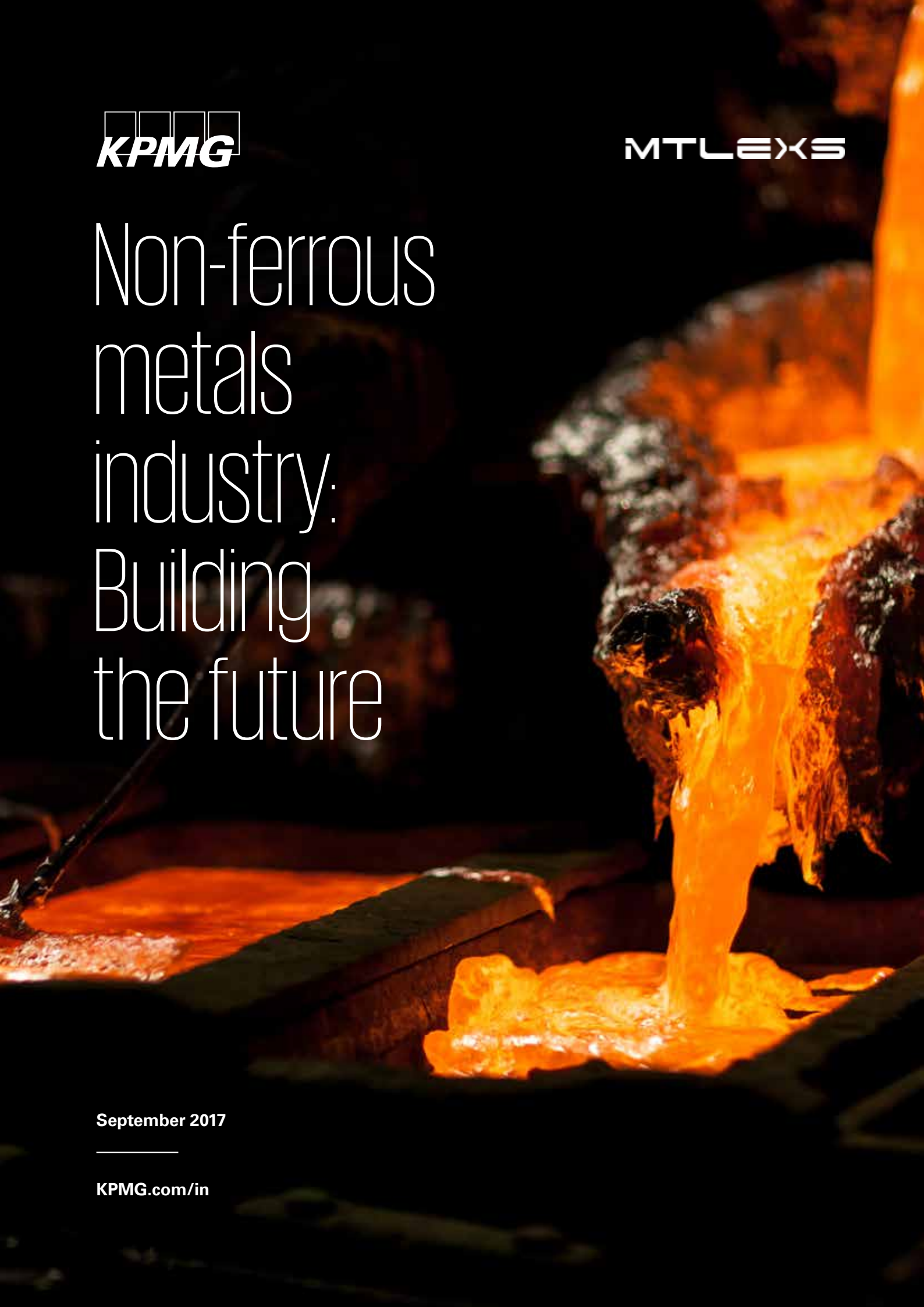


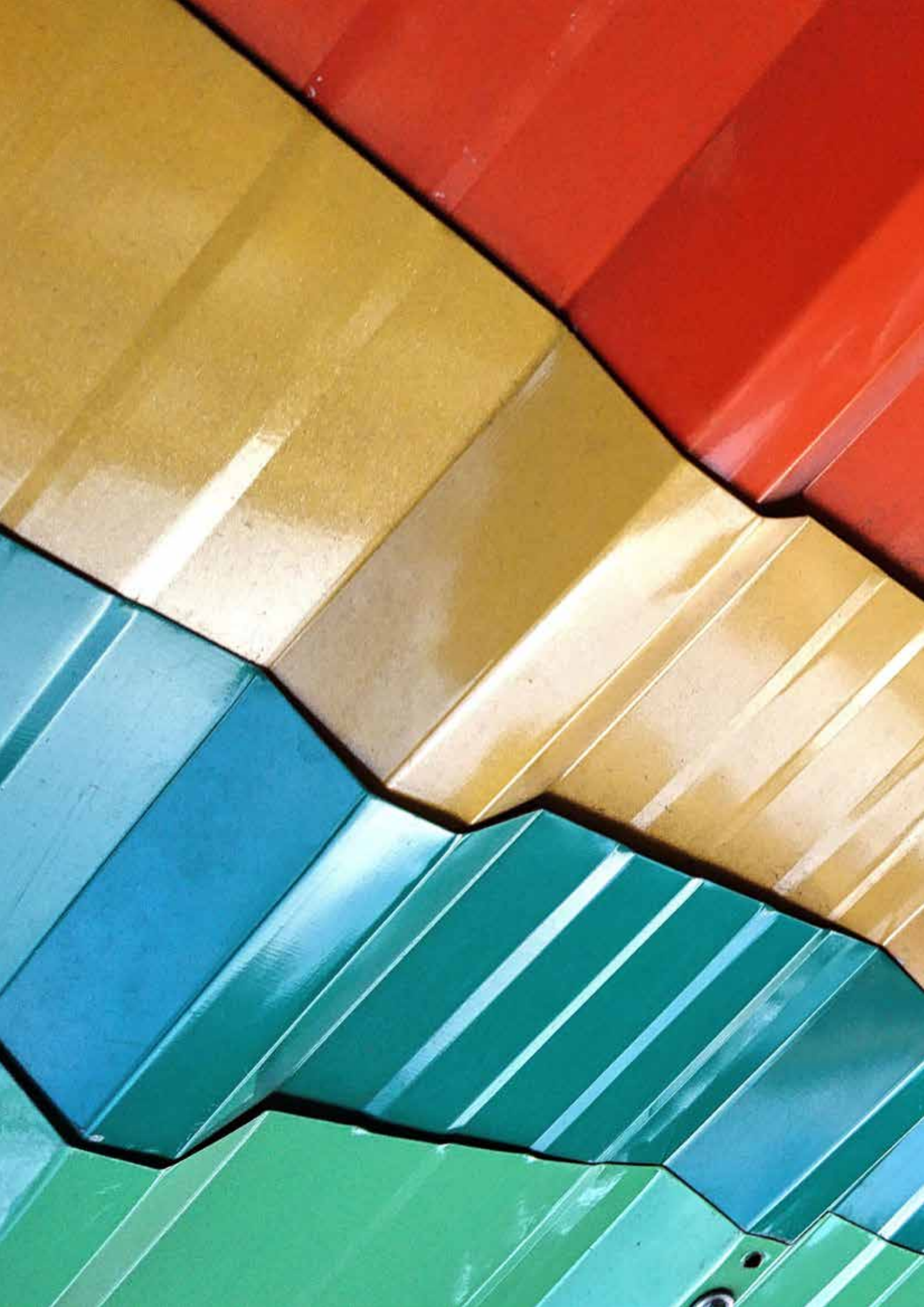
KPMG

MTLEXS

Non-ferrous metals industry: Building the future

September 2017

KPMG.com/in



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Foreword - KPMG

Indian non-ferrous metals industry has been growing at healthy pace in the past five years. In the future too, we expect immense opportunities for the development of the industry in India given the inclination of strong economic growth of the country. Intense impetus on the 'Make in India' initiative further gives a boost to the manufacturing sector thereby benefitting the non-ferrous metal industry.

Globally, the non-ferrous metal industry faced a turbulent time owing to a number of factors which included global economic growth slowdown at large and the slowdown of Chinese economy in particular along with the high raw material prices. Strong resilience in the Indian economy has resulted in non- ferrous metal industry outpacing the global trend. Apart from strong demand base and future potential, India is rich in terms of raw material reserves coupled with a relatively low cost structure of production thereby providing huge opportunity for the development of non-ferrous metals industry in India.

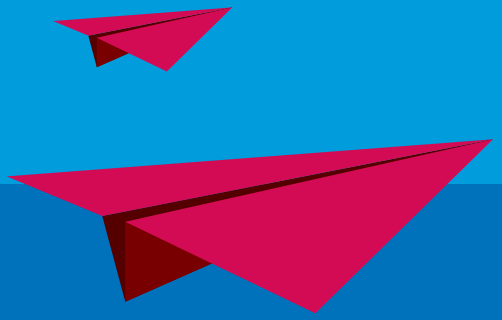
The country has witnessed healthy growth in the recycling industry too. However, there is a need to develop a scrap recycling ecosystem with appropriate legislations so as to promote organised scrap collection and segregation in India eventually resulting in lesser import of scrap.

