCR kiln operators. | Knowledge and skills of operating and controlling the new kilns. | Team 2 |
| | Chemists and quality control officers. | Knowledge of providing the right raw mix and control sample testing of the new kilns. | Team 2 |
| | Laboratory operating staff. | Knowledge and skill of providing the right raw mix and control sample testing for the new kilns. | Team 2 |
| | All the operating staff of the kiln, mills and packing plant operations. | Knowledge and skill to provide the support service to operate the new high capacity plant. | Team 2 |
| | All the maintenance staff of the plant like electricians, fitters, instrument mechanics, riggers, air conditioning mechanics, diesel mechanics, etc. | Knowledge and skill for maintaining the new equipment which shall come with the new plant. | Team 2 |
| | All the operation and maintenance in the mining department. | Knowledge and skill for operating and maintaining the mines for catering to the high capacity plant, which would require higher capacity more fuel efficient machines and mines planning. | Team 2 |
| | Procurement engineers. | Knowledge to arrange for vendor development and specifications for the new stores and spares required for the new plant. | Team 1 |
| | Procurement support staff. | Knowledge to arrange for the procurement of the stores and spares of the right specifications for the new plant. | Team 1 |
| | Stores stock and issue staff. | Knowledge and skill to properly accept, stock, identify and issue the stores and spares of the right specifications for the new plant. | Team 1 |
| | Marketing and sales staff. | Knowledge and skill for marketing the high quantity of cement, which shall be supplied to the market. | Team 3 |
| | The market and knowledge transfer team. | Knowledge and skill of the new product to ensure that the new product and its quantity are accepted by the market. Also the knowledge and skill of the technology so as to ensure that the engineers and skilled artisans are provided the right training to properly operate and maintain the plant. | Team 4 |

Source: Based on discussions with the advisors, authorities, unions, procurement people and the plant.

**Cluster B – Technologies for using alternative fuels and raw materials**

The technologies that comprise Cluster B, from B1 to B7 as elaborated in Section 2 are listed below. Most of these technologies B1 to B7 are very similar to one another a propos the requirement of skills, knowledge, skilled artisans and engineers. There are shared green jobs with their respective skills and knowledge which are required for implementing all the technologies B1 to B7. These shared jobs are a prerequisite to the implementation of Cluster B technologies in the cement sector. These shared jobs with their respective skills and knowledge are required to do market mapping of waste, identify the waste which can be co-processed in the cement plant, negotiate the contract, take trial burns where required, get environmental permits for transport, storage and co-processing the waste, arranging for the storage and feeding systems with proper safety systems integrated in them, get the internal stakeholders in the plant to slot in the new set of people to accept, store, and feed the AFR to the cement kiln or mill, and provide the training to the CCR operators, laboratory personnel and engineers to accept the waste and learn to operate the cement kiln or mill with this waste. These jobs have to be done for each of the waste that is accepted for co-processing by the cement plant. We shall separately, first, give details of the skills and knowledge requirements of these shared green jobs and then each technology shall be dealt with separately, to beget greater clarity. It must be appreciated that the shared green jobs are needed for this Cluster B technology initiative, and the other details dealt with in each technology B1 to B7 later on are the specific requirements of skills and knowledge for the implementation of the specific technology in addition to the shared green jobs.

Of the various teams working in the cement plants, there are four teams, which are prominently involved in introducing these technologies in the cement plant. These are listed below. The details of the shared green jobs with their respective skills and knowledge for the whole Cluster B and other specific jobs with their respective skills and knowledge considered necessary for each of the technologies A1 to A7 are given in table 13.[10]

**Cluster B technologies:**

B1. Use of agricultural waste

B2. Use of industrial and municipal solid waste

B3. Use of discarded tyres

B4. Use of waste oil and solvents

B5. Use of waste plastic, textiles and waste residue

B6. Use of industrial off-specification waste, market rejects, expired medicines and products

B7. Use of alternative raw materials like lime, iron, alumina, silica rich industrial waste to replace raw materials and additives

[10] This is based on discussions with the advisors, authorities, unions, procurement people and the plant.

## The skilled teams that shall work for inducting these technologies are:

Team1. Input material procurement team
Team2. The plant production team
Team3. Product distribution team
Team4. The marketing and knowledge transfer team

**Table 13. Cluster B – Technologies for using AFR**

| | Green(ing) jobs | Required skills and knowledge | Related teams from 1 to 4 |
|---|---|---|---|
| Cluster B | Shared green jobs and the required skills and knowledge | | |
| New green jobs | | | |
| Overall management. | Manager AFR. | Chemical engineering graduate with post-graduation in production and marketing management.<br>Managerial knowledge for operating the AFR department. Knowledge of chemical engineering, permitting and regulation for transport, storage and co-processing if AFR is required. Good communications, liaison and leadership skills are desirable. | Team 2 |
| Invoicing and billing. | Support staff in accounts. | Graduate in commerce and cost accountancy.<br>Knowledge and skill for invoicing and billing to the customers for the services of co-processing their waste. | Team 1 |
| Scheduling and transportation. | Scheduling engineer. | Production engineering graduate with Bachelor of Management.<br>Knowledge and skill for scheduling the dispatch of the AFR from the customer and receipt at the plant. Knowledge of the legal transport requirements for the hazardous and non-hazardous waste transportation of the country. | Team 1 |
| | Support staff for scheduling. | Commerce graduate.<br>They have to be trained for scheduling and transportation of AFR. | Team 1 |
| Mapping and arranging of AFRs from industries, communities and rural areas. | Contracts experts. | Commerce graduate or chartered accountants.<br>Knowledge and skill of negotiating a proper contract with the clients, safeguarding the interests of the company as per the contracts law of the country. | Team 2 |
| | Support staff. | Science or commerce graduates.<br>Basic skills of mapping the waste from the industries, including knowledge of their location and contacts. | Team 1 |
| | Mapping engineers. | Chemical engineering graduates.<br>Knowledge and skill of mapping the hazardous and non-hazardous waste from the industries, including the | Team 1 |

| | | | |
|---|---|---|---|
| | | knowledge of the contacts and location of the industries. | |
| Material acceptance and storage. | Material acceptance staff. | Science graduates.<br>Basic skills of sampling, sample transport, checking test reports and accepting the received materials. They should know the weighing arrangements and have inspection skills of the materials received. | Team 2 |
| | Material storage staff. | Science graduates.<br>Basic skills of checking test reports, storage requirements of the received waste, and accepting the received materials. They should know the storage and extraction arrangements and have inspection skills of the materials received. | Team 2 |
| | Testing and tracking staff in laboratory. | Science graduate.<br>Basic testing skills for AFR received and the decision-making skills to identify and track the received materials and to clear them for acceptance. | Team 2 |
| Complying with permits and regulation. | Permitting expert. | Science graduates/postgraduates with post-graduation in management.<br>Knowledge of the permitting process and the laws governing the hazardous and Non-hazardous waste utilization/disposal/co-processing. Knowledge and contacts with the officers dealing with the permitting process to ensure proper permits and where necessary getting the new legislation passed to make it possible to get permits for co-processing of waste in the cement sector. | Team 3 |
| | Liaoning expert. | Science Graduates/Postgraduates with Bachelor of Management.<br>Basic Liaison support skills and knowledge for getting the proper permits and legislation in the country/state. | Team 3 |
| | Support staff. | Science or commerce Graduates.<br>Basic support skills and knowledge for getting the proper permits and legislation in the country/state. | Team 3 |
| Trial burn. | Trial burn engineer expert. | Chemical Engineering graduate preferably with Post graduation in Production Management.<br>The knowledge and skill or organizing trial burns with proper, required measurements of the process parameters, as per the requirements of the authorities, through approved agencies. The presenting it to the authorities, as required to get the permits for the co-processing of the wastes. | Team 2 |
| Waste preparation and co-processing. | Waste engineers, | Chemical Engineering graduates with specialization in Waste Management.<br>Knowledge of the waste chemical characteristics, waste mix chemical characteristics, mixing machines and experience in both cement and waste materials characteristics and equipment requirements. | Team 2 |
| | Pre-processing | Chemical engineering graduate with specialization in pre- | Team 2 |

| | | | |
|---|---|---|---|
| | expert. | processing of hazardous and non-hazardous waste.<br>Knowledge of the waste chemical and inter mix characteristics and the requirement of handling, storage, physical mixing and transportation machines and processes. | |
| | AFR laboratory expert. | Postgraduate in chemistry with specialization in waste chemistry.<br>Knowledge of the waste chemical and inter mix characteristics and the requirement of testing and specific tracking characteristics. | Team 2 |
| | Support staff. | Graduate in chemistry with exposure to waste chemistry.<br>Skills to support the efforts of the waste engineers, pre-processing experts and the laboratory. | Team 2 |
| Customer feedback and communication with the community. | Communication expert. | Science/commerce graduate with post-graduation in personnel management and communication.<br>Knowledge of the communication avenues, presentation skills, writing skills and the good control on language. Knowledge of the community and the general environment so as to zero in on the right communication channels. | Team 4 |
| | Support staff. | Science/commerce graduates with exposure to communication skills and community service. | |
| Marketing and sales. | Marketing expert. | Science/commerce graduate with Post graduation in marketing management.<br>Knowledge of the marketing of the services of co-processing of Hazardous and nonhazardous materials. Here the marketing has to be in the service line, where you get paid for the material we co process. | Team 3 |
| | Support staff. | Science/commerce graduates with exposure to marketing.<br>Skills to provide the support service to the Marketing expert on the market survey, availability of waste and interaction as well as organizing meetings. | Team 3 |
| Special technical operations and coordination with cement operations and maintenance. | AFR Technical expert. | Chemical engineer with specialization in AFR and cement plant operations and process.<br>Knowledge of AFR availability and its compatibility with the cement process for its use to replace fuel and raw materials with minimum effect on product output and fuel consumption. | Team 2 |
| Operations of AFR laboratory. | AFR Laboratory expert. | Graduate/Postgraduate in chemistry with specialization in AFR testing and tracking.<br>Knowledge of the waste chemical and inter mix characteristics and the requirement of testing and specific tracking characteristics. | Team 2 |
| | Support staff for laboratory. | Graduate in chemistry with exposure to AFR testing and tracking.<br>Skills for sampling, testing and record keeping of the AFR to support the laboratory expert. | Team 2 |

| | | | |
|---|---|---|---|
| Liaison with authorities and industry. | Liaison expert. | Postgraduate in marketing management.<br>Basic liaison support skills and knowledge for getting the proper permits and legislation in the country/state. | Team 3 |
| Skill, knowledge and technology mapping and transfer. | R&D engineer. | Postgraduate in chemical engineering/chemistry<br>Knowledge of waste and its co-processing requirements in the cement plant. Good communication skills and contacts worldwide in the co-processing circuit in the cement plants. | Team 4 |
| | Communication expert. | Science/commerce graduate with post-graduation in personnel management and communication.<br>Knowledge of the communication avenues internationally with other cement plants co-processing waste in their plant, presentation skills, writing skills and the good control on language. Knowledge of the AFR co-processing R&D community and the general AFR co-processing personnel in cement plants so as to zero in on the right communication channels for the developing co-processing initiatives. | Team 4 |
| | Support staff. | Science/commerce graduates with exposure to communication skills and community service. | Team 4 |
| Greening of existing jobs | | | Team 1 |
| Scheduling and transportation. | Support staff. | Science/commerce graduates.<br>They have to be trained for scheduling and transportation of AFR. | Team 1 |
| Mapping in industry. | Support staff. | Science/commerce graduates.<br>They have to be trained for mapping in the industry for AFR. | Team 1 |
| Mapping in communities. | Support staff. | Science/commerce graduates.<br>They have to be trained for mapping in the communities for AFR. | Team 1 |
| Mapping in rural areas. | Support staff. | Science/commerce graduates.<br>They have to be trained for mapping in the rural areas for AFR. | Team 1 |
| For permits and regulation compliance. | Support staff. | Science/commerce graduates.<br>They have to be trained for getting permits and regulation requirements for transport, storage and co-processing of AFR. | Team 2 |
| Marketing and sales. | Support staff. | Science/commerce graduates.<br>They have to be trained for Marketing and Sales of the environmental services the company is providing by co-processing the AFR. They come in after the mapping exercise is over and AFR have been earmarked. | Team 4 |

B1. Use of agricultural waste

| | | | |
|---|---|---|---|
| New green jobs | Mobile procurement officers. | Science/commerce graduates.<br>Knowledge to ride a two wheeler, and skill to close small contracts with individual agricultural land owners, procuring it, transporting it and making the payments for it. | Team 1 |
| Greening of existing jobs | None | None | None |

B2. Use of industrial and municipal solid waste

| | | | |
|---|---|---|---|
| New green jobs | Municipal solid waste (MSW) coordinators with the municipality. | Science/commerce graduates.<br>They should know the MSW collection and disposal system and have the skill to be able to coordinate with the officers in charge to finalize contracts for its disposal through co-processing with proper co-processing/tipping fee. | Team 1 |
| Greening of existing jobs | None | None | None |

B3. Use of discarded tires

| | | | |
|---|---|---|---|
| New green jobs | Discarded tires procurement coordinator. | Science/commerce graduates.<br>They should know the discarded tire movement cycle in the country and have the skill to be able to finalize contracts for its disposal through co-processing with proper co-processing/tipping fee. | Team 1 |
| Greening of existing jobs | None | None | None |

B4. Use of waste oil and solvents

| | | | |
|---|---|---|---|
| New green jobs | Waste oil and solvents procurement coordinator. | Science/commerce graduates.<br>They should know the discarded tire movement cycle in the country and have the skill to be able to finalize contracts for its disposal through co-processing with proper co-processing/tipping fee. | Team 1 |
| Greening of existing jobs | None | None | None |

B5. Use of waste plastic, textiles and waste residue

| | | | |
|---|---|---|---|
| New green jobs | Waste plastic, textile and waste residue procurement coordinator. | Science/commerce graduates.<br>They should know the waste plastic, textile and waste residue movement cycle in the country and have the skill to be able to finalize contracts for its disposal through co- | Team 1 |

| | | | |
|---|---|---|---|
| | | processing with proper co-processing/tipping fee. | |
| Greening of existing jobs | None | None | None |

B6. Use of industrial off-specification waste, market rejects, expired medicines and products

| | | | |
|---|---|---|---|
| New green jobs | Industrial off-specification waste, market rejects, expired medicines and products procurement coordinator. | Science/commerce graduates.<br>They should know the Industrial off-specification waste, market rejects, expired medicines and products movement cycle in the country and have the skill to be able to finalize contracts for its disposal through co-processing with proper co-processing/tipping fee. | Team 1 |
| Greening of existing jobs | None | None | None |

B7. Use of alternative raw materials like lime, iron, alumina, silica rich industrial waste to replace raw materials and additives.

| | | | |
|---|---|---|---|
| New green jobs | Mapping engineer for alternative raw materials. | Chemical engineering graduates.<br>Knowledge and skill of mapping the alternative raw materials, including the knowledge of the contacts and location of the industries. Knowledge of the waste rich in such raw materials as lime, iron, alumina. | Team 1 |
| | Processing engineer for alternative raw materials. | Chemical engineering graduates or Postgraduates in chemistry.<br>Knowledge and skill of mapping the alternative raw materials, including the knowledge of the contacts and location of the industries producing them. Knowledge of the waste rich in such raw materials as lime, iron, alumina. Knowledge of the methods of using the identified waste rich in raw materials so as to maintain quality and reduce cost. | Team 2 |
| | Alternative raw materials like lime, iron, alumina, silica rich industrial waste procurement coordinator. | Science/commerce graduates.<br>They should know the alternative raw materials like lime, iron, alumina, silica rich industrial waste movement cycles in the country and have the skills to be able to finalize contracts for disposal through co-processing with proper co-processing/tipping fee. | Team 1 |
| Greening of existing jobs | None | None | None |

Source: Based on discussions with the advisors, authorities, unions, procurement people and the plant.