With steady growth in demand, non-ferrous metals are being consumed in several emerging applications offered by defence and aerospace, hybrid and electric vehicles, railways, etc. which requires complex design, be it large aerostructural parts or miniature structural components which is difficult through traditional manufacturing route. However, lately there has been technological disruption in multiple industries including metals too such as metal additive manufacturing or 3D printing which offers the possibility of complex parts production at a faster pace and lower cost. There have been a number of industries which is increasingly using these technologies to revolutionise the manufacturing process.

A well-developed non-ferrous metals industry is vital for any developing country as it provides important raw material to many industries which are the pillars of economic development. With the increasing usage of these metals in several existing as well as emerging applications coupled with new technologies there is a paradigm shift that can change the way non-ferrous metals are consumed in the future.

This report provides a glimpse of opportunities that are available for the development of the non-ferrous metals industry in India which is riding on the strong economic growth momentum to build its own future.

Niladri Bhattacharjee
Partner
IGS - S&O
KPMG in India



Foreword - MTLEXS

It is my true honour and privilege to write a foreword for "Non-ferrous metals industry: Building the future". The unique nature of non-ferrous metals makes them the metal of the future. Their exceptional thermal, electrical and isolating characteristics, coupled with endless recyclable capabilities, make them indispensable to achieve energy and resource efficiency goals.