**Cluster C – Technologies for producing blended cements.** The technologies that comprise Cluster C, from C1 to C5 as elaborated in Section 2 are listed next. Most of these technologies are very similar to one another a propos the requirement of skills, knowledge, skilled artisans and engineers. There are shared green jobs with their respective skills and knowledge, which are required for the implementation of all the technologies C1 to C5. These jobs are a prerequisite to the implementation of Cluster C technologies. They are essential to do mapping of the pozzolonic materials in the country, identify those which can be used to make blended cements, negotiate the contract to procure them, get environmental permits for transport and storage, and support the process of manufacture and marketing of blended cements. These shared manpower resources will have to also arrange for the installation of storage and feeding systems for the pozzolonic materials with proper safety systems integrated in them, get the internal stakeholders in the plant to slot in the new set of people to accept, store, and feed the pozzolonic materials to the cement mills, and provide the training to the CCR operators, laboratory personnel and engineers to operate the cement mills to produce the blended cement meeting the country standards. These shared jobs are essential for each of the technologies C1 to C5 that are implemented by the cement plant. We shall separately give details of these shared green jobs with their respective skills and knowledge and then each technology C1 to C5 shall be dealt with in regards to the additional jobs required.

Of the various teams working in the cement plants, there are four teams, which are prominently involved in introducing these technologies. These are listed below. The details of the shared green jobs with their respective skills and knowledge for the whole Cluster C and other specific jobs with their respective skills and knowledge considered necessary for each of the technologies C1 to C5 are given in table 14.

**Cluster C Technologies:**

C1. Use of granulated blast furnace slag as pozzolonic material to make slag cement

C2. Use of fly ash from coal-based power plants as pozzolonic material to produce pozzolonic cement

C3. Use of naturally occurring pozzolona for making pozzolona cement

C4. Use of limestone as an additive in cement

C5. Use of recycled concrete as a cement additive after processing

**The skilled teams that shall work for inducting these technologies are:**

Team1. Input material procurement team.
Team2. The plant production team.
Team3. Product distribution team.
Team4. The marketing and knowledge transfer team.

**Table 14. Cluster C – Technologies for producing blended cement**

| | Green(ing) jobs | Required skills and knowledge | Related team from 1 to 4 |
|---|---|---|---|
| Cluster C | Shared green jobs and the required skills and knowledge | | |
| New green jobs | | | |
| Market mapping and contracting. | Market mapping expert. | Chemical engineering graduates.<br>Knowledge and skill of mapping the hazardous and non-hazardous waste from the Industries, including the knowledge of the contacts and location of the industries. | Team 1 |
| | Contract expert. | Commerce graduate or chartered accountants.<br>Knowledge and skill of negotiating a proper contract with the clients, safeguarding the interests of the company as per the contracts law of the country. | Team 2 |
| | Support staff. | Science or commerce graduates.<br>Basic skills of mapping the waste from the industries, including knowledge of their location and contacts. | Team 1 |
| Skill, knowledge and technology mapping and transfer. | R&D engineer. | Postgraduate in chemical engineering/chemistry.<br>Knowledge of blended cement and its processing requirements in the cement plant. Good communication skills and contacts worldwide in the blended cement circuit in the cement plants. | Team 4 |
| | Communication expert. | Science/commerce graduate with post-graduation in personnel management and communication.<br>Knowledge of the communication avenues internationally with other cement plants processing blended cement in their plant, presentation skills, writing skills and the good control on language. Knowledge of the blended Cement R&D community and the general blended cement personnel in cement plants so as to zero in on the right communication channels for the developing blended cement initiatives. | Team 4 |
| | Support staff. | Science/commerce graduates with exposure to communication skills and community service. | Team 4 |
| Material acceptance and storage. | Material acceptance staff. | Science graduates.<br>Basic skills of sampling, sample transport, checking test reports and accepting the received pozzolonic materials. They should know the weighing arrangements and have inspection skills of the pozzolonic materials received. | Team 2 |
| | Material storage staff. | Science graduates.<br>Basic skills of checking test reports, storage requirements of the received waste, and accepting the received materials. They should know the storage and extraction arrangements and have inspection skills of the pozzolonic materials received. | Team 2 |
| | Testing and tracking staff in | Science graduate.<br>Basic testing skills for the pozzolonic materials received | Team 2 |

| | | | |
|---|---|---|---|
| | laboratory. | and the decision-making skills to identify and track the received materials, and to clear them for acceptance. | |
| Greening of existing jobs | | | |
| Production team. | Process engineer. | Chemical engineer with specialization in cement plant operations and process.<br>Knowledge of blended cement quality control, production, standards in the country and operation of the cement mills for producing blended cement. | Team 2 |
| | CCR operator of cement mill. | Science graduates with experience in operating the cement mills.<br>Skill of operation of the cement mills for producing Blended Cement. | Team 2 |
| | Quality control staff. | Postgraduate in chemistry and knowledge of blended cement production.<br>Knowledge of blended cement quality control, production, standards in the country and operation of the cement mills for producing blended cement. | Team 2 |
| Raw material inventory and quality. | Chemist | | Team 2 |
| | Survey or for inventory. | | Team 2 |
| | Support staff. | | Team 2 |
| Marketing team. | Marketing head. | | Team 3 |
| | Customer service expert. | | Team 3 |
| | Support staff. | | Team 3 |

C 1. Use of granulated blast furnace slag as pozzolonic material to make slag cement

| | |
|---|---|
| New green jobs | The shared staff shall be able to manage, and if there is surplus existing staff with experience as desired for the new positions, they can be trained to take up these positions. |
| Greening of existing jobs | |

C 2. Use of fly ash from coal-based power plants as pozzolonic material to produce pozzolona cement.

| | |
|---|---|
| New green jobs | The shared staff shall be able to manage, and if there are surplus existing staff with experience as desired for the new positions, they can be trained to take up these positions. |

| | |
|---|---|
| Greening of existing jobs | |
| C 3. Use of naturally occurring pozzolona for making pozzolona cement. | |
| New green jobs | The shared staff shall be able to manage, and if there are existing surplus staff with experience as desired for the new positions, they can be trained to take up these positions. |
| Greening of existing jobs | |
| C 4. Use of limestone as an additive in cement. | |
| New green jobs | The present staff shall be able to manage with some minor training except for the SKT mapping and transfer staff. |
| Greening of existing jobs | |
| C 5. Use of recycled concrete as a cement additive after processing. | |
| New green jobs | The shared staff shall be able to manage, and if there are surplus existing staff with experience as desired for the new positions, they can be trained to take up these positions. |
| Greening of existing jobs | |

Source: Based on discussions with the advisors, authorities, unions, procurement people and the plant.

**Cluster D – Use of progressive green technologies under development globally to reduce GHG emissions.** The technologies that comprise Cluster D, from D1 to D5 as elaborated in Section 2, are listed next. These technologies D1 to D5 and others that shall be developed in the future shall be very different from the present requirement of skills, knowledge, skilled artisans and engineers. But there are shared green jobs with their respective skills and knowledge, which shall be required for all the technologies D1 to D5. These are a prerequisite to the implementation of Cluster D technologies. These jobs and skills are necessary to undertake market mapping of the new technologies being developed and keep track of their development and at the right time become a partner for its induction into the cement plants in Indonesia. They are also necessary for those technologies that have been already identified as D1 to D5.

Of the various teams working in the cement plants, there are four teams, which are prominently involved in introducing these new technologies in the cement plant. These are listed below. The details of the shared green jobs with their respective skills and knowledge for the whole Cluster D and other specific jobs with their respective skills and knowledge considered necessary for each of the technologies D1 to D5 are given in table 15:

D1. Use of the energy efficient fluidized bed technology

D2. Use of CCS applications in power plants and cement plants

D3. Use of oxy fuel technology to reduce energy consumption and increase plant capacities of the present kilns

D4. Use of algal technologies to recycle $CO_2$ as a fuel for cement and power plants

D5. Use of alternative green cements

**The skilled teams that shall work to introduce these technologies are:**

Team1. Input material procurement team
Team2. The plant production team
Team3. Product distribution team
Team4. The marketing and knowledge transfer team

**Table 15. Cluster D – Use of progressive green technologies under development globally to reduce GHG emissions**

| | Green(ing) jobs | Required skills and knowledge | Related team from 1 to 4 |
|---|---|---|---|
| Cluster D | Shared green jobs and the required skills and knowledge | | |
| New green jobs | | | |
| Skill, knowledge and technology mapping and transfer. | R&D engineer. | Postgraduate in chemical engineering/chemistry<br>Knowledge of new progressive green technologies for cement and its processing requirements in the cement plant. Good communication skills and contacts worldwide in the new progressive green technologies for cement | Team 4 |

| | | | |
|---|---|---|---|
| | | circuit in the global R&D world. | |
| | Communication expert. | Science/commerce graduate with postgraduate qualification in personnel management and communication.<br><br>Knowledge of the communication avenues internationally with other R&D centres conduction work on new progressive green technologies for cement plants, presentation skills, writing skills and the good control on language. Knowledge of the R&D community conduction work on new progressive green technologies for cement so as to zero in on the right communication channels for providing proactive support to the work being done. | Team 4 |
| | Support staff. | Science/commerce graduates with exposure to communication skills and R&D work. | Team 4 |

Greening of existing jobs

D 1. Use of the energy efficient fluidized bed technology

New green jobs — The shared staff shall be able to manage, and the new requirement shall be based on the discussions with the technology transfer process from the technology and equipment manufacturers.

Greening of existing jobs

D 2. Use of carbon capture and storage application in power plants and cement plants.

New green jobs — The shared staff shall be able to manage, and the new requirement shall be based on the discussions with the technology transfer process from the technology and equipment manufacturers.

Greening of existing jobs

D 3. Use of oxy fuel technology to reduce the energy consumption and increase plant capacities of the present kilns.

New green jobs — The shared staff shall be able to manage, and the new requirement shall be based on the discussions with the technology transfer process from the technology and equipment manufacturers.

Greening of existing jobs

D 4. Use of algal technologies to recycle $CO_2$ as fuel for cement and power plants.

New green jobs — The shared staff shall be able to manage, and the new requirement shall be based on the discussions with the technology transfer process from the technology and equipment manufacturers.

| | | |
|---|---|---|
| Greening of existing jobs | | |
| | D 5. Use of alternative green cements | |
| New green jobs | The shared staff shall be able to manage, and the new requirement shall be based on the discussions with the technology transfer process from the technology and equipment manufacturers. | |
| Greening of existing jobs | | |

Source: Based on discussions with the advisors, authorities, unions, procurement people and the plant.

## 4.3 Direct and indirect manpower in the Indonesian cement sector

In the previous Section 4.2 we discussed the fine points of the knowledge and skills requirements for direct manpower in the Indonesian cement sector with the introduction of the Clusters A to D of green technologies.

The split of the skilled labour required for indirect manpower in the coming years, skill-wise, was given in Section 4.2. To meet the demand for this skilled manpower in the coming years, the country will need an enabling environment as most of these people are trained either on the job or through private institutes. Some of the courses can be infused into the curriculum of the existing vocational training institutes run by the government, and for others some incentives should be developed for the private institutes so that sufficient private institutes are started to meet the residual demand. The details of the skills and knowledge requirement of these jobs are discussed in table 16.

**Table 16. Indirect manpower in the Indonesian cement sector**

| | **Green(ing) jobs** | **Required skills and knowledge** | **Related team from 1 to 4** |
|---|---|---|---|
| Indirect manpower in the Indonesian cement sector and the required skills and knowledge | | | |
| New green jobs | | | |
| | Truck driver | Secondary school and driving school certificate.<br>Driving skills for the normal trucks and the RMC trucks | Team 5 |
| | Truck helper | Primary school.<br>Driving helper skills of navigation and properly securing the material in the truck for the normal trucks and the addition of chemicals for the ready mix concrete trucks | Team 5 |

| | | | |
|---|---|---|---|
| | Rigger supervisor | Secondary school with vocational training in rigging.<br>Rigging skills for loading and unloading the cement, steel and other equipment needed at site like mixers, cutting machines etc. | Team 5 |
| | Rigger helper | Secondary school.<br>Rigging helper skills for loading and unloading the cement, steel and other equipment needed at site like mixers, cutting machines etc. | Team 5 |
| Construction worker group | Bar bender | Secondary school with vocational training in bar bending.<br>Bar bending skills to make the steel bar structure as per drawing. They should be able to read the drawings and also have the skill of bar cutting and bending at site to make the steel cages as per drawing. | Team 5 |
| | Shuttering expert | Secondary school with vocational training in shuttering.<br>Shuttering skills to make the shuttering for columns and roof as per drawing. They should also be able to read the drawings and make the shuttering as per requirements. | Team 5 |
| | Cement mixing expert | Secondary school with vocational training or experience at site in cement mixing.<br>Cement mixing skills so as to make the cement grout as per requirement, and also have the knowledge to use the Ready mix concrete. They should also be able to read the drawings so as to use the right mix. | Team 5 |
| | Architects | Degree in Architecture.<br>They should be trained for making buildings. | Team 5 |
| | Surveyor for measurements | Secondary school with vocational training in surveying.<br>They should be able to take measurements for the jobs executed at site. | Team 5 |
| | Construction helpers | Primary school.<br>They should have the skill to help all the work at site like digging, loading, unloading, shifting of steel, cement, soil and installing steel cages etc. | Team 5 |
| | Heavy Equipment operators | Secondary school with vocational training in heavy equipment operation.<br>They should be able to operate the excavators for excavation of land at site. | Team 5 |
| Greening of existing jobs | The present worker strength shall be insufficient to cater to the requirement of the future. | | |

Source: Based on discussions with the advisors, authorities, unions, procurement people and the plant.

The skill development of the manpower resources discussed in the preceding sections, with its composition of green jobs in the marketing and distribution of low carbon cement, identification, procurement and supply of green materials for green cement, handling and transportation of the

added capacity are major areas where work still needs to be done. A concerted effort in these areas to develop this manpower resource shall ensure that the green technology induction initiatives to reduce the GHG emissions in the cement sector bears fruit and shifts the technology Clusters A to D to a business as usual status and an OEM supply with the plant. The avenues and proactive measures to be taken to develop these skills have been discussed in other sections of this report.

## 4.4 Basic education and communication skills of the manpower resource of the future in the cement sector in Indonesia

In the Indonesian cement sector, with the intention to reduce energy consumption, improve productivity and lower operational and maintenance costs, the installation of high capacity cement plants with greater automation are planned to be a substantial initiative in the coming decade. This initiative would reduce the man-hours per tonne of cement produced. However, the absolute manpower would increase on account of higher production. It must be appreciated that with greater complexity of operations in the high capacity plants, the skills, knowledge and education required would also increase. With exclusive outsourced technology being provided by the machinery suppliers, it has become important to factor in the requirement of specialized knowledge and how to enforce the annual maintenance contracts for these exclusive technologies in the maintenance and skill map of the manpower resources of the plants. For areas and equipment under the annual maintenance contracts, the direct skills requirement of the maintenance staff in the plant will reduce mostly to identification of any faults encountered and the aptitude to discuss these problems with the manufacturers' technical staff. The maintenance staff should have the capability and skills to understand and administer these annual maintenance contracts. This is because the actual rectification is currently done by the supplier's manpower. These communication skills to interact with the manufacturers' technical staff and the skills to understand and administer the annual maintenance contracts are new to the cement sector in Indonesia. These skills require higher educational qualifications and good communication skills at all levels of the hierarchy of the maintenance module in the plant.

With the upgrading of the technology, automation, introduction of the material handling equipment and outsourcing of the specialized maintenance for exclusive technology, the education level and the communication skills of the total workforce requires a significant improvement. At present, in the absence of new high capacity automated plants and new green technologies, the unskilled and possibly uneducated form a large constituent of the workforce of the cement sector. This would totally change in the next decade, and minimum education would become essential to get work in the plants. Progressively, as the new plants are commissioned, this section of the uneducated and, unskilled and pre-primary educated workforce shall be marginalized. There is a need to undertake initiatives to retrain and upgrade the basic education level of the present and the future workforce. It would thus be desirable to start initiatives in the plant for adult education classes to improve the education and skill level of the uneducated section of the workforce. To improve the educational map of the future workforce it would be

desirable to extend the free education provided until primary schooling, to secondary schools level also, and the entry level to be upgraded for vocational trainings from primary to secondary level education. Making secondary education compulsory with an emphasis on improving communication skills would help the job market and reduce the unemployment rate, as more people would then become employable and ready for work in the new scenario.

The programmes at the national level would have to be amended to provide the support needed by the cement and sector to provide:

1. education and communication skills to the uneducated section of the workforce who are at present working in the sector;
2. skills training for the unskilled section of the workforce working in the sector; and
3. better education and communication skills by making secondary level education compulsory and free and improving the curriculum to include communication as an additional subject.

# 5. Skills programmes in the cement sector at the national level in Indonesia

## 5.1 General background of the training requirements of the cement sector till 2020

An overview of the required knowledge, and skills and training requirements whether internal or external has been condensed into the table 17 below for the four technology Clusters A to D.

**Table 17. Identification of training for skills for greening the cement industry for Cluster A to D technologies**

| Sr. No | New green technology | Additional skills required | Type of job identified | |
|---|---|---|---|---|
| | | | Green Job / training status | Greener job / training status |
| Cluster A – Technologies for improving energy efficiency. | | | | |
| | Technology A1, A3, A4 and A6: Use the most energy efficient technology by modernizing the old kilns, and improve efficiency all around. | New CCR operators for the kilns and mills. | X/X | √ / Internal available |
| | Technology A2: Waste heat from the kiln/cooler/power house can be used to produce power. Expected commercialization at viable rates during the coming decade, and is expected to be implemented by 2020. | Power generation personnel in the kiln plant. | X/X | √ / External from Power Generation industry |
| | | CCR operators for the turbine to be trained. | X/X | √/External from Power Generation industry |
| | | Mechanics, electricians, instrument technicians to be trained to take care of the boilers and turbines. | X/X | √/Internal available |
| | | CCR operators of the kilns to be imparted additional skills to run the WHRS while controlling the process and product. | X/X | √/Internal available |
| | Technology A5: Installation of captive power plants (CPP) to save on transmission losses. | All the staff and artisans of the power plant to be recruited and trained on the turbines and boilers installed in the plants. | √ / Required from power generation industry | X/X |
| | Technology A6: Replacement of old plants by high capacity energy efficient plants. | The full staff and artisans of the new plant are needed and the staff and artisans of the old plant can be retrained to operate the new plant except for the specialist required for the new plant. | √ / Specialists required from cement industry | √/External from the suppliers of the plant. |
| Cluster B - Technologies for using alternative fuels and raw materials | | | | |
| | Technologies B1, B2, B3, B4, B5: | New skills to provide service to the customers. | √ /Internal available | X/X |

| | | | |
|---|---|---|---|
| Using high calorific value wastes as fuel replacement. | New skills to handle, store, feed these materials to the kiln. | √/Internal available | X/X |
| | New skills to understand their effect on the process and the product and the skills to maintain quality and production. | √/Internal available | √/Internal available |
| | Additionally trained CCR operation personnel to run these Kilns. | X/X | √/ Internal available |
| Technology B6: Providing brand protection service to FMCG industries, by using the kiln to destroy the off-specification, market rejects, expired products, and get paid for doing so. This also reduces GHG since otherwise they would have to be incinerated for which further fuel is needed. | Marketing personnel to get the service level agreements with the FMCG manufacturers. | √/External from WMC | X/X |
| | The skills of discipline to provide the brand protection to the products which come into the plant for destruction are to be imparted to the set of people handling these materials. | √/Internal available | X |
| | The skills of the operating and maintenance staff have to upgraded to ensure that these materials do not affect the process and the product. | X/X | √/Internal available |
| | New staff has to be trained to identify CDM projects and then take them to their natural end so that CDM credits are gained. | √ /Internal available supported by the CDM consultants | X/X |
| Technology B7: Using alternative raw materials in place of limestone, alumina, iron, gypsum. | New skilled manpower to identify these materials and procure them as service to the waste generator so that it adds to the bottom line | √ / Required from waste management companies (WMC) | X/X |
| | Additional skills in the quality control and kiln operation to understand their effect on the product and production. | X/X | √/Internal available |
| | Additional skills to handle, store, feed these materials as replacement of the original raw materials. | X/X | √/Required from WMC |
| Cluster C -Technologies for producing blended cements (BF) | | | |
| Technology C1, C2, C3: Use clinker substitutes - fly ash, blast furnace slag, and naturally occurring pozzolona | Upgrading the skills of the lab, the CCR operators, process engineers, product quality control are new skills that are desired. | X/X | √ /Internal available |
| Technology C4: Use limestone as an additive in cement. | Minor upgradation of skills of process engineers, lab personnel, quality control personnel, CCR operators. | X/X | √ /Internal available |
| Technology C5: Use of recycled concrete as a cement additive after processing in cement. | Minor upgradation of skills of process engineers, lab personnel, quality control personnel, CCR operators. | X/X | √ /Internal available |
| Cluster D -Use the progressive technologies under development in the world to reduce GHG emissions (PT) | | | |
| Cluster D1, D2, D3, D4, D5: Fluidized bed technology, CCS, OFT, algal technologies and alternative green cements – this provides a sure way of reducing GHG footprint, but its pilot plant technology commercialization is expected only | New skills of operators to operate the equipment for CCS. | √/NEW | √/ NEW |
| | Additional skills to be imparted to the CCR operators for maintaining the process while using the CCS, even though it is using the end product $CO_2$. | √/NEW | √/NEW |

| | | | |
|---|---|---|---|
| by 2020. | Additional skills to transport, store, and take care of the stored $CO_2$ over the future would be totally new green jobs skills, as this is a new technology. | √/NEW | √/NEW |

Note: X–Not applicable √-Applicable

Source: Based on discussions with the advisors, authorities, unions, procurement people and the plant.

The potential educational qualifications and skills required for manpower for each of the technologies of the green technology Clusters A to D have been listed in Section 4. Cluster D technologies are likely to be commercialized and introduced into the Indonesian cement sector by 2020. As Cluster D technologies become commercially viable and are introduced into the cement plants, there shall be a visible shift in the requirement of new skills for these green jobs and greening of the present jobs. This scenario, which is expected to open up over the next two decades, will require initiating a plan, in this decade, to prepare an adequate workforce with the right education, communication skills and other technical skills to handle these totally new green jobs that shall surface by 2020 in the cement sector.

## 5.2 The national programmes for education and technical training in Indonesia

### Background

The Indonesian Government has decentralized the administrative powers of governance. They maintain a three tier administrative control at the district, provincial and the federal level. These power centres are independent of each other for their day-to-day work, budgets and planning. To organize the skilled workforce for the industry and the common public utilities, the MOMT, and the Ministry of Education and their counterparts in the provinces and the districts provide the nodal agencies under whose guidance the vocational training institutes, the polytechnic and the graduate schools operate based on their geographical locations in Indonesia. The country has 17,000 islands, 33 provinces, and 500 districts with a population of 220 million.

### Distribution of the polytechnic vocational schools and the vocational training centres in Indonesia.

The workforce of the country in 2008 was estimated to be 103 million, which is 47 per cent of the total population. Of this, the Government of Indonesia has estimated that 1.99 million is in the chemical, fertilizer, clay and cement sector, i.e. almost 4 per cent of the population, as shown in table 18.

The country has 141 polytechnics, 7,286 vocational schools, (public and private) and 15,000 vocational training centres (public and private). The control distribution of the 281 Government VTI of the country is as follows:

1. District control 240
2. Provincial control 30
3. Ministry of Manpower and Transmigration control 11

**Table 18. Grouped cement manpower figures for Indonesia and total employment**

| Sector | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| Chemical, fertilizer, clay and cement (CFCC) | 1 732 490 | 1 769 089 | 1 857 509 | 1 986 709 |
| Total employment | 95 463 860 | 95 973 952 | 100 942 135 | 103 450 686 |
| CFCC employment as per cent of total employment | 1.815 | 1.843 | 1.840 | 1.920 |

Source: ILO, 2010.

The objectives of the skills and productivity development system in the country are to:

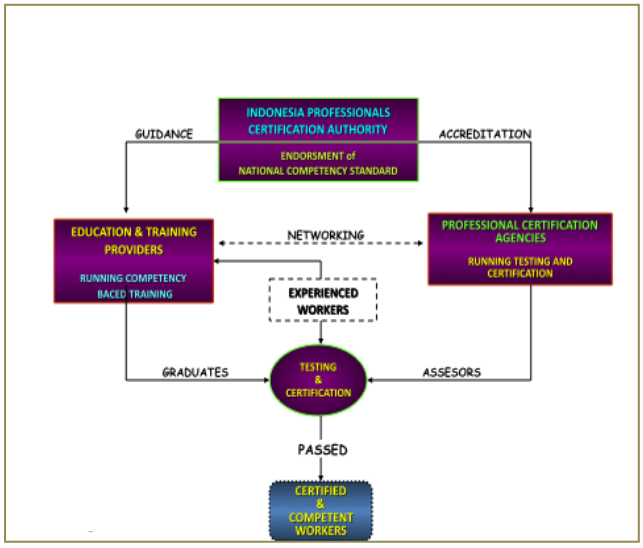
- enhance competency;
- drive productivity;
- support mobility; and
- increase prosperity.

## Skill development and evaluation, training and certification systems in Indonesia and the gaps identified to enhance its effectiveness

The skill development and evaluation system in Indonesia is very well planned and has integrated the inherent checks and balances to ensure proper implementation.

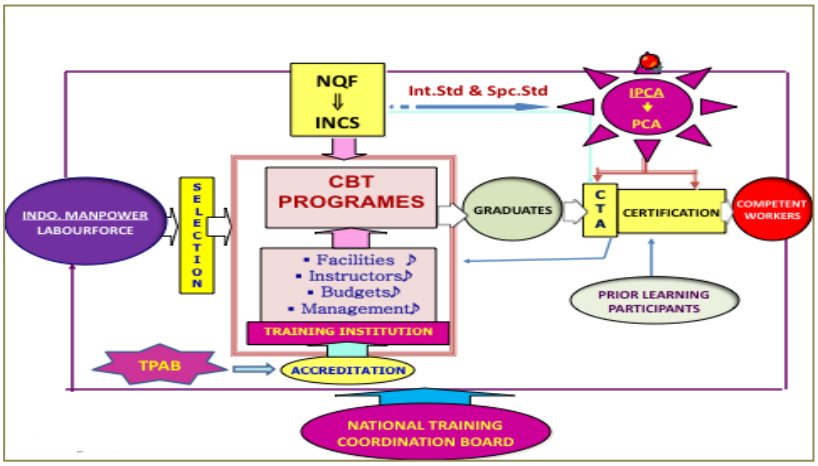
The training and certification system is also very well designed wherein the experienced workers also provide their hands on expertise to the new jobseekers. The system envisages substantial networking and assessment measures. The training and certification system is shown in figure 1 – more details of the system are given in the annexes. Figure 2 shows the skills development and evaluation system in Indonesia.

**Figure 1. Training and certification**




Source: Ministry of Manpower and Transmigration, 2011.

**Figure 2. Skills development and evaluation system in Indonesia**




Source: Ministry of Manpower and Transmigration, 2011.

Enormous efforts have been taken to design comprehensive skills development and evaluation, training and certification systems. However, to implement these systems and to draw the maximum intended benefits from them require a well-trained group, which understands and appreciates the systems developed and has the will to implement them.

The group which is assigned the detailed work to implement these systems has to be identified in the country. This group would be formed of people from various departments. It has then to be subdivided into various sub-groups who will deal with each section of the system.

Then a well-developed training programme is required to be designed for each group that will implement the systems. Once these groups are properly trained to understand the system and the thought behind them, they will be able to produce the right quality workforce. The interaction between industry and the training group is very important, and efforts should be made to ensure the curriculum is regularly upgraded and modified to include the areas required by industry.

Herein lays the crux of the problem, the gap between the industrial requirement of skills in the jobseekers and the skills of the jobseekers provided by the system needs to be bridged. The system is well designed and wholehearted efforts are made by the groups given the jobs to implement it, but the groups falls short of the training and understanding of the system to provide a properly trained workforce for the industry. Their understanding of the system, the thought behind it and the interactions between the training groups and industry needs to be improved. Furthermore, the curriculum should be upgraded to meet industry requirements and should be given the highest priority by the system designers, the industry and the training group.

So as to close this gap between the industrial requirement of skills in the jobseekers and the skills of the jobseekers provided by the system, the cement plants have started their own internal training initiatives at vocational, polytechnic and graduate levels. These initiatives provide the required differential training to fill in the gaps in the skills required and provided. This investment and initiative ensures that the skill inventory of their skilled manpower remains sufficiently robust and ensures that the plant operations and maintenance groups are adequately supplied with properly trained manpower. They receive on-the-job training, in addition to classroom education in the technology and occupation-based skills.

The VTIs run by the MOMT have sufficient financial support and are the most effective, where as the ones run by the provincial and districts as well as the private ones require further support. The MOMT at the federal level is aware of the requirements of the 270 VTIS operated by the district and the provincial governments. The entry level for these VTIs is primary education, and these institutes award secondary vocational certificate accreditation. These VTIs provide training in all general skills such as: welding, fitting, telemetric, instrumentation use, carpentry, construction, etc. with which the jobseekers can, after taking the certificate, either go work for industry or work for themselves.

The ministerial and VIT administrators, industry, students and the community are aware of the wide gap between the skills of the VTI, polytechnic and graduate school trained workforce and the requirements of the cement industry. The following systems are in place to identify gaps and upgrade the National Competency Standards (NCS) and the curricula:

- the NCS;
- the curricula which is based on the NCS;
- the accreditation system of institutes both public and private; and
- a system of TNA of the industry.

However, the skills required for doing the TNA itself, which is the base on which the gaps are assessed and fixed, has not yet been developed. These cannot be learnt on the job since they are very new initiatives and there are no people on the job to impart the hands-on training. The

country's skills training setup is not able to adapt itself to continually upgrade the training instruments – the NCS and the curricula to meet the continuous changing requirements of the industry. More data and information on the training system and its spread is given in table 19.

**Table 19. Data and information for the skills training system in Indonesia**

| No | Description | Number |
|---|---|---|
| 1. | National competency standards | 116 |
| 2. | Sectors of economics | 9 |
| 3. | Training providers | |
| | Polytechnics | 141 |
| | Vocational schools (public and private) | 7 286 |
| | Vocational training centres (public and private) | 15 000 |
| | Vocational training institutes (government) | 281 |
| | Federal | 11 |
| | Provincial | 30 |
| | District | 240 |
| 4. | Professional certification agencies | |
| | Licensed PCAs | 35 |
| | Candidates under the process of licensing | 83 |
| 5. | Competency assessors | 4 243 |
| 6. | Budgets | |
| | National government budget | |
| | Provincial government budget | |
| | Local/district government budget | |
| | Private sector budget | |

Source: Ministry of Manpower and Transmigration, 2011.

# 6. Recommendations for a skills development strategy for green jobs in the cement sector in Indonesia

## 6.1 Background

The Government of Indonesia views the reduction of GHG emissions from the cement industry as a high priority for the next decade. With their 90 action plans across eight industrial sectors including cement, the Government plans to abate 70 per cent of the GHG emissions from industry by 2020. The cement industry alone accounts for 41 per cent of the total GHG emissions in Indonesia. In this paper we have reviewed the present scenario concerning manpower skills for the cement sector and the systems in place today to provide the skills for jobseekers. We have also projected the anticipated changes in the skill map of manpower for the cement sector as the Clusters A to D of green technologies are introduced and reflected on the preparedness of the present system to provide these skills in the future. Based on the study, recommendations have been made help improve the system. Our recommendations have been made in two separate heads.

**Direct manpower**

**Present system:** This section shall cover recommendations to speed up the implementation of the present system so as to cover the gaps in the skills density, between that which is desired and that which is provided to the cement sector in Indonesia.

**Future system:** This section shall cover the recommendations to prepare the system to provide the required skill density of direct skilled manpower of the cement sector, for the introduction of the Clusters A to D green technologies in the coming decade.

**Indirect manpower:** This section shall cover recommendations to energize the skills development system for the jobseekers to provide the skilled and semi-skilled indirect manpower for the cement sector in Indonesia.

**Direct manpower in the cement sector**

This study concludes that the direct specific man-hours per tonne in the cement industry is expected to be reduced with the introduction of more efficient, automated and green technologies. In spite of the sizable increase in cement production, a significant rise in the absolute direct manpower in cement industry over the next two decades is unrealistic. Of the 116.5 million manpower strength of Indonesia in 2010, the direct manpower deployed by the cement sector was estimated at around 9,500 in 2005 and is expected to increase by more than 30 per cent to reach 12,500 in 2020 on account of the increased production levels and improved technology. However, with a sizable reduction in the specific man-hours per tonne of cement produced. The numbers may not be large but the skills profile of the requisite manpower shall go through a radical far-reaching change. The details of the new skills profiles desired with the implementation of the Clusters A to D of green technologies have been detailed in the previous

sections. The required recommended initiatives to upgrade the systems, which will be needed to train the new staff and retrain the old staff to meet the new skills profiles in the coming decade, shall be discussed in the subsequent sub-sections.