Indian non-ferrous metals has performed very well in the past year and has provided the much-needed impetus to the domestic economy. The industry has led to the growth in business opportunities and development in major sectors such as infrastructure, power, manufacturing, automobile, environment, defence, transport, R&D, telecom, oil & gas, among others.

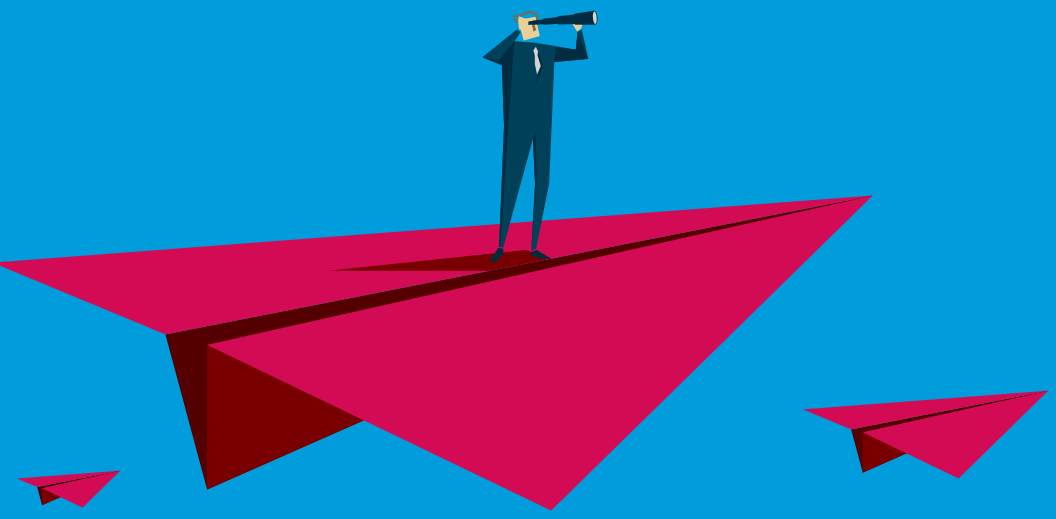
KPMG in India has authored the paper very systematically by incorporating information spanning from India's growth and role of non-ferrous metals, to the need of major sectors of the country's economy. The authors have also compared GDP growth of major global players like China, U.S., EU, Japan, Russia and Brazil, along with India.

Facts and figures regarding requirement of non-ferrous metals for major infrastructure projects under the 'Make in India' initiative, have been presented very well in the report. I congratulate KPMG for presenting the detailed scenario of major non-ferrous metals including Aluminium, Copper, Zinc and Lead.

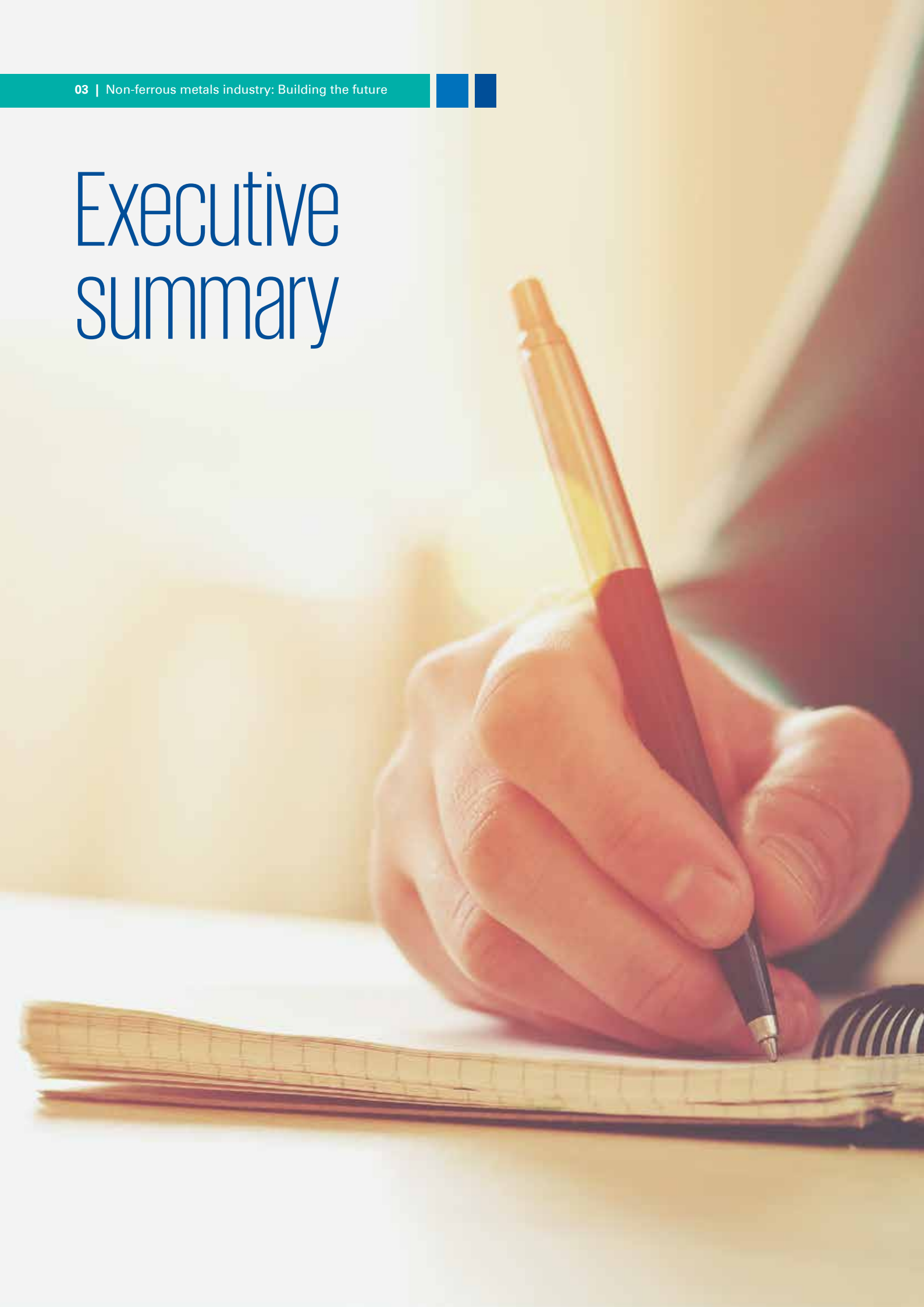
The report also covers topics including raw materials availability, scrap recycling and future potential of non-ferrous metals industry in various sectors of the economy. Other timely issues such as the challenges faced by the industry in India and need for the government support has also been covered well by KPMG.