### Indirect manpower in the cement sector

The study indicates that the indirect manpower required for the cement sector in the coming decade will increase to support the projected increased production, distribution and consumption of cement. For the indirect manpower, the skills profile of this group would not change, but the absolute numbers required shall increase from around 0.6 million in 2005 to almost a million by 2020. In the sub-sections on indirect manpower, we shall provide the recommended initiatives to be taken to make sure that this additional indirect manpower is provided the required training to ensure the proper support for the additional cement production.

## 6.2 Direct manpower

### Present systems

**i. Training for the implementers of the governmental programmes.** The systems designed for skills development and evaluation, training and certification have been studied and it was concluded that they are excellent. However, it is observed that there is an unambiguous gap between the skills required by industry and those of the skilled jobseekers available. This is reinforced by the fact that the cement sector is organizing secondary trainings for the skilled artisans and engineers before putting them on the job, to bring their skill standards up to that required by the sector. During the study it was also observed that this gap is because of inadequate implementation of the training systems. It was apparent that the groups implementing the designed systems need further training to understand and appreciate the systems developed. It is recommended that the following steps be taken which would help in closing the gap in the system implementation:

**Step 1.** It is recommended that the group which is assigned the detailed work to implement these systems should be clearly identified in the country. This group is formed of people from various levels and departments.

**Step 2.** It is recommended that the identified group be subdivided into various sub-groups who will deal with each hierarchical stage of the system across the country.

**Step 3.** It is recommended that a comprehensive training programme be designed for each identified hierarchical group, which is to implement these systems.

**Step 4.** It is recommended that the interaction between the industry and the training group is to be emphasized, and systems directions should be modified to ensure that these are regular and fruitful. A time bound programme is required if after discussions the curriculum is to be upgraded and modified to include the areas required by industry.

With these recommended steps it is expected that these implementing groups will be properly trained to understand the system and the thought behind it, then the system would be able to turn out the right quality of skilled jobseekers for the industry.

**ii. Cement sector skills development strategy to be part of the Climate Change Action Plan of the Indonesian Government.** The Climate Change Action Plan for the cement industry has not provided the elements of a skill development programme for this critical industrial sector for the reduction of emissions of GHG through induction of the green technologies.

It is critical that such a skills development strategy be incorporated within the Climate Change Action Plan and other programmes. The following recommendations are proposed to meet the challenge:

a. A skills expert should be made part of the group formulating the Climate Change Action Plan.
b. The skills expert shall examine the skills upgrade needed for implementing each of the initiatives. He shall formulate a plan to provide these skills to the present workforce and also ensure that the trained manpower is made available where the skills required are totally new.
c. These recommendations should form part of the Climate Change Action Plan.

**iii. Training on how to conduct training needs assessments (TNAs) and modifying the curricula.** The study reveals that the ministerial and VIT administrators, industry, students and the community are aware of the wide gap between the skills of the VTI, polytechnic and graduate school trained jobseekers and those required by the industry. The following systems are in place to continually identify this gap and close it by changing the NCS and the curricula:

- the NCS;
- the curricula which is based on the NCS;
- the accreditation system of institutes both public and private; and
- a system of TNAs for the cement industry.

The study indicates that the skills required for doing a TNA, which is the base on which the gap is assessed and closed will require further improvement. The implementing group cannot learn these skills on the job since these are very new initiatives and there are no people on the job to impart the hands-on training. The polytechnic and graduate schools which are controlled by the Ministry of Education also suffer from this shortfall in training for conducting the TNAs and continually upgrading the NCS and curricula to close the gaps observed.

The country's skills training setup is not able to continually upgrade the NCS and the curricula to meet the continuous changing requirements of industry, including the cement sector.

**It is recommended** that the implementing groups be identified and then provided detailed training on how to conduct TNAs and the system improved to ensure that the gaps observed during the TNAs are incorporated in the curricula to close the gaps observed in a time bound period.

**iv. Workplace training for students at training centres/polytechnics.** The study indicates that in the BAU scenario there is a high percentage of unskilled workforce requirements. With the introduction of new technologies, the basic education level of the workforce required to operate and maintain these plants and market the new product would rise. The study shows that the unskilled and uneducated workers are being increasingly sidelined and their lack of education make them not fit for relocation. Strategic efforts are needed to ensure that the new general workforce has a higher basic education of primary level and the skilled workforce has secondary level education. For this some basic changes shall be desirable to be made in the national level programmes, so as to protect the present and future unskilled workforce of the industry.

**It is recommended** that the programmes at the national level be re-engineered to provide:

1. Basic education and communication skills to be provided to the uneducated section of the workforce at present working in the cement sector in association with the management.
2. Specific skills training to be provided to the unskilled section of the workforce at present working in the sector to ensure their future employability.
3. Better education and communication skills be provided to the jobseekers preparing for the future, by enforcing the following actions:
    a. The required legislation is to be approved to make basic education up to primary level compulsory and free for all with English as an obligatory subject. This is because the skill, knowledge and technology information for the new technologies are all developed in the Western world, and are available in English. Acquiring English knowledge capability would make the absorption of these technologies easier.
    b. The curriculum of the vocational training institutes both private and government is to be upgraded to include communication as an additional subject for all vocations.
    c. The required legislation is to be approved which would upgrade the entry-level education required for vocational training institutes to secondary level.

**v. Improving the contracts management skills in the plant workforce.** The study shows that with the introduction of Cluster A to D technologies and the installation of new high

efficiency plants, there shall be an influx of exclusive technologies in to the plants. These shall require annual maintenance contracts to be entered into with the suppliers and enforced by the engineers and managers of the plant. In this scenario, which is expected to become a reality in the coming decade, the skills for contract management will become more important for the managers and engineers. These skills in contracts management shall have to be provided to the present workforce and also to the new jobseekers for the level of managers and engineers, to ensure proper enforcement.

**It is recommended** that the curriculum of the polytechnics and graduate schools be upgraded as follows:

a. The subject of contracts management should be added as a common and compulsory subject for all branches of the polytechnic and graduate schools.
b. Trained part-time or full-time contracts management trainers should be inducted to provide the training to the students in the graduate and polytechnics schools.
c. Sufficient short-term executive programmes should be included, for the working professionals on contracts management so as to give an opportunity to the working professionals to get trained in contracts management skills.

**vi. Graduate and polytechnic-based programmes for skilled workers and supervisors.**

**1. It is recommended** that the graduate and polytechnic-based programmes being run by leading plants in Indonesia (refer to the case study of Holcim, Annex I), and should be replicated in all the graduate and polytechnic institutes. The last semester should be used for hands-on training at the plants of the student's choice, so that they are ready for taking up responsibility as soon as their certification is complete.

**2. It is recommended** that the plants select the students who would take the on-the-job training, so that there is a clear possibility for their absorption upon graduation and certification.

**3. It is recommended** that a public-private partnership between the Government institutes at vocational, polytechnic and graduate levels and the cement producers, either individually or collectively, should be organized on the lines of existing examples that are found already in the country (refer the case study of Holcim in Annex I). For instance, Holcim Indonesia have their own academy which runs the programmes in association with the Government training institutes to provide technology and occupation-based training for their technicians and graduate engineers. In this academy the Government bodies associated with the venture give the certification to the students. This can be done through the vocational training academy being run by the Indonesian Cement Association. For this the following plan has been formulated for Indonesia.

**Step 1.** The Ministry of Manpower should send out directions to the polytechnics to develop collaboration with their nearest cement plants. The support from the plants should be ensured through a directive from the Ministry of Industry to the Cement Association and the plants. The training institute being operated by the Cement

Association should be made the nodal point to help stabilize the programmes in the polytechnics.

**Step 2.** The Ministry of Education should send out directions to the graduate schools to develop collaboration with their nearest cement plants to undertake graduate engineer trainings. The support from the plants should be ensured through a directive from the Ministry of Industry to the Cement Association and the plants. The training institute being operated by the Cement Association should be made the nodal point to help stabilize the programmes in the graduate schools.

**Future systems**

**i. Recommended actions to be taken with the implementation of the Cluster A technologies (energy efficiency)** It is an accepted norm that these technologies can be adopted while installing new capacity and also while changing the old equipment or its spares when they have served their normal life. The study indicates that this is not being done extensively because of:

a. lack of knowledge with the plant managers and the maintenance staff about the new energy efficient equipment, spares and control systems which are to be introduced via a continual improvement programme; and
b. competing investment strategies, where investments are made for reliability and new capacity rather than for energy efficiency.

**It is recommended** that every cement plant should have a plan to provide extensive exposure to developments in the energy efficient technologies and equipment for the engineering, process, laboratory and operating staff of the cement plants. This would help them to bring in these technologies not only when the new energy efficient plants are installed but also during maintenance of the equipment.

**ii. Recommended actions to be taken with the implementation of the Cluster B technologies (alternative fuels and raw materials).** The study indicates that, internationally, these technologies are relatively new. The percentage use of AFRs in Indonesia compared to its use in other developed countries is almost negligible. It follows through that there is a need both at the level of the authorities and industry for skill, knowledge and technology transfer from the countries where AFR percentage usage is high.

**Step 1. Training programmes for managers, engineers and workers of cement plants.**

**It is recommended** that the group dealing with AFRs in the other developed countries be contacted and training programmes be organized to improve the following skills of the new group of managers, engineers and workers at Indonesian cement plants:

a. To effectively identify, procure and use the AFRs in the cement plants.

b. To match the available waste to the fuel or raw material to be replaced.
c. To do a market scan of the Indonesian waste and identify wastes in sufficient quantities to replace the fuel or raw material.
d. To understand and replicate the equipment and processes for using the available waste in the cement process. For this contacts have to be developed with leading countries using these technologies.
e. To understand the economic viability of the use of AFRs against the use of traditional fuels with additional investments in handling, storage, feeding and control systems.
f. To understand the control process and the desired supply chain system to take care of the unreliability of supply, both in quantity and quality of the waste, since it is a waste and not a product.
g. To understand the legal and financial limitations of the use of AFRs sometimes may result in lower specific outputs of the kiln. This becomes important since in Indonesia the licence requirement of the state-owned plants is that they have to meet the production output before their income can be retained for reinvestment. Efforts to adjust the legislation are desired, so as to improve innovation and GHG emission abatement activities through AFR, for the state-owned plants in Indonesia.
h. To understand the legal limitations of the country, since Indonesia has laws for waste disposal units but there are no laws for its disposal in cement and power plants. These new laws have to be generated and legislated.
i. To understand the internal stakeholder apprehension concerning cement plants, that AFR's use would adversely affect reliability and production.
j. To upgrade knowledge of the government ministries and environment control departments in regards to use of AFRs in the cement and power plants.

**Step 2. Specialized skills for drivers for handling hazardous waste.** Private companies in Indonesia have been providing the requisite trainings (see Annex I for details) to the drivers and helpers handling the vehicles carrying hazardous waste to their works. Industry has had experience in conducting safety trainings since 2008 such as two-day classroom training and a day of practical modules for each of the drivers of vehicles carrying hazardous waste. This can be implemented with the help of the Indonesian Association of Hazardous Waste Transporters.

**It is recommended that** other works handling hazardous waste in their plants should receive training for the drivers and helpers handling hazardous waste to their plants.

The following plan should be implemented:

**Step 1.** The Ministries of Manpower and Transmigration and Industry should provide guidelines and make it mandatory for all cement plants to provide such training to the drivers and helpers of the vehicles transporting hazardous waste to their plant and within the plant.

**Step 2.** The Ministries of Manpower and Transmigration and Industry should arrange for a training the trainers programme for the other works, with the help of leading cement companies and the Indonesian Association of Hazardous Waste Transporters.

**Step 3.** So as to ensure implementation of the directions of the Ministries, the plants should be asked by the Ministries of Manpower and Transmigration and Industry to keep a record of the trainings provided to the drivers and helpers of the vehicles transporting hazardous waste to their plant and within the plant. Inspection of this record should be part of the audit of the factory inspector who visits the factories for audit of safety procedures in the plant.

**iii. Recommended actions to be taken alongside the implementation of the Cluster C technologies (Blended Cement).** The market share of the blended cement in any country is limited by the lack of technical knowhow and the availability of pozzolonic materials in sufficient quantities and quality. It is also limited by the success of the efforts made for marketing this new product to the end users, architects, masons, and governmental agencies through dedicated marketing and selling initiatives in the country. These initiatives are needed to improve the market acceptance of this equally good cement product as a replacement of Portland cement.

The study indicates that there is a need both at the level of the authorities and the industry, for SKT transfer from the countries where the market share of blended cement is high.

**It is recommended** that the cement groups manufacturing and marketing blended cement in other countries be contacted by the Indonesian Cement Association and the management of Indonesian cement plants to enter into an arrangement for conducting training programmes on blended cement manufacture and marketing. These training programmes would be an amalgamation of country visits of critical groups from Indonesia and classroom programmes in Indonesia by experts from those groups. These programmes shall aim to improve the skills of the managers, engineers and workers of the Indonesian cement plants, and the Indonesian end users, architects, masons, and governmental agencies, of the manufacture and marketing of blended cements in Indonesia.

**The study recommends,** in addition to the above, the following to facilitate the manufacture and acceptance of the blended cements in Indonesia:

a. **Indonesian Ministry of Environment to start proceedings to modify the hazardous waste law**, which prescribes powerhouse fly ash and steel slag as hazardous waste, by classifying them as non-hazardous, so as to ensure their

extensive usage as pozzolonic materials and to improve the market share of the blended cements in Indonesia.

b. **The Indonesian cement sector to organize educational and marketing initiatives** among the users, architects, masons, and governmental agencies, to mitigate adverse public perception of the cement quality when made from pozzolonic materials. Cement marketing and the quality control officers from the plant are to be trained to promote the qualities of the pozzolona cement and allay the adverse public perception of the quality. They have to be trained to organize mason meets, architect meets, meetings of the government officers, public meetings, etc. These two groups have to be trained to organize public relation efforts and the experience of other countries like India and China have to be drawn upon to train these groups.

c. **The Indonesian cement sector with the support of the Government to organize** extensive training, supported by the experience of India and China, for managers, engineers and workers of the cement plants, on the economic viability of investing in new facilities of preparation, storage, handling, transportation, and grinding to make blended cements.

**iv. Recommended actions to be taken with the implementation of the Cluster D technologies (progressive technologies).** There are technologies which are in the developmental stage, and which can, when commercialized, help reduce GHG emissions. As per the planning of the Indonesian Government, most of the important Cluster D technologies are to be inducted in the cement sector by 2020. The study indicates that this will require initiating a plan, in this decade, to prepare an adequate workforce with the right education, communication skills and other technical skills for catering to the operations and maintenance of the cement plants with these technologies in place. The study recommends the actions explained in detail in the following sub-sections to be taken by the Government and industry in this decade to ensure that the required skills and knowledge are available in the sector for proper acceptance and then implement these Cluster D technologies as they are commercialized.

**a) Skill knowledge and technology group.** There is a recognized need to address the requirements of industry to improve access to the information and training on the Cluster D technologies. The study indicates the need for a strategy to track the development of these technologies and dissipate the information among the cement plants. This has to be developed by the Indonesian Ministry of Industry in association with the Indonesian Cement Association, the Ministry of Manpower and Transmigration (MOMT) and the Indonesian Ministry of Research and Technology. This model would ensure that the cement plants are well aware of the development of the technologies, and can plan their induction as well as train the trainers to ensure proper manpower availability when the technology is dovetailed into the plants. The availability of the requisite knowledge and skills exclusive to the technologies shall ensure a proper return on investment for adopting the same in the plants.