I believe that the authors of the report can be confident that there will be many grateful readers who will have gained a broader perspective of the non-ferrous metals industry as a result of their efforts.

Suneel Mardia
CEO
Mtlexs Online Pvt. Ltd.



Executive summary



India is one of the fastest growing economies in the world. Strong domestic demand coupled with several reforms that the government has undertaken augurs well to maintain the economic growth momentum going forward. As non-ferrous metals find widespread applications across the economy, the strong growth in GDP provides a tremendous opportunity for the development of the Indian non-ferrous metals industry in the future. A major push is expected to emerge from the government's 'Make in India' initiative, which aims to increase the manufacturing share of GDP from the present 17 per cent to 25 per cent by the end of 2025[01]. Under this initiative, the government has identified 25 sectors such as Automotive, Power, Defence manufacturing, etc. which have extensive applications of various non-ferrous metals, and therefore, can provide a boost to the industry.

On the global front, the non-ferrous metals industry faced troubled times due to multiple challenges in the recent past such as a slowdown in global economic growth, slowdown in the Chinese economy and high raw material prices. China accounts for half of the consumption of non-ferrous metals like Aluminium, Copper, Zinc and Lead[02] and the slowdown in Chinese demand severely impacted the industry in terms of demand, utilisation, prices and profitability. Although, the slowdown in China has destabilised the industry's trend, the contribution from other emerging countries are expected to provide support to these metals going forward.

Given the strong resilience in the Indian economy, the performance of the non-ferrous metals industry in India has far outpaced the global trend. The key end-use sectors of these metals have grown at a healthy pace over the past five years, albeit at a slower rate than the previous decade. India has huge raw material reserves, a wide demand base and relatively low-cost of production which provides a strong impetus to the development of the non-ferrous metals industry. This has reflected in strong growth of supply which is sufficient to meet the domestic demand and is gaining considerable significance in the export market as well. However, certain metals are characterised by import, especially downstream products such as Copper wire, Aluminium foils, etc. because of various reasons such as relatively undeveloped downstream industry, global competition, quality availability, etc. and warrants development in that direction.

Apart from the development in primary metals, India has witnessed strong growth in the recycling industry. A growing emphasis on environment conservation and sustainable development has shifted the focus to metals recycling. Over time, the share of recycling in the total production of metals has increased significantly and is now almost equivalent to the global level. However, a majority of the scrap used by the recycling industry is imported. India has a huge population base that generates a vast volume of scrap. Therefore, there is a need to develop a scrap recycling ecosystem with appropriate legislation and laws to promote organised scrap collection and segregation in India.

The non-ferrous metals industry in India is expected to show strong growth in the future, better than the trend observed in the last five years which witnessed moderation on account of slowdown in the economy. With a slew of reforms undertaken by the government, the end-use sectors of non-ferrous metals such as Automotive, Electricals, Packaging, Consumer durables, Railways, Ports and Inland waterways, Roadways and Renewable energy are expected to experience the strong growth trajectory. Furthermore, these metals are witnessing increasing applications in the existing sectors as well as exploring many newer applications. Over 2016-17 to 2021-22, the demand for these metals is expected to grow by around 8 per cent[03] in line with strong economic prospects, thrust on manufacturing sector, healthy growth in key end-use segments further aided by rising usage intensity. However, strong government support is required to further strengthen the industry. Efforts need to be focused towards developing domestic downstream and recycling industry in terms of technology, manufacturing quality, building proper infrastructure and curtailing undue import and promote export.

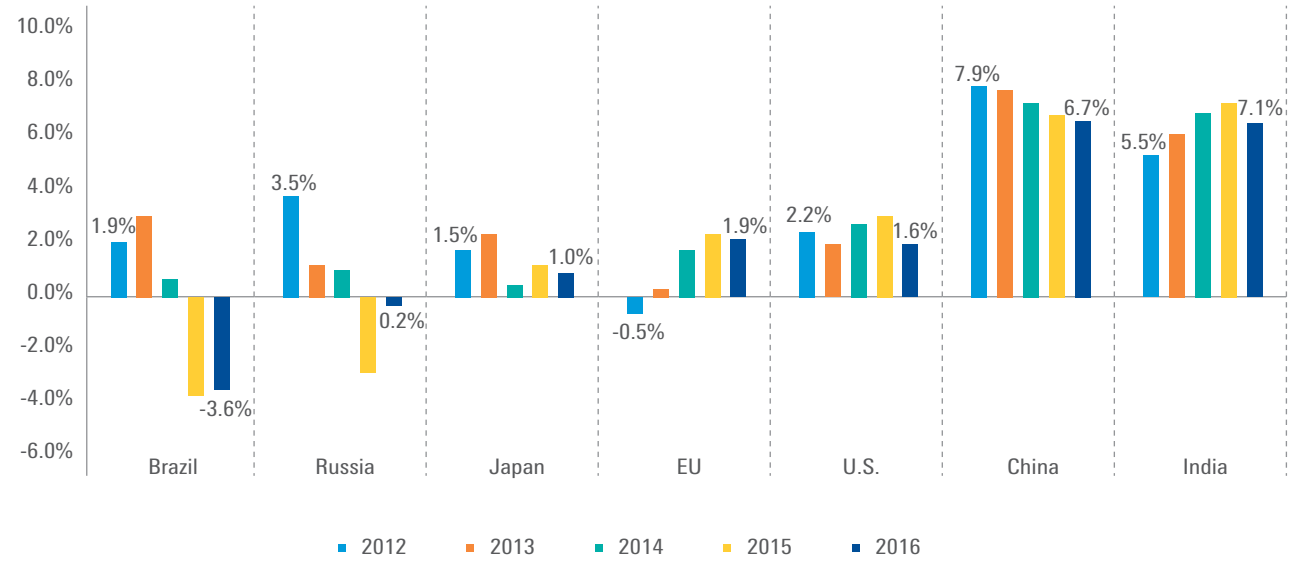
01. Make in India: The vision, new processes, sectors, infrastructure and mindset, Make in India website, http://www.makeinindia.com/article/-/v/make-in-india-reason-vision-for-the-initiative, accessed July 2016
02. Current IAI statistics, World Aluminium, accessed July 2017; Copper mine, smelter, refinery production and refined Copper usage by geographical area, International Copper Study Group, accessed July 2017; Press release- 15 February 2017, International Lead and Zinc Study Group, accessed July 2017;
03. KPMG in India's analysis, 2017

New economic growth trajectory of India

The Indian economy at a glance

Despite a weak global economic environment, the Indian economy has shown resilience and has become one of the fastest growing economies in the world, due to its inherent strength coupled with strong government reforms through various campaigns such as 'Make in India', 'Digital India', 'Ease of Doing Business', etc.

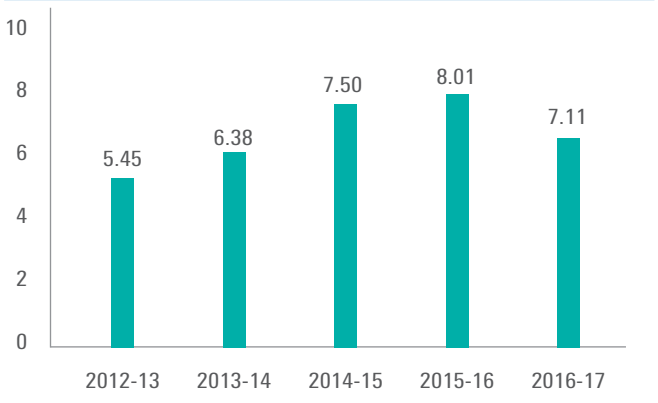
GDP Growth Comparison



Source: GDP (Constant 2010 US$, World Development Indicators, The World Bank, accessed July 2017

However, the government's decision to demonetise high denomination notes negatively impacted the demand in the short run which was reflected in the FY 2016-17 GDP growth. Accordingly, GDP grew by 7.11 per cent in 2016-17 as against 8.01 per cent in 2015-16.[04]

GDP growth rate



Source: Annual and Quarterly Estimates of GDP at constant prices, 2011-12 series, Ministry of Statistics and Programme Implementation, accessed August 2017

04. Annual and Quarterly Estimates of GDP at constant prices, 2011-12 series, Ministry of Statistics and Programme Implementation, accessed August 2017

Over the past few years, the government has introduced several reforms that have transformed India to a high growth nation. Below are the key reforms undertaken by the government which are expected to strengthen India's economic prospects in the future.

Key reforms

Make in India

Aims to develop manufacturing capabilties that are among the best in India by facilitating investment, fostering innovation, enhancing skills development and protecting intellectual property. The Government of India has set a target to increase the manufacturing sector's contribution to GDP to 25 per cent by 2025[05] from the present level of 17 per cent. This initiative is expected to boost manufacturing growth in the country and enable sustainable and high economic growth.

Smart Cities

It is an urban renewal programme by the Government of India with a mission to develop 100 such cities all over the country by making them citizen-friendly and sustainable. It intends to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology. The main features of the initiative are provision of adequate water supply, 24x7 electricity, sanitation, open spaces like parks, playground, a variety of transport systems, sustainable environment and safety and security of the citizenry.