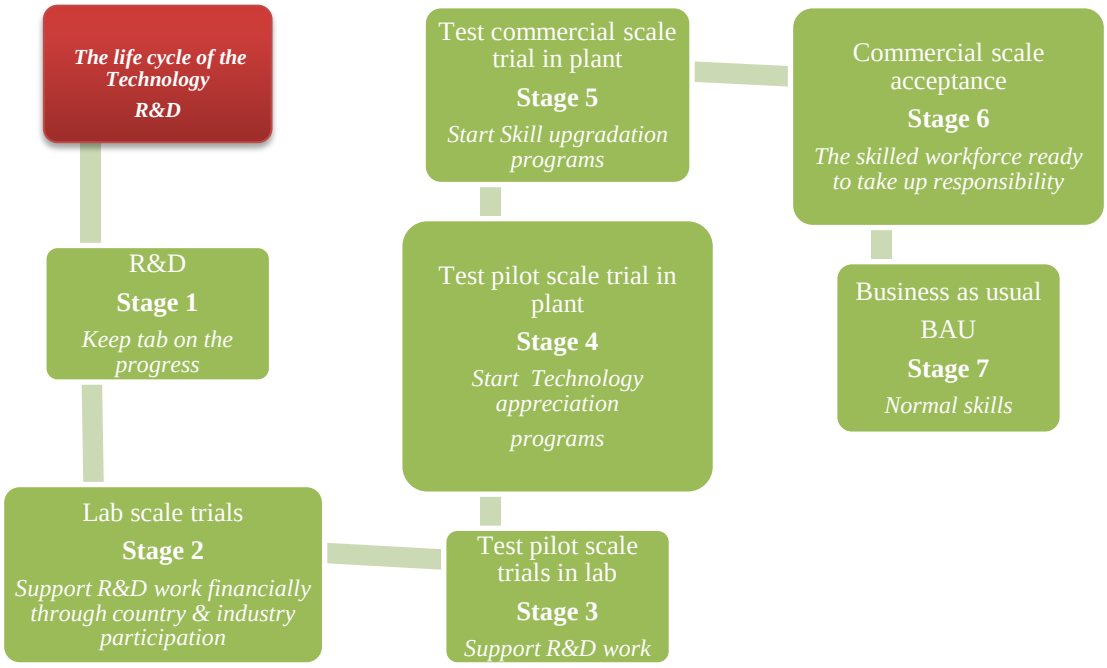
**It is recommended to take** the following steps to formulate this skill, knowledge and technology group:

**Step 1** A team of three people to be formed with one person from the Indonesian Cement Association, the Indonesian Ministry of Industry, the Ministry of Manpower and Transmigration, and the Indonesian Ministry of Research and Technology, with the Indonesian Ministry of Research and Technology acting as the nodal point for implementation. This PPP model is to ensure country-to-country coordination for the proper transfer of SKT during development, deployment, diffusion, and transfer of cluster 2 technologies for the cement sector. The life cycle of the R&D projects is detailed in figure 3.

**Step 2** This team should organize a meeting of the various R&D centres and explain the importance of improving the access to information, knowledge and skills required for the green technologies of the future. In this meeting two groups should be formed.

a. **A technology management group**, which shall track the progress of the global scale of the various identified technologies and also identify the new technologies on the horizon. This group shall also keep the cement plants updated on progress through leaflets/seminars and workshops.
b. **A skill and knowledge management group**, which shall track the development of the skills and knowledge for adopting the technologies into the plants. Their work shall start when the technologies are tried out in the plant on pilot scale. They shall then keep track of the progress on the knowledge and skills and keep the plants updated through leaflets/seminar/workshops and visits to the plants where pilot/commercial and final industrial scale trials are being undertaken. With this information the plants can start the transfer of knowledge and skills well before the technologies are adopted. This shall ensure that the technology shall give the right return on investment and is not marred by lack of skills and knowledge.

**Figure 3. The life cycle of the R&D projects**




Source: ILO, 2011.

**b) Transparency in the local R&D groups.** It is recommended that the Ministry of Education and Industry, Ministry of Manpower and Transmigration and the Ministry of Research and Technology should start proceedings for the required legislation, guidelines or directions to the local R&D groups to take proactive steps to share their knowledge on these Cluster D technologies with the Indonesian Cement industry.

**c) Continual upgrading of knowledge of trainers in the country.** It is recommended that the Ministry of Manpower and Transmigration and the Ministries of Education and Industry should start proceedings to incorporate in their training systems additional sections through which the knowledge of the trainers in the VTIs, polytechnics and graduate colleges is continually upgraded on the new skills required for these progressive Cluster D technologies under development.

## 6.3 Indirect manpower

Indirect manpower is required in areas of procurement and transportation of the raw materials, such as iron ore, bauxite, clay, fly ash, performance enhancers, coal, diesel, bags, stores and spares, and the marketing and distribution of cement over long distances around the country. The study indicates that the total indirect manpower requirement over the life cycle of cement from its mining and procurement of raw materials till its use at the construction site is expected to reach 1 million by 2020 in Indonesia. The indirect manpower is at present trained either on the job or by private training institutes. To provide an enabling environment for the generation of the

proper trained indirect skilled manpower of truck drivers, riggers and construction workers, it is recommended that the following steps be taken in the country:

**i. Providing opportunities for the private motor vehicle training institutes to flourish and to provide trained drivers for the indirect manpower requirement for handling the increased cement.** The study uncovered that of the 1 million indirect manpower projected to be required for handling the cement produced by 2020, 0.2 million shall be the drivers and their assistants for handling the trucks for transportation of cement and raw materials. These drivers and their assistants are trained at private motor training institutes. The present facilities shall not be adequate to provide the training to this large skilled workforce.

**The study reveals that the development of these private institutes is** a very important skills development strategy in the coming decade. To meet this challenge it is recommended that the following actions be taken.

a. Specific courses to be started in the vocational institutes to train these driver trainers, so that they can become small time entrepreneurs to start new motor training institutes.
b. Specific subsidized microfinance schemes should be started by the banks to support these trained entrepreneurs in their endeavors.
c. The motor vehicle driving licensing system to be enhanced and made stricter to ensure proper safe and efficient driving skills are present in the drivers and their assistants who use the trucks on the road.

**ii. Providing opportunities for the Government and private institutes to provide trained riggers and rigger assistants for the indirect manpower requirement for handling the increased cement in the market.** The study uncovers that of the 1 million indirect manpower for handling the cement produced by 2020, 0.3 million shall be riggers and their assistants for handling the cement at various places during its journey from the plant to the site of use. At present there are no proper courses for the riggers and their assistants for handling cement and other materials. These workers get their training through hands-on experience from their seniors on site. The present system of hands-on experience is very slow in generating trained and skilled hands in the market. It shall not be able to meet the demand expansion with respect to the increase in production and demand of cement. This shall bring in untrained workers to handle the increased production, which would be very unsafe.

**The study revealed that the** development of the rigger and rigger assistant skilled category in the VTIs, both private and Government, is a very important skills development strategy in the coming decade. To meet this challenge it is recommended that the following actions be taken:

a. Specific courses for riggers and rigger assistants should be started in the vocational institutes to train rigger trainers so that they can operate as small time entrepreneurs to start private rigger training institutes.
b. Specific subsidized microfinance schemes should be started by the banks to support these trained rigger entrepreneurs in their endeavor to start rigger training institutes.

**iii. Providing opportunities for the Government and private training institutes to provide trained multi-tasking construction workers for the indirect manpower requirement for handling the increased cement.** Of the estimated 1 million indirect workers required by 2020, 0.5 million shall be the multi-tasking construction workers. The training for multi-tasking construction workers, capable of doing the work of bar bending, shuttering and cement mixing requires to be inducted in the Government and private sponsored VTIs. The present facilities shall not be adequate to provide the required multi-tasking construction workers by the coming decade, as a proper multi-tasking construction worker training curriculum is not in place in the VTIs.

**The development** of the curriculum for the multi-tasking construction workers both in the private and Government VTIs shall be a very important skills development strategy in the coming decade. To meet this challenge it is recommended that the following actions be taken:

a. Specific course curriculum should be developed and started in the vocational institutes to train these multi-tasking construction workers.
b. Special training should be organized for the trainers of these courses, so that proper training can be provided to the jobseekers being trained under these courses.

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# Annexes

## Annex I. Case study PT Holcim Indonesia Tbk

Holcim is represented in 70 countries, including nine nations across South Asia and ASEAN. It has a well thought out formal system to abate the risks of Climate Change through the mitigation of $CO_2$ and other GHG emissions. As a member of the Cement Sustainability Initiative (CSI), Holcim is focused on their four initiatives towards the abatement of GHG emissions:

- efficient use of natural resources;
- meeting stakeholder expectations through greater transparency and open engagement;
- creating new market opportunities through process, product and service innovation; and
- managing cost and environment impact.

Holcim worldwide has already achieved its target of a 20 per cent reduction of $CO_2$ emissions by 2010 and has set a new target of a 25 per cent reduction by 2015 above the baseline of 1990.

Holcim Indonesia has pursued sustainable development and GHG emission reductions through the following programmes:

- it has taken steps towards energy management, use of mineral components in cement and preventive maintenance to operate efficiently;
- long term reforestation and rehabilitation of old mines;
- biodiversity initiatives to protect the ecosystem of the Cilacap plant surroundings in Central Java;
- to increase the use of biomass in the Cilacap Plant (under a clean development mechanism (CDM) project of UNFCCC); and
- industrial waste management services in Naragong plant in West Java.

Holcim Indonesia has also implemented triple bottom line accounting techniques to meet the aspirations of all the stakeholders:

- in economic terms with their business stakeholders;
- in social terms with their community and its development; and
- in environmental terms regarding:
    - how they manage their natural resources through reuse, recycle and renewal;
    - how the impact of the operations on environment and climate can be abated; and
    - how the company can give back to society through energy management and waste management services.

The major achievements for skill development and reducing the GHG emissions of Holcim Indonesia in 2009 have been:

- training of 6,187 masons in vocational and technical skills;
- eradicated 16,500 kg of ozone depleting chlorofluorocarbons (CFCs) which is equivalent to 165 million kg of $CO_2$;
- treated and eradicated 220,125 tonnes of waste (industrial and biomass);
- over 420,000 trees planted in last two years;
- zero domestic plant waste at all Holcim Plants: all organic waste is composted;
- microfinance provided to 3,365 customers through the Holcim microfinance fund; and
- 1,312 safety inspections of the trucks leading to a 50 per cent improvement in the transporter safety performance.

**Eco-friendly homes**

Holcim Indonesia has collaborated with the Technical Academy of Manufacturing Engineering in Solo, Central Java to develop the Eco-home. These homes use only eco-friendly local building materials through sub collaboration with 15 sustainable building material suppliers. The Eco-home initiative:

- reduces cooling load by 53 per cent;
- provides a 42 per cent self sufficient water supply; and
- cuts electricity consumption by 50 per cent.

**Sustainable products**

The initiatives taken by Holcim Indonesia to reduce GHG emissions are threefold: to improve energy management and improve productivity, increase the use of alternative fuels and raw materials and to reduce the clinker factor by increasing market and production share of blended cement.

It has undertaken many initiatives to improve technology in the plant and the skills and knowledge of the workforce to raise the productivity levels of the plant and improve operational and energy efficiency and have achieved a 14 per cent reduction in power consumption over the years. An evaluation of the plant by an expert team to unravel the energy and operational improvement potential has been taken. These initiatives shall further help the plant to reduce $CO_2$ emissions at the plant. To reduce the impact of $CO_2$ emissions, efforts have been made to convert the Holcim Beton mixer trucks to compressed natural gas (CNG) and the company is keeping track of the pollution of the cars being used by their employees to see that they maintain proper emission standards.

Holcim Indonesia has been using alternative fuels since 1994, when they first installed the liquid handling plant. In 2009, they achieved a fuel substitution rate of 8.5 per cent, which is expected to increase progressively. Holcim Indonesia uses the following materials as alternative resources through their waste management services branch of Geocycle:

- freon CFCs (refrigerants);
- refinery catalysts;

- plastics;
- expired products;
- off-spec consumer products;
- packaging materials;
- rubber waste;
- textile waste;
- refinery waste;
- paint waste;
- oil sludge;
- oil filters;
- waste water treatment filter cakes;
- contaminated materials;
- foundry sand; and
- fly-ash/bottom ash.

In most of the cases these wastes have to be pre-processed before they can be co-processed in the cement kiln. The pre-processing is a specialized set up where compatibility tests are conducted and various wastes are mixed to produce a homogeneous product. The product has to be consistent, within a bandwidth, both in its physical and chemical properties, so that it does not affect the productivity of the clinkering process. This pre-processing activity provides another avenue of specialized green job creation, where again the skills upgrading programme shall play a vital role in its success. This is because the skills availability is rare in the country and what is available is not exactly suited to the requirements. The skills of handling and disposal are with the waste management companies (WMC), but for waste pre-processing, the requirement is beyond these skills. Here the waste has to be thoroughly understood, and its compatibility with other wastes has also to be identified before they are mixed to provide the homogeneous pre-processed product.

Under the scheme for AFR Certification (ACert), the three departments of occupational health and safety, Geocycle and environmental management have conducted trainings for the full value chain of waste. With the help of the Indonesian Association of Hazardous Waste Transporters, Geocycle has been conducting safety trainings since 2008, with two-day classroom training and a day of practical modules.

This initiative also makes the hazardous waste drivers aware of the Indonesian law, which makes it mandatory for the drivers to be able to handle waste, contingencies and spills. Practically it has been seen that few of the drivers have these skills. This again shows that the laws are well thought out, but their implementation requires initiatives to provide the skills first to the trainers and then to the operators. The initiative taken by Holcim Geocycle Indonesia could be replicated by the Government and rolled out across the country to ensure compliance.

Holcim Indonesia has brought out blended and composite cement products including the well-known Serba Guna brand. These low carbon products reduce the quantity of clinker required per tonne of cement by using clinker substitutes like pozzolana, fly ash, and mineral components

with cement-like properties. This reduced clinker requirement means lower specific $CO_2$ emissions and conserves fossil fuels.

**Training initiatives**

1. Holcim Indonesia has its own academy which was established in 2007. The academy has three core objectives:
    a. learning and development;
    b. organizational performance improvement; and
    c. talent management.

Over the years, the learning and development faculty offered courses covering technical, business, and leadership modules. The in-house consultants guided employees through the leadership development programme which strengthens the talent pool for Holcim's future managers.

2. At the academy they provide a graduate development programme, where they train the incoming graduate engineers from the graduate schools for one year. A two-month classroom training in cement is followed by on-the-job exposure in all the different departments of the cement plant, before giving them individual independent charge in the department of their choice.
3. The academy also provides short-term management training to small groups of Indonesian staff at the company. They delivered 64,954 hours of training in 2009 at the Holcim academy.
4. At the academy they also provide a vocational development programme. Holcim enterprise-based vocational education (EVE) is a programme which selects highly motivated local high school graduates and guides them through a tough, hands-on three-year education programme to become certified, diploma-holding technicians:
    a. It is an initiative by the company to improve the caliber and credibility of the young technicians in Indonesia.
    b. It is the best case study where the Government sponsored training and certification set up is combined with an industry initiative, which dovetails the additional requirements they identify to the programme to develop a job seeker who is able to provide the required support in the plant as required.
    c. This initiative can be rolled out across the industry and also the collaboration between the training institutes and the industry would provide continual improvement in the training quality and reduce the gap between what is required and what is provided. The industry shall provide the gap faculty and investment of skills from their plant and also specialised trainers from the suppliers.
    d. 148 EVE students have been enrolled to date.
    e. All the 60 students who have graduated have been recruited as permanent employees.

Holcim Indonesia holds local vocational training programmes in the nearby rural areas. In 2009, 316 participants were there for these programmes.

Holcim Indonesia has also trained masons in the construction field so that they can understand the new ways of using the new construction materials. 10,597 Masons have been trained in the last two years.

**Education**

Education is key to the development of the community in general and the skilled technicians in particular. With the influx of high technology and automation, the education level needed to run and manage the equipment and plants needs to improve and to get the right returns on investments. Realizing the importance of this, Holcim Indonesia is awarding scholarships to the high scoring but under privileged children of the local communities. Two hundred and twenty one scholarships have been awarded in Naragong, 250 in Cilacap and 12 in Tuban. The students ranged from elementary to high school level.

It is important that the authorities also take note of this very important factor and the Ministry of Education takes action to ensure that the base level of education rises as the new equipment for capacity upgradation, increased energy productivity, reduction of GHG, requires higher education levels to understand and manage.

**Community vocational training**

Holcim Indonesia is providing life-skill trainings to improve the vocational opportunities in the community around the plants. These trainings provide skills development on such sectors as:

- car repairs;
- welding;
- embroidery; and
- English.

In 2009, 316 local villagers from Cilacap and Tuban benefited from these programmes.

These attempts to provide specialized skills, which can provide long-term employment outside and an entrepreneurial attitude can encourage people to start their own small scale enterprises for sustained livelihood.

**Human resource management**

Holcim Indonesia offers an open communication between the employees and the supervisors, through which the human resources (HR) department can gain a greater understanding of the employee's needs, which guides the strategic direction of the HR initiative.