Skill India

Launched in 2015 with an aim to train over 40 crore people in India by 2022, this initiative's idea is to enhance confidence, increase productivity and provide a direction to the Indian workforce so that they can contribute substantially towards the economic growth of the country.

Pradhan Mantri Awas Yojna (Housing for All)

This scheme was divided into two components 'Urban' and 'Rural'. The urban scheme was launched in June 2015 to provide affordable housing to the urban poor by 2022, while the rural scheme was launched in Novemeber 2016 to provide concrete houses for those people living in rented accommodation or who have their own house but which needs reconstruction. It targets to deliver two crore permanent houses in urban and rural areas by 2022. It is expected to have a multiplier effect on the economy of the country in terms of government spending, employment generation, infrastructure development, etc.

24x7 Power for all

A joint inititative by the Government of India and the state governments, it aims to provide power to households, commercial spaces, industries, agriculture and any energy-consuming entity. Under this initiative, the government has announced several measures such as the Deendayal Uphadayaya Gram Jyoti Yojna and the Integrated Power Development Scheme to boost the transmission and distribution network, installation of 100 GW of solar power generation capacity by 2019 under the Jawaharlal Nehru National Solar Mission (JNNSM), the Ujwal DISCOM Assurance Yojna (UDAY) to reduce the liablities of power distribution companies, etc.

Digital India

The main objective of this campaign is to improve the digital infrastructure of the country and empower it in the field of technology which can benefit in terms of efficiency to drive economic growth.

Startup India

The government launched this campaign with an aim to promote entreprenuers in the country that can drive sustainable economic growth and increase employment opportunities in the country. In order to meet the objectives of the initiative, the government has announced an action plan that addresses various aspects of the start-up ecosystem i.e. funding support, incentives, regulatory requirements, etc.

Goods and Services Tax

One of the biggest tax reform undertaken by the government, it has been introduced to do away with the cascading effect of multiple layers of taxes like VAT, service tax, excise, etc. on customers with an aim to easily do business in the country. Apart from its expected positive impact on the economic growth, this reform is expected to further help India in the long run in terms of improving ease of doing business, bolstering investor sentiments and luring more foreign investment.

05. Make in India: The vision, new processes, sectors, infrastructure and mindset, Make in India website,, http://www.makeinindia.com/article/-/v/make-in-india-reason-vision-for-the-initiative, accessed July 2016

'Make in India' initiative – A boost to the manufacturing sector

Productivity growth and technology advancement are the core to economic development of any country. Many of the technological advancements are seen in the manufacturing sector, such as automotive, mobile phone manufacturing, and building aircrafts, etc. The sector acts as an engine for economic growth while supporting employment growth. Therefore, a focus on the manufacturing sector is important for the sustainable development of any country.

However, the Indian manufacturing sector has grown at the same rate as the overall GDP growth and the share of the manufacturing sector has remained stagnant and low at around 17 per cent[06] which is much lower than that of other similar countries.

Comparison of share of manufacturing in GDP

Source: World Bank National Accounts data and OECD National Accounts data files, World Bank, April 2017/ July 2017

The above chart depicts the contribution of the manufacturing sector to the respective countries' GDP averaged over consecutive five year buckets across a period spanning 1991–2016. It is apparent that the share of manufacturing in India's GDP has remained stagnant at around 17 per cent throughout the period under analysis. This is in contrast to the other countries which have shown a strong share of manufacturing over a majority part of the analysis period. To achieve sustainable economic growth and employment, it is necessary to ensure a higher share of manufacturing. In this regard, the 'Make in India' campaign was launched in 2014 to address major obstacles and revitalise India's manufacturing sector.

Through the 'Make in India' initiative, the Government of India has focussed on the following 25 sectors to attract investment, foster innovation, enhance skills and build best-in-class infrastructure so as to develop their potential to transform them into global players.

06. World Bank National Accounts data and OECD National Accounts data files, World Bank, April 2017/ July 2017; KPMG analysis 2017

Sector in focus

The manufacturing sector growth in India has been plagued by a multitude of obstacles. However, there are several key barriers including the ones listed below that can be addressed through changes in policy and infrastructure upgradation and the Make in India initiative seeks to address these specific pain points to spur economic growth.

- No 'ease of doing business'
- Inadequate infrastructure
- Investment regulations
- Inflexible labour laws
- Skill gaps.

In this regard, the government has undertaken several initiatives with regards to the mitigation of these key barriers.

No 'ease of doing business'

- Passage of Insolvency and Bankruptcy code, 2016
- Reduced time for registering business
- Easier process of incorporation
- Integration of process through eBiz portal
- Making tax laws simpler.

Inadequate infrastructure

The government plans to focus on the following major areas of infrastructure in order to augment the overall infrastructure, attract investment and facilitate overall growth.

1. Railways

- 100 per cent FDI allowed
- Policies focussed on promotion of participative models to increase participation from other agencies/bodies
- Implementation of eastern and western dedicated freight corridors
- Review of wagon making scheme to facilitate private participation.

Inadequate infrastructure

2. Roadways

- 100 per cent FDI allowed.
- The Ministry of Road Transport and Highways has undertaken major policy initiatives for enhanced inter-ministerial coordination, innovative project implementation models and revival of languishing projects.

3. Sagarmala project (for ports and coastal development) and inland waterways

4. Housing for all.

Investment regulation

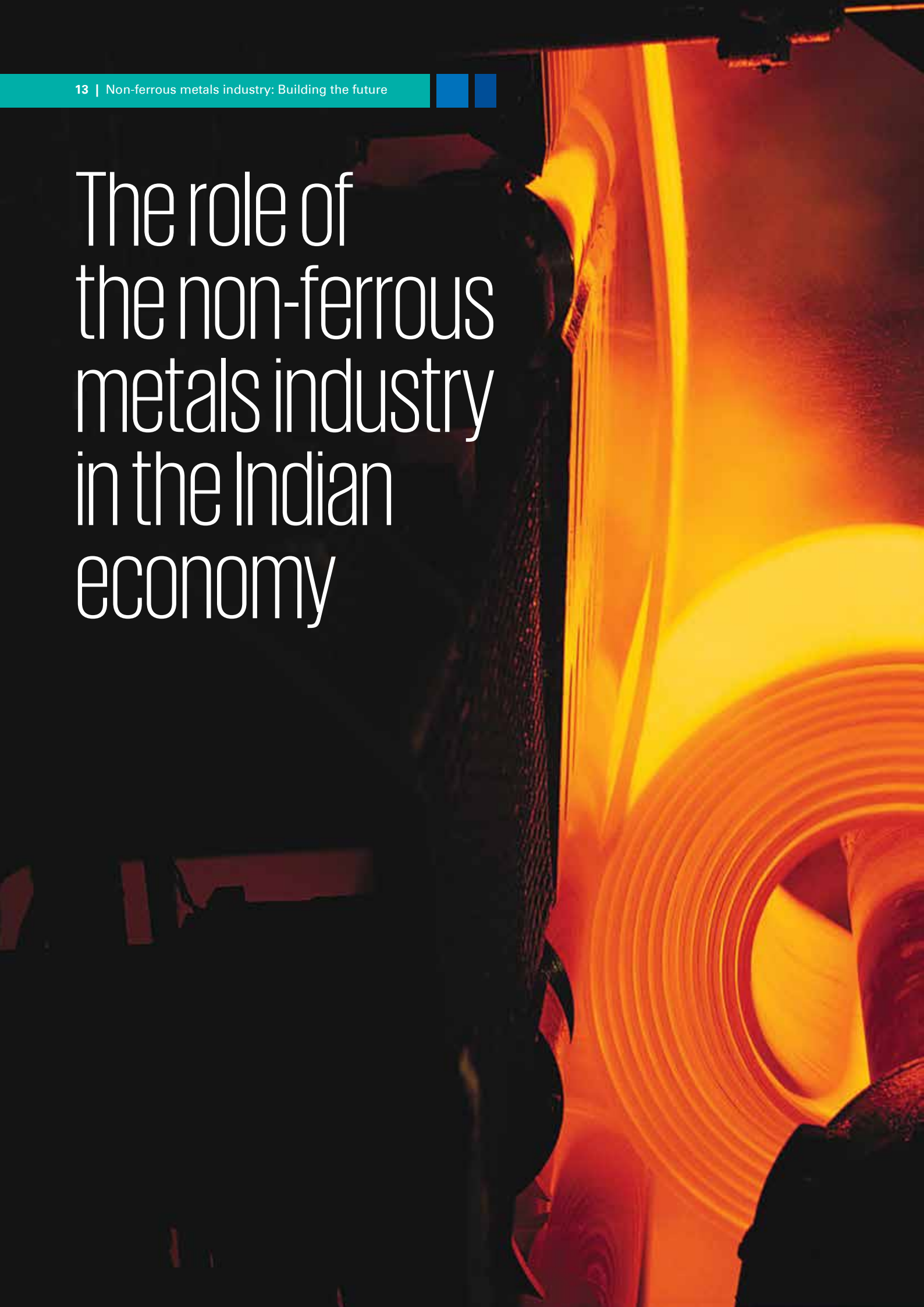
India has witnessed a substantial increase in Foreign Direct Investment (FDI) inflow with USD161 billion received between April 2014 and March 2017 due to a favourable policy in sectors such as defence manufacturing, railways, aviation, etc.

Inflexible labour laws and skill gaps

The government has initiated various reforms such as Shram Suvidha portal, Universal Account Number, Apprentice Protsahan Yojana to make the environment employee friendly.

In addition, the government has also launched 'Skill India' in order to build strong human capital to take advantage of the improved business environment and physical infrastructure.

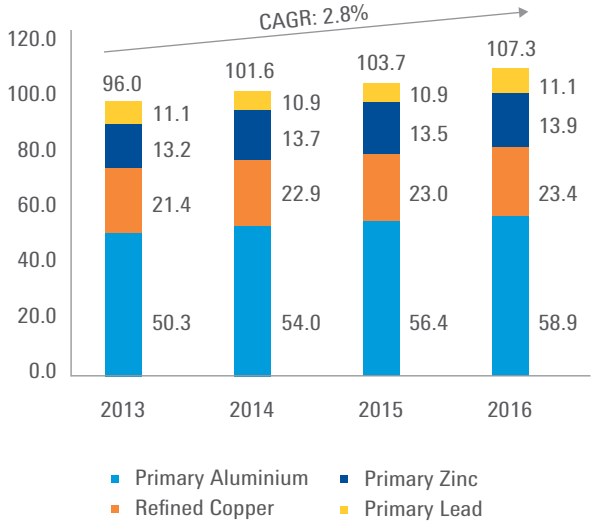
The role of the non-ferrous metals industry in the Indian economy



Global scenario

Globally, the growth of the non-ferrous metals industry has been closely associated with the economic growth activity due to widespread application of these metals in major spheres of economic activities including infrastructure sectors like construction, power, steel, and automotive. The demand for non-ferrous metals have grown at a steady pace with a CAGR of 2.8 per cent[07] during 2013 to 2016 in line with global GDP growth of 3.4 per cent[08] during the same period.