E-dialogue, an electronic tool for recording the results of the face-to-face dialogues between the employees and supervisors was launched in 2009. This initiative provides an opportunity for performance reviews, skills inventory, skill development planning, and the planning of training programmes. Other programmes such as focus group discussions are also conducted to align employees on welfare, working conditions and productivity standards of the company.

**Employment**

As of 31 December 2009 Holcim Indonesia employed a total workforce of 2,137, a decrease of 4 per cent from 2008. Holcim is an equal opportunity employer and values both the genders equally. The salary structure is the same for both genders. Females constituted 8 per cent of the workforce in 2008 and grew to 9 per cent in 2009. Eighty per cent of all the employees are Indonesians.

Holcim Indonesia's entry-level salary is 206 per cent higher than the minimum wages prescribed by the Indonesian authorities. There are many more additional benefits such as medical coverage, skills development, educational sponsorship, retirement benefits, etc., which are provided to the employees.

Holcim enjoys close relations with their three employee unions: Serikat Pekerja Nusantara, which covers Cilacap; Serikat Pekerja Holcim Indonesia for Naragong; and Serikat Pekerja Mandiri, which represents Holcim Beton. Eighty six per cent of the workforce is unionized, 63 per cent of who are at middle management.

Improved productivity and the transformation of the company into a solutions and added value provider is creating new opportunities, requiring new skills. The voluntary retirement programme is in vogue for employees who would like to leave the company for any reason, and the company can spare them. Thirty-one employees took voluntary retirement in 2009. The turnover in the last two years has been low at less than 15 per cent.

**Green jobs at Holcim Indonesia**

Various green areas and green departments have been identified at the company where green jobs exist and those having potential of green jobs in the future. At Holcim Indonesia these have been identified as:

- training;
- human relations:
  - skills assessment programmes; and
  - education scholarships;
- productivity improvements:
  - assessment and installation of new technologies; and
  - monitoring and maintaining the efficiency of the plant at its optimum levels;
- alternative fuels and raw materials:
  - overall management;

    - invoicing and billing;
    - scheduling and transportation;
    - mapping and arranging of AFRs from:
        - industries; and
        - community;
    - complying with permits and regulation;
    - waste preparation and co processing;
    - customer feedback;
    - communication with community;
    - marketing and sales;
    - special technical operations;
    - operations of AFR laboratory;
    - customer service;
    - coordination with cement operations and maintenance; and
    - liaising with stake holders, authorities, industry and the community;
- blended cement manufacture:
    - mapping and arranging for clinker substitutes like fly ash, pozzolona volcanic ash, and blast furnace slag and burnt lime;
    - keep abreast of the global advance in the technology of blended cement and bring the same to be used in the plant;
    - specialized R&D to improve absorption of clinker substitutes while maintaining strengths and other properties like setting time and water requirements; and
    - operations and control of the grinding, storage and packing of multi products;
- blended cement marketing:
    - identification of potential opinion leaders in the market like architects, contractors, civil engineers, etc.;
    - organization of seminars and programmes to change the opinion of these leaders towards blended cement use; and
    - organization of special training and appreciation programmes for the masons to know the use of blended cements versus normal Portland cement.

Areas which require the skills to be upgraded and those requiring investment for new skills, knowledge and technology have also been identified. The details of the jobs and their skill requirements and the SKT transfers needed for the training department and the human relations are given in table A1 and A2.

It must be mentioned that these jobs are specified under each area, but in many cases, the jobs would have been combined in the real life situation existing in Holcim Indonesia. As the job load increases, the same shifts from a combined to a single job.

## Other technologies

It must be mentioned that for the other green technologies under development like the CCS, OFT and algal, an effort needs to be made at the plant level to keep themselves updated on their development and commercialization, and to develop the skills needed to keep abreast of the same. The skills development programme and the SKT transfer initiative should be taken at the correct time to take the first mover advantage. At present there is no section looking after this area.

## Conclusions

While Holcim Indonesia has a lot of further potential to improve energy productivity, use of alternative fuels and to improve the clinker factor and market share of blended cements, there are many very good initiatives towards skills development and improved education levels to meet the new automated plant's requirements of skills and knowledge. These would be very good areas where a collaborative initiative can be taken by the authorities to spread the benefits all over the country to provide an effective workforce suited to the sectors requirements. The authorities should study the Holcim model of the graduate and the technician support training of both technology and occupation-based trainings. They should roll out the model to all the cement plants, giving the required collaboration for educational support and certification. Further efforts are to be made at the federal Government and the plant level to keep abreast of the new cluster two technologies to adopt them at the right time with the right skilled workforce and get the first mover advantage.

**Table A1. Identification of green areas, departments and jobs with skills status in Holcim Indonesia**

| | | Skills | | | |
|---|---|---|---|---|---|
| **Areas** | **Jobs** | **Green jobs** | **Require greening** | **Require SKT transfer** | **Remarks** |
| Training | | | | | |
| Academy | Principal, faculty for green skills. | √ | X. | √ | The Academy provides the basic avenue through which the green skills are identified, acquired and transferred. They have these skills and the system to acquire the same. |
| | Accounting staff | X | √ | X | |
| | Support staff. | X | √ | X | |
| Mason training on use of blended cements | Blended cement use Trainers | √ | X | √ | The SKT initiative needs development. |
| | Organizers of programmes | X | √ | X | |
| EVE programme | Faculty for green skills | √ | X | √ | The SKT initiative needs development |
| | Support staff | X | √ | X | |
| Graduate programme | Faculty for green skills | √ | X | √ | The SKT initiative needs development |
| | Support staff | X | √ | X | |
| Short term professional training | Faculty for green skills | √ | X | √ | The SKT initiative needs development |
| | Support staff | X | √ | X | |

Source: Holcim Indonesia, 2010.

**Table A2. Identification of green areas, departments and jobs with skills status in Holcim Indonesia**

| | | Skills | | | |
|---|---|---|---|---|---|
| **Areas** | **Jobs** | **Green jobs** | **Require greening** | **Require SKT transfer** | **Remarks** |
| Human Relations | | | | | |
| Skills assessment | E-dialogue operators | X | √ | X | |
| Education scholarships | Education award organizers | √ | X | X | Higher education shall provide better jobseekers more suited to the modern plants. |
| Source: Holcim Indonesia, 2010. | | | | | |

**Table A3. Identification of green areas, departments and jobs with skills status in Holcim Indonesia**

| | | Skills | | | |
|---|---|---|---|---|---|
| **Areas** | **Jobs** | **Green jobs** | **Require greening** | **Require SKT transfer** | **Remarks** |
| Productivity improvement in Plant | | | | | |
| Assessment and installation of new technology | Process engineer | X | √ | √ | SKT transfer plays an important role in installing the right technology and getting the right returns |
| | Erection staff | X | √ | X | |
| | O&M staff | X | √ | X | |
| | Support staff | X | √ | X | |
| Monitoring and maintaining the efficiency of the plant | Process engineer | X | √ | X | Up gradation of the knowledge of monitoring and maintaining is desired. |
| | Monitoring staff | X | √ | X | |
| Source: Holcim Indonesia, 2010. | | | | | |

**Table A4. Identification of green areas, departments and jobs with skills status in Holcim Indonesia**

| | | Skills | | | |
|---|---|---|---|---|---|
| **Areas** | **Jobs** | **Green jobs** | **Require greening** | **Require SKT transfer** | **Remarks** |
| Alternative Fuel and Raw materials | | | | | |
| Overall management | Manager AFR | √ | X | √ | The SKT initiative needs development |
| Invoicing and billing | Support staff in accounts | X | √ | X | - |
| Scheduling and transportation | Scheduling engineer | √ | X | √ | The SKT initiative needs development |
| | Support staff | X | √ | X | - |
| Mapping and arranging of AFR from | | | | | |
| Industries | Mapping engineers | √ | X | √ | The SKT initiative needs development |
| | Contracts experts | √ | X | √ | - |
| | Support staff | X | √ | X | - |
| Community | Mapping engineers | √ | X | √ | The SKT initiative needs development |
| | Contracts experts | √ | X | √ | - |
| | Support staff | X | √ | X | - |
| Rural areas | Mapping engineers | √ | X | √ | The SKT initiative needs development |
| | Contracts experts | √ | X | √ | - |
| | Support staff | X | √ | X | - |
| Complying with permits and regulation | Permitting expert | √ | X | √ | The SKT initiative needs development |
| | Liaoning expert | √ | X | √ | - |
| | Support staff | X | √ | X | - |
| Waste preparation and co processing | Waste engineers, pre-processing experts, laboratory experts | √ | X | √ | The SKT initiative needs development |

| | | | | | |
|---|---|---|---|---|---|
| | Support staff | X | √ | X | - |
| Customer feedback | Communication expert | √ | X | √ | - |
| Communication with community | Communication expert | √ | X | √ | - |
| Marketing and sales | Marketing expert | √ | X | √ | The SKT initiative needs development |
| | Support staff | X | √ | X | - |
| Special technical operations | AFR Technical expert | √ | X | √ | The SKT initiative needs development |
| Operations of AFR laboratory | AFR Laboratory expert | √ | X | √ | The SKT initiative needs development |
| Coordination with cement operations and maintenance | AFR Technical expert | √ | X | √ | The SKT initiative needs development |
| Liaise with authorities and industry | Liaise expert | √ | X | √ | The SKT initiative needs development |

Source: Holcim Indonesia, 2010.

**Table A5. Identification of green areas, departments and jobs with skills status in Holcim Indonesia**

| | | Skills | | | |
|---|---|---|---|---|---|
| **Areas** | **Jobs** | **Green jobs** | **Require greening** | **Require SKT transfer** | **Remarks** |
| Manufacture of Blended cements | | | | | |
| Mapping and arranging for clinker substitutes like fly ash, pozzolona volcanic ash, granulated blast furnace slag and burnt lime. | Geological expert | X | √ | √ | The SKT initiative needs development |
| | Laboratory testing officer | X | √ | X | - |
| | Procurement officer | X | √ | X | - |
| | Contracts expert | X | √ | X | - |
| Keep abreast of the global advance in the technology of blended cement and bring the same to be used in the plant. | Process engineer | √ | X | √ | The SKT initiative needs development |
| | International expert in blended cement | √ | X | √ | The SKT initiative needs development |
| | Support staff | X | √ | X | - |
| Specialized R&D to improve absorption of clinker substitutes while maintaining strengths and other properties like setting time and water requirements | R&D officer | √ | X | √ | The SKT initiative needs development |
| | Support staff | X | √ | X | - |
| Operations and control of the grinding, storage and packing of multi products | O&M staff | X | √ | X | The SKT initiative needs development |

Source: Holcim Indonesia, 2010.

**Table A6. Identification of green areas, departments and jobs with skills status in Holcim Indonesia**

| | | Skills | | | |
|---|---|---|---|---|---|
| **Areas** | **Jobs** | **Green jobs** | **Require greening** | **Require SKT transfer** | **Remarks** |
| Marketing of blended cements | | | | | |
| Identifying the potential opinion leaders in the market like architects, contractors, civil engineers, etc. | Techno marketing experts | √ | X | √ | The SKT initiative needs development |
| Organization of seminars and programmes to change the opinion of these leaders towards blended cement use. | Blended cement faculty for discussions and seminars | √ | X | √ | The SKT initiative needs development |
| | Event managers for seminars | X | √ | X | - |
| Organization of special training and appreciation programmes for the masons to know the use of blended cements vis. a vis. normal Portland cement | Blended cement faculty for discussions and seminars with masons | √ | X | √ | The SKT initiative needs development |
| | Event managers for seminars | X | √ | X | - |

Source: Holcim Indonesia, 2010.

**Table A7. Details of the manpower in Holcim Indonesia**

| | 2008 | 2009 |
|---|---|---|
| By age | | |
| <30 years | 254 | 203 |
| 30 – 50 years | 1 783 | 1 778 |
| >50 years | 185 | 156 |
| Total | 2 222 | 2 137 |
| By employee group | | |
| Permanent | 2,085 | 2 102 |
| Temporary | 120 | 19 |
| Expatriate | 17 | 16 |
| Total | 2 222 | 2 137 |
| By location | | |
| Ciacap | 586 | 614 |
| Narogong | 935 | 928 |
| Others | 701 | 595 |
| Total | 2 222 | 2 137 |
| By gender | | |
| Male | 2 036 | 1 953 |
| Female | 186 | 184 |
| Total | 2 222 | 2 137 |
| By management Level | | |
| Board and senior management | 56 | 56 |
| Middle management | 62 | 64 |
| Superintendent level | 249 | 267 |
| Officers, supervisors and full-time Employees | 1 855 | 1 750 |
| Total | 2 222 | 2 137 |

Source: Holcim Indonesia, 2010.

**Table. A8. Details of the targets of Holcim Indonesia and their status in 2008 and 2009**

| Target | 2008 status | 2009 Status |
|---|---|---|
| To develop energy efficient, sustainable products and services. | Clinker factor reduced to 81.2 per cent by increasing use of mineral components in cement (MIC) including pozzolana (volcanic rock). | • Clinker factor increased further to 81.7 per cent. MIC programme was accompanied by a task force to boost product quality and application performance.<br>• Pilot initiated converting diesel trucks to CNG |
| To promote sustainable construction solutions. | Launched PPP Megacity think tank to foster urban planning. | Developed and launched the first low impact energy saving commercial Eco Home with local partners. |
| To support the SME constriction sector. | Trained 4,411 masons. | • Trained 6,186 masons.<br>• Advanced materials masons courses launched |
| All operation to be accredited with ISO 9001 and 14000 | Done for all plants and grinding units | |
| to reduce $Co_2$ emissions globally by 20 per cent with 1990 as reference. | • Specific net $CO_2$ emissions per tonne of clinker and cement reduced by 15.5 per cent since 2002.<br>• Secured CDM approval from UNFCCC. | • Maintained historic low $CO_2$ emissions<br>• CDM project verified in Sept 2009. |
| To exceed industry standards in responsible environment management. | Under Government PROPER annual awards was awarded the GREEN status. | Achieved GREEN status and green industry award. |
| To increase the use of alternative fuels and raw materials to conserve natural resources. | • Co processed 96,982 tonnes of industrial waste and 112,429 tonnes of biomass.<br>• Co-processed 6,990 kg. of CFC ozone harming gases. | • Co processed 80,506 tonnes of industrial waste and 139,619 tonnes of biomass.<br>• Total CFC ozone harming gases co-processed till date 16,500 kg. |
| To initiate biodiversity plans at all Holcim production sites in accordance with ICUN guidelines. | • ICUN expert reviewed all sites.<br>• Planted 380,000 trees in Cilacap, Narogong and Tuban. | • Plans to conduct a study on biodiversity at Cilacap, Central Java.<br>• Planted additional 40,664 trees in Cilacap, Narogong and Tuban. |

Source: Holcim Indonesia, 2010**.**

## Annex II. Calculations of the indirect man-hours per tonne for cement

Assuming the cement product is to be sent to the market and it goes directly to the dealer and gets sold to the user. The track shall be as follows with the estimated man-days required at each stage.

1. Loading of 20 tonnes on the truck 4 persons for 4 hrs.
    a. Rigger supervisor 1 man-hours 4 hrs
    b. Rigger helper 3 man-days 12 hrs 16 man-hours

    *(Takes care of the loading at various places before it reached the dealer for final sale)*
2. 4 days travel till it reached the dealer 2 persons for 4 days.
    a. Truck driver 1 man-days 32 hrs
    b. Truck helper 1 man-days 32 hrs 64 man-hours

    *(Takes care of the intermediate travel before it reaches the dealer for final sale)*
3. Unloading at dealer and other intermediate places 4 persons for 4 hrs.
    a. Rigger supervisor 1 man-days 4 hrs
    b. Rigger helper 3 man-days 12 hrs 16 man-hours

    *(Takes care of the unloading at various places before it reaches the dealer for final sale)*
4. Storage and other handling 1 person for six days.
    a. Rigger helper 1 man-days 48 hrs 48 man-hours

    *(Takes care of the storage and handling at various places including that of the dealer for final sale)*
5. Truck driver and cleaner for delivery to site in town for 2 hrs.
    a. Truck driver 1 man-days 2 hrs
    b. Truck helper 1 man-days 2 hrs 4 man-hours
6. Unloading at usage point 6 persons for 2 hrs (manual).
    a. Rigger supervisor 1 man-days 2 hrs
    b. Rigger helper 5 man-days 10 hrs 12 man-hours
7. Usage of cement at 20 tonnes per day.
    a. [11]Construction workers 40 man-days 320 hrs 320 man-hours
8. Total man-hours for 20 tonnes 480 man-hours
9. Man-hours per tonne of cement delivered and used 24 man-hours
10. Similar man-hours are used up from No. 1 to 8 for all the raw materials used for producing cement. The requirement is almost 1 tonne of raw materials and stores per tonne of cement produced other than the captive mined limestone, etc.
    a. Thus for each tonne of raw material and stores and spares handling per tonne of cement produced and used we require (480 - 320)/20=8 8 man-hours
11. Thus for each tonne of cement produced indirect labour required is (9 + 10) i.e. 24 + 8 = 32 man-hours per tonne of cement.

[11] These workers work in a group of around 20 and are multi skilled in bar bender, carpenter, mixer operator, loader, shuttering expertise, fitter and also unskilled work of moving material. These multi skilled workers need special training, which at present is being given to them through on-the-job work.

**Table A9. the distribution of the 32 man-hours per tonne of cement skill-wise**

| No. | Skilled artisan | Man-hours per tonne of cement |
|---|---|---|
| 1. | Truck driver | 3.4 |
| 2. | Truck helper | 3.4 |
| 3. | Rigger supervisor | 1.0 |
| 4. | Rigger helper | 8.2 |
| 5. | Construction workers | 16.0 |
| 6. | Total man-hours/tonne | 32.0 |

Source: Holcim Indonesia, 2010.

# Annex III. New sectors emerging from the greening of the economy in Indonesia

**Table A10. The main new sectors emerging as the result of greening economy in Indonesia – environmental services**

| Sector | Company scale | | Location | | Ownership | | New occupation |
|---|---|---|---|---|---|---|---|
| | Large | SMEs | Rural | Urban | National | Jt Venture/ MNC | |
| Environmental services | | | | | | | |
| Environmental impact assessments | √ | √ | - | √ | √ | - | Environmental officer |
| Recycling | √ | √ | - | √ | √ | √ | Waste collector<br>Recycle officer and engineer for large scale operation |
| ISO 1400 Consultant | √ | √ | - | √ | √ | √ | Environmental officer |
| Waste management | √ | √ | √ | √ | √ | √ | Waste expert |
| Environmental lab | √ | √ | √ | √ | √ | √ | Physicists / Biologist/ Engineer / Chemist |
| Environmental quality monitoring | √ | √ | - | √ | √ | √ | Environmental expert |
| Maintenance | √ | √ | - | √ | √ | - | Environmental officer<br>Instrument engineers<br>Electricians |
| Environmental training and education | √ | √ | - | √ | √ | - | Educator, Psychologist, faculty with environment experience |

Source: SRKLI, 2010.

**Table A11. The main new sectors emerging as the result of greening economy in Indonesia – renewable energy**

| Sector | Company scale | | Location | | Ownership | | New occupation |
|---|---|---|---|---|---|---|---|
| | Large | SMEs | Rural | Urban | National | Jt Venture /MNC | |
| Renewable energy | | | | | | | |
| Geothermal | √ | - | √ | - | √ | - | Geothermal engineer<br>Electrician |
| Big hydro | √ | - | √ | - | √ | - | Hydro engineer<br>Electrician |
| Micro Hydro | - | √ | √ | - | √ | - | Hydro engineer<br>Electrician |
| Solar panel retailer | - | √ | - | √ | √ | - | Electrician |
| Wind power | √ | - | - | √ | √ | √ | Wind power engineer |
| Biogas | √ | √ | √ | √ | √ | - | Biogas engineer<br>Electrician |
| Municipal waste | √ | √ | - | √ | √ | - | Waste engineer |
| Bio fuel | √ | √ | √ | - | √ | - | Bio fuel/waste engineer |
| Carbon consultants | √ | √ | - | √ | √ | √ | Carbon accounting expert<br>Financial analyst for carbon projects |

Source: SRKLI, 2010.

# Annex III. (continued)

**Table A12. The main new sectors emerging as the result of greening economy in Indonesia – Industrial waste utilization**

| Sector | Company scale | | Location | | Ownership | | New occupation |
|---|---|---|---|---|---|---|---|
| | Large | SMEs | Rural | Urban | National | Jt Venture /MNC | |
| Industrial waste utilization | | | | | | | |
| Water and Liquid management | √ | √ | √ | √ | √ | √ | Waste expert |
| Hazardous and Toxic waste management | √ | √ | √ | √ | √ | √ | Waste expert<br>Safety expert<br>Hazardous waste storage expert<br>Processing expert<br>Hazardous and toxic laboratory expert |
| Pre-processing platforms for all types of waste | √ | √ | √ | √ | √ | √ | Waste engineers<br>Compatibility experts<br>AFR laboratory experts and operators<br>Plant O&M staff<br>Waste mapping and procurement experts<br>Contracting experts<br>Waste and pre-processed Transportation experts |
| Noise management | √ | √ | √ | √ | √ | √ | Noise expert and monitoring officer |
| Air pollution management | √ | √ | - | √ | √ | √ | Air quality expert and monitoring officer |

Source: SRKLI, 2010.

## Annex IV. Demographic information about Indonesia and its cement sector for 2009[12]

### Cement industry

Design capacity:

- Clinker : 40 899 264 tonnes/year
- Cement : 47 975 060 tonnes/year

Production:

- Clinker : 35 598 687 tonnes
- Cement : 36 906 432 tonnes

### Supply

Domestic:

- Cement : 37 029 459 tonnes

Export:

- Clinker : 2 797 195 tonnes
- Cement : 1 218 598 tonnes

Import:

- Cement : 1 383 456 tonnes

Domestic cement consumption: 38 412 915 tonnes

Cement consumption per capita: 166 kgs.

### Geography

Area: 1 922 570 $km^2$

Capital city: Jakarta

### Demography

Population: 231million

Population growth rate: 1.2 per cent

[12] Sources: Central Bureau of Statistics & Bank Indonesia in Indonesia Cement Statistics published by the Indonesian Cement Association in 2010.

**Economy**

GDP per capita: US$2,590

Annual GDP growth rate: 4.5 per cent

Annual inflation rate:  2.78 per cent

Local currency: Rupiah

US$ exchange rate (Feb. 2014): 11,450 Indonesian Rupiah (IDR)

# Annex V. Locations of the Indonesian cement plants


Source: Central Bureau of Statistics & Bank Indonesia in Indonesia Cement Statistics published by the Indonesian Cement Association in 2010.

# Annex VI. Indonesian cement companies

**Table A13. Capacities of Indonesian cement plants**

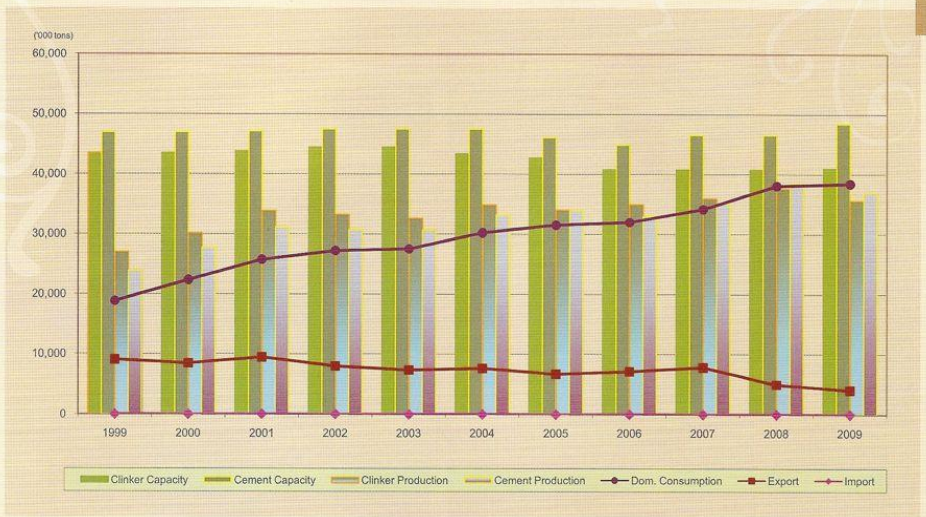
| Company | Operation since | Clinker design capacity ('000) | | Cement design capacity ('000) | | Share holders |
|---|---|---|---|---|---|---|
| | | 2008 | 2009 | 2008 | 2009 | |
| Semen Gresik Group | | | | | | 51.01 per cent government |
| -PT Semen Padang(SP) | 1 910 | 5 000 | 4 952 | 5 240 | 5 410 | 24.90 per cent Blue Valley Holding Pte. Ltd. |
| -PT Semen Gresik, Tbk.(SG) | 1 957 | 6 600 | 7 161 | 8 200 | 8 530 | |
| -PT Semen Tonasa (ST) | 1 968 | 3 320 | 3 528 | 3 480 | 3 900 | 2.09 per cent public |
| PT Holcim Indonesia, Tbk. (HI) | 1 975 | 6 358 | 6 358 | 7 820 | 8 265 | 73 per cent Holcim<br>22.67 per cent public and creditors |
| PT Indocemt Tunggal Prakarsa Tbk. (ITP) | 1 975 | 14 800 | 15 600 | 15 650 | 17 100 | 51 per cent Birchwood Omnia Ltd. England<br>13.03 per cent PT Mekar Perkasa<br>35.97 per cent public |
| PT Semen Baturja (SB) | 1 980 | 1 200 | 1 200 | 1 250 | 1 200 | 100 per cent government |
| PT Semen Andalas Indonesia (SAI)[13] | 1 982 | - | - | - | - | 88.00 per cent Cementia Holding AG<br>12.00 per cent IFC |
| PT Semen Kupang (SK) | 1 984 | 300 | 300 | 570 | 570 | 100 per cent government |
| PT Semen Bosowa Maros (SBM) | 1 999 | 1 710 | 1 800 | 1 800 | 3 000 | 100 per cent national private company |
| Grand total | | 39 288 | 40 899 | 44 010 | 47 975 | |

Sources: Central Bureau of Statistics & Bank Indonesia in Indonesia Cement Statistics published by the Indonesian Cement Association in 2010.

[13] PT SAI Plant is under construction.

# Annex VII. Cement capacity and other details from 1999 until 2009 for Indonesia

## INDONESIA CEMENT OVERVIEW 1999 - 2009

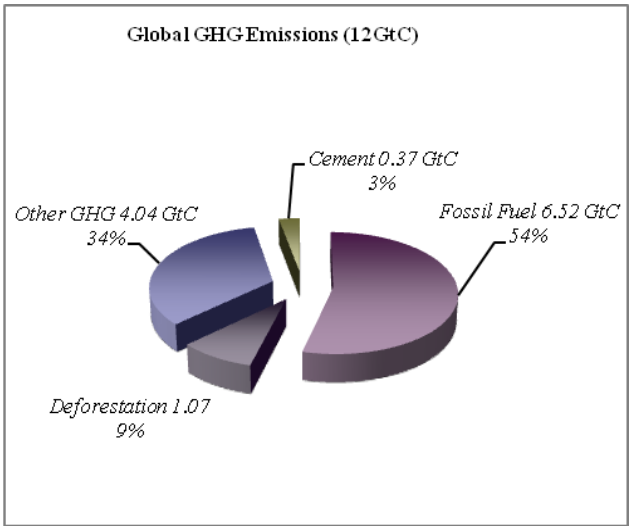



| YEAR | DESIGN CAPACITY ('000 ton) | | PRODUCTION ('000 ton) | | | | SALES ('000 ton) | | | | IMPORT CEMENT ('000 ton) | DOMESTIC CONSUMPTION ('000 ton) | PER CAPITA CONSUMPTION (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Clinker | Cement | Clinker | Utility (%) | Cement | Utility (%) | Domestic | Export | | Total | | | |
| | | | | | | | | Clinker | Cement | | | | |
| 1999 | 43,470 | 46,970 | 27,025 | 62 | 23,925 | 51 | 18,817 | 3,940 | 5,108 | 27,865 | - | 18,817 | 94 |
| 2000 | 43,470 | 46,970 | 30,119 | 69 | 27,789 | 59 | 22,307 | 3,552 | 4,903 | 30,762 | 24 | 22,331 | 110 |
| 2001 | 43,780 | 47,140 | 33,880 | 77 | 31,099 | 66 | 25,700 | 3,707 | 5,750 | 35,157 | 44 | 25,744 | 125 |
| 2002 | 44,425 | 47,490 | 33,248 | 75 | 30,720 | 65 | 27,173 | 4,184 | 3,791 | 35,148 | 60 | 27,233 | 130 |
| 2003 | 44,425 | 47,490 | 32,629 | 73 | 30,647 | 65 | 27,528 | 4,270 | 3,073 | 34,872 | 11 | 27,539 | 130 |
| 2004 | 43,340 | 47,490 | 34,886 | 80 | 33,230 | 70 | 30,192 | 4,673 | 2,946 | 37,810 | 17 | 30,208 | 140 |
| 2005 | 42,690 | 46,090 | 34,004 | 80 | 33,917 | 74 | 30,432 | 3,407 | 3,289 | 37,128 | 1,055 | 31,487 | 144 |
| 2006 | 40,730 | 44,890 | 34,970 | 86 | 33,032 | 74 | 30,695 | 5,023 | 2,245 | 37,964 | 1,280 | 31,975 | 145 |
| 2007 | 40,730 | 44,890 | 35,914 | 88 | 35,033 | 78 | 32,763 | 4,8 3 | 2,929 | 40,565 | 1,410 | 34,172 | 152 |
| 2008 | 40,730 | 44,890 | 37,630 | 92 | 38,533 | 86 | 36,539 | 3,301 | 1,641 | 41,481 | 1,532 | 38,072 | 152 |
| 2009 | 40,730 | 44,890 | 35,599 | 87 | 36,906 | 82 | 37,029 | 2,797 | 1,219 | 41,045 | 1,383 | 38,413 | 166 |

Source: Central Bureau of Statistics & Bank Indonesia in Indonesia Cement Statistics published by the Indonesian Cement Association in 2010.

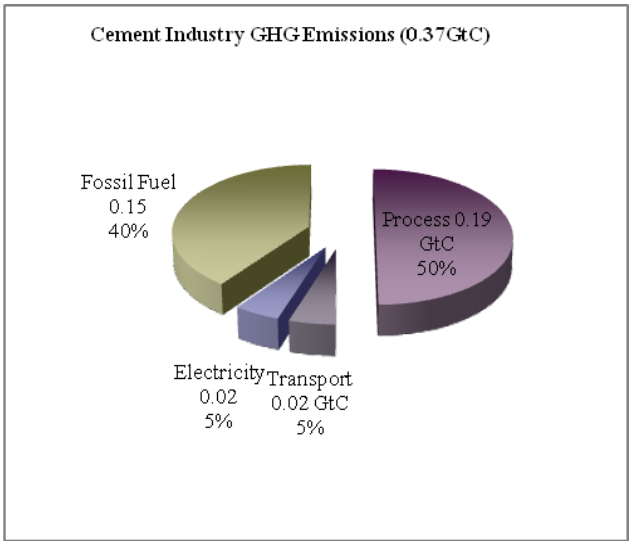
# Annex VIII. Global and cement $CO_2$ distribution amongst its components

**Figure A1. Global GHG emissions**




Source: World Business Council for Sustainable Development (WBCSD).

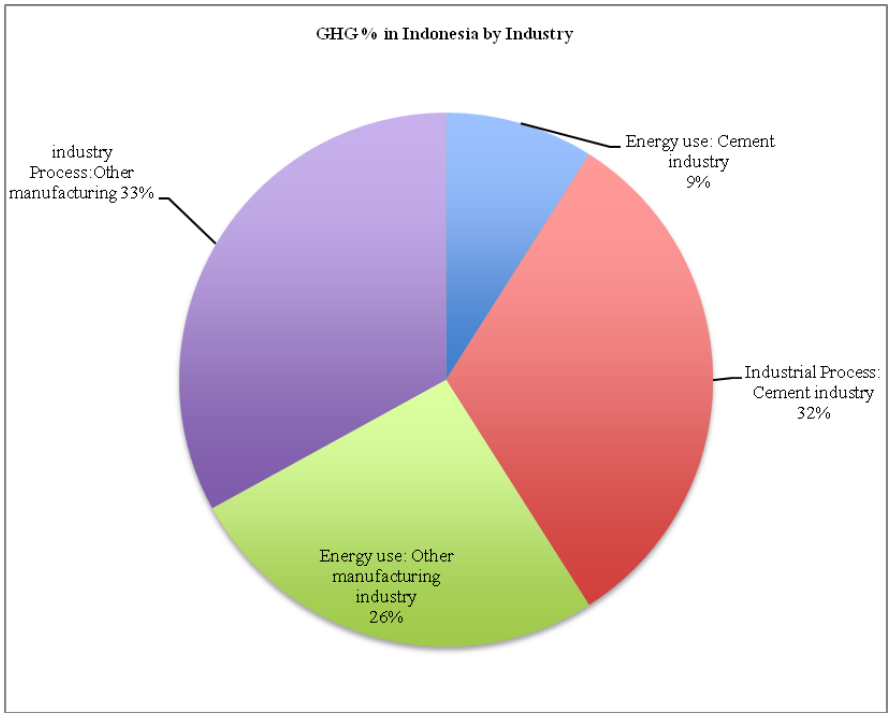
**Figure A2. Cement industry GHG emissions**




Source: WBCSD.

# Annex IX. Contribution of GHGs from industrial sectors in 2000

**Figure A3. Percentages of GHGs emitted by industrial sectors in Indonesia**



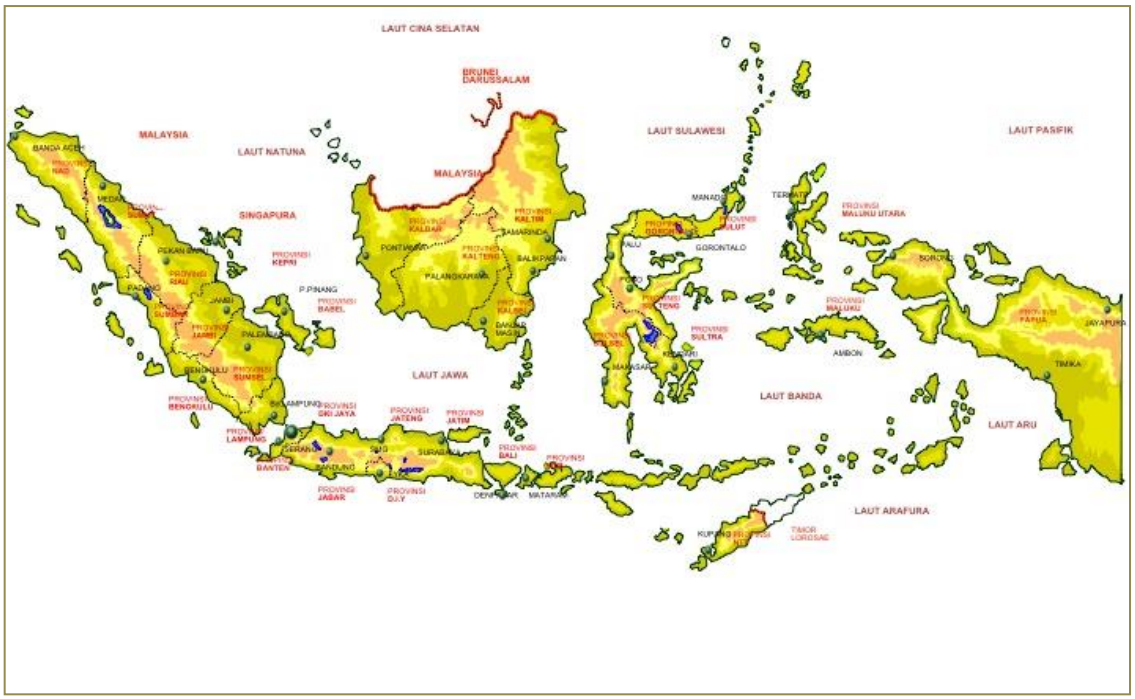

Source: Indonesian Climate Change Road Map, 2009.

# Annex X. Emission factors for GHG baseline of 2008 based on default values of IPCC 2006

| **Source of emissions** | **Emission intensity** |
|---|---|
| Clinker production | |
| Emissions due to calcinations | 0.525t $CO_2$/t clinker |
| Emissions from fossil fuel combustion in kiln | 0.298t $CO_2$/t clinker |
| Emissions from grid supplied electricity | 0.017t $CO_2$/t clinker |
| Emissions from self-generated electricity | 0.046t $CO_2$/t clinker |
| Total: Clinker production | 0.886t $CO_2$/t clinker |
| Total: Clinker production | 0.869t $CO_2$/t clinker |
| (Excluding grid supplied electricity) | |
| | |
| Material preparation/ blended cement grinding | |
| Emissions from grid supplied electricity | 0.11t $CO_2$/t clinker |
| Emissions from self-generated electricity | 0.024t $CO_2$/t clinker |
| Total: Cement grinding/material preparation | 0.035t $CO_2$/t clinker |
| | |
| Emission intensity of cement production | 0.833t $CO_2$/t clinker |
| (Baseline for 2008 business as usual) | |

Source: Indonesian Climate Change Road Map, 2009.

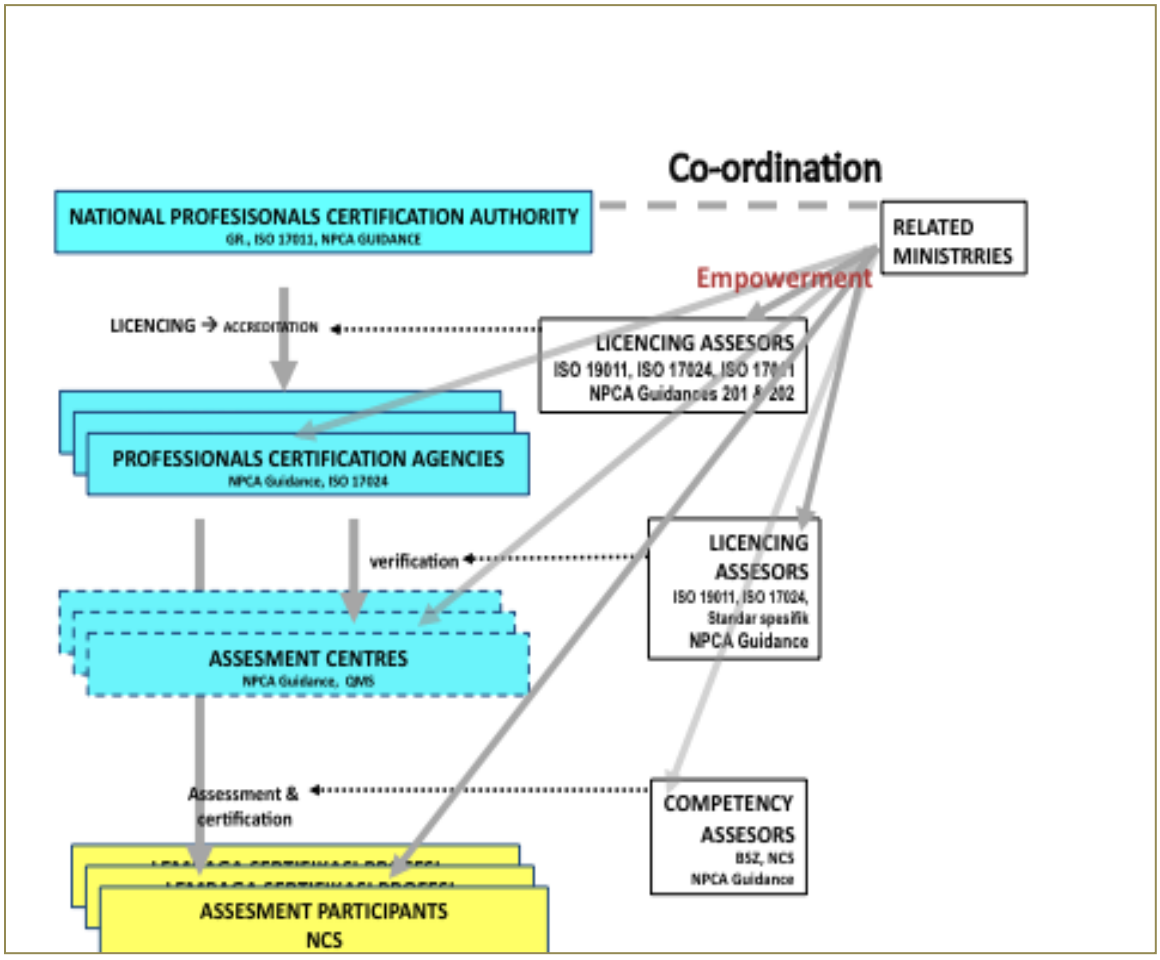
# Annex XI. The area, population and other data of Indonesia




Source: Ministry of Manpower and Transmigration of Indonesia, 2010.

# Annex XII. Traceable competency certification system

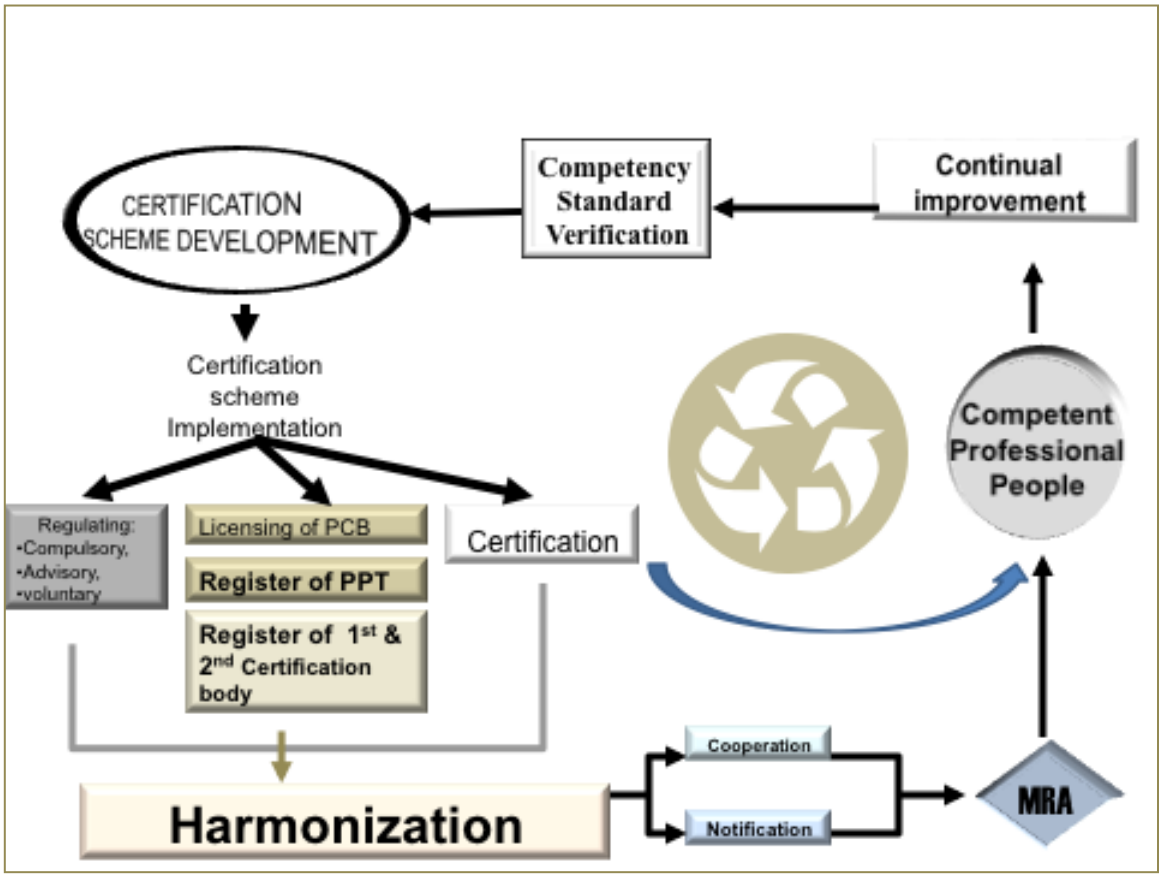
**Figure A4. The traceable competency certification system**




Source: Ministry of Manpower and Transmigration, 2010.

# Annex XIII. Indonesia competency certification system

**Figure A5. Indonesian competency certification system**




Source: Ministry of Manpower and Transmigration, 2010.

# Annex XIV. Details of energy demand and $CO_2$ reductions in Indonesia and the cement sector

**Table A14. Projection of energy demand in the cement and non-metal sector**

| Scenario | Type | Unit | 2005 | 2010 | 2015 | 2020 | 2025 |
|---|---|---|---|---|---|---|---|
| Business as usual (BAU) | | | | | | | |
| | Oil product | Thousand kiloliters | 727.98 | 940.90 | 1278.83 | 1486.40 | 1773.05 |
| | Coal | Million tonnes | 11.21 | 14.74 | 19.65 | 31.38 | 34.26 |
| | Natural gas | Million cubic feet (MMCF) | 16 562.00 | 28 950.00 | 59 757.08 | 111 983.37 | 223 252.15 |
| | Oil product | Thousand kiloliters | 727.98 | 675.00 | 625.90 | 580.30 | 538.10 |
| | Coal | Million tonnes | 11.21 | 14.40 | 18.40 | 23.60 | 30.30 |
| | Natural gas | Million cubic feet (MMCF) | 16 562.41 | 26 856.30 | 52 133.40 | 101 542.30 | 184 206.70 |

Source: Technology Transfer Working group & National Council on Climate Change of Indonesia, 2010.

**Table A15. $CO_2$ emissions in cement sector in Indonesia**

| | Million tonnes/annum $CO_2$ | | |
|---|---|---|---|
| **Year** | **BAU scenario** | **Efficient scenario** | **Per cent reduction** |
| 2005 | 0.017 | 0.017 | - |
| 2010 | 0.022 | 0.021 | 6.66 |
| 2015 | 0.030 | 0.026 | 12.42 |
| 2020 | 0.045 | 0.039 | 12.65 |
| 2025 | 0.060 | 0.050 | 17.41 |

Source: Technology Transfer Working group & National Council on Climate Change of Indonesia, 2010.

## Annex XV. Discussions with the following experts and officers form the basis of the report

### ILO, Jakarta

- Mr Peter van Rooij, ILO Country Director Indonesia
- Mr F. Leohansen Simatupang, National Programme Officer for Jobs and Education Counseling
- Mr Patrick Daru, Chief Technical Adviser, Education and Skills Training (EAST)
- Mr Srinivas Reddy, Skills Development Specialist, Education and Skills Training (EAST)
- Mr Gorm Skjaerlund, Adviser – Vocational Training

### The Ministry of Manpower and Transmigration

- Mr Indah Anggoro Putri, Dy. Director for International Cooperation and Legal Affairs
- Dr. Edy Dawud, Head of B2PLKLN CEVEST
- Mr Muchtar Azizs, Skills Expert, Indonesia Skills

### Visit to CEVEST (Centre for Vocational Training and Skills Upgrading)

- Dr. Edy Dawud, Head of B2PLKLN CEVEST
- Bergianta Sinulingga, TNA Expert

### Ministry of Industry, (Directorate of Energy Efficiency)

- Tri Reni Budhiharti, Director of Green Industry and Environment
- Ir. Shinta D. Sirait, Deputy Director of Energy Assessment
- Emmy Suryandary, Chief of Section for Global Environment

### Indonesia Cement Association

- Mr Urip Timuryono, Chairman

### Indonesia Cement Association and PT.ISBI

- Ir. Sudaryanto, Technical Committee and Sr. Advisor

### Visit to Holcim plant in Narogong, Bogor

- Vincent Aloyious, AFR Manager Indonesia
- Ita Sadono, Communication and Relations Manager

- Kiki Sutjahyo, Occupational Health Specialist
- Pungki Yudono, Corp. OHS and Trade Union Head
- Budi Yulliadi Nugraha, Technical Engineer
- Shiva Sharma, Engineer in AFR
- Augus Muljono, EVE Training Head
- Liesda Indah, HR Head for Recruitment

**Skills trends for green jobs in the cement industry in Indonesia**

This report reviews in a systematic manner the skills available and skills required for the introduction and deployment of green technologies in the cement industry in Indonesia. It reviews the existing systems in place for developing a skilled labour force and proposes some specific recommendations on how to adapt to evolving demands. This report builds on continuing efforts made by the International Labour Organization in reviewing the need for skills for green jobs and the development of sector-based analysis that can advance global research work on promoting decent work. The report provides evidence and additional new information to support a well-informed tripartite dialogue on the best approach for promoting access to skills for green jobs and the greening of existing jobs in the Indonesian cement industry to help create decent, productive work and to improve the environmental sustainability and competitiveness of the sector.

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