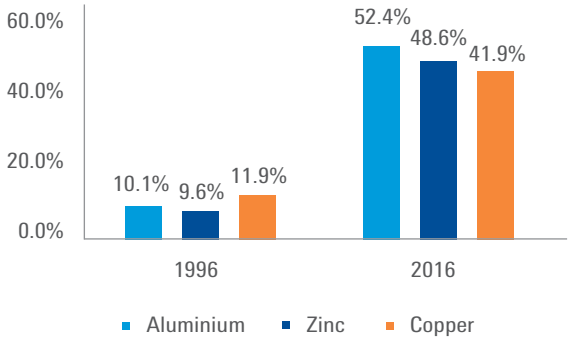
Global non-ferrous metals consumption (in millions tonnes)



Source: Current IAI statistics, World Aluminium, accessed July 2017; Copper mine, smelter, refinery production and refined Copper usage by geographical area, International Copper Study Group, accessed July 2017; Press release- 15 February 2017, International Lead and Zinc Study Group, accessed July 2017

China accounts for almost half of the world's consumption of non-ferrous metals like Aluminium, Copper, Lead and Zinc. Over the years, China's investment-led growth has made it the largest consumer of these metals.

China consumption share (% of world)



Source: Press release- 15 February 2017, International Lead and Zinc Study Group, accessed July 2017; Industry, Company reports

07. Current IAI statistics, World Aluminium, accessed July 2017; Copper mine, smelter, refinery production and refined Copper usage by geographical area, International Copper Study Group, accessed July 2017; Press release- 15 February 2017, International Lead and Zinc Study Group, accessed July 2017

08. GDP (Constant 2010 US$, World Development Indicators, The World Bank , accessed July 2017

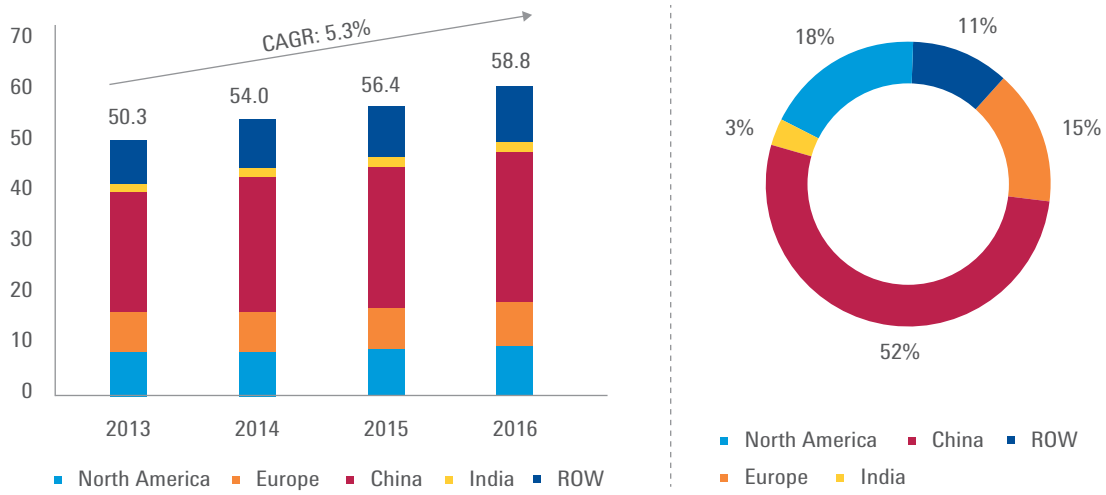
Being the largest consumer of non-ferrous metals, China majorly influences the dynamics of this industry. The recent economic slowdown in China has significantly impacted the global industry in terms of demand and supply, trade, prices and profitability.

Aluminium

Aluminium is a highly valued metal due to its properties such as a higher strength to weight ratio, resistance to corrosion, formability, dampness to name a few, which is evident from the fact that it is the fastest growing metal as compared to other non-ferrous metals[09]. Increasing consumption in the automotive sector has proven to be game-changing from an incremental usage perspective for Aluminium, similar to the demand generated by the beverage can market in the past. China continued to be a major consumer of Aluminium accounting for almost 52 per cent of the global consumption. Elsewhere in Asia, consumption showed a declining trend in Japan but is compensated by higher demand from India and the Middle East. North America's consumption has also firmed up since the global financial crisis.

On the supply side, overcapacity, environmental concerns and historically high level of inventories and falling prices have prompted China and western Aluminium producers to cut production. Supply cuts along with healthy demand growth, especially in emerging countries has reflected in Aluminium prices which recovered since early 2016.

Global Aluminium consumption (in million tonnes) and regional share (2016)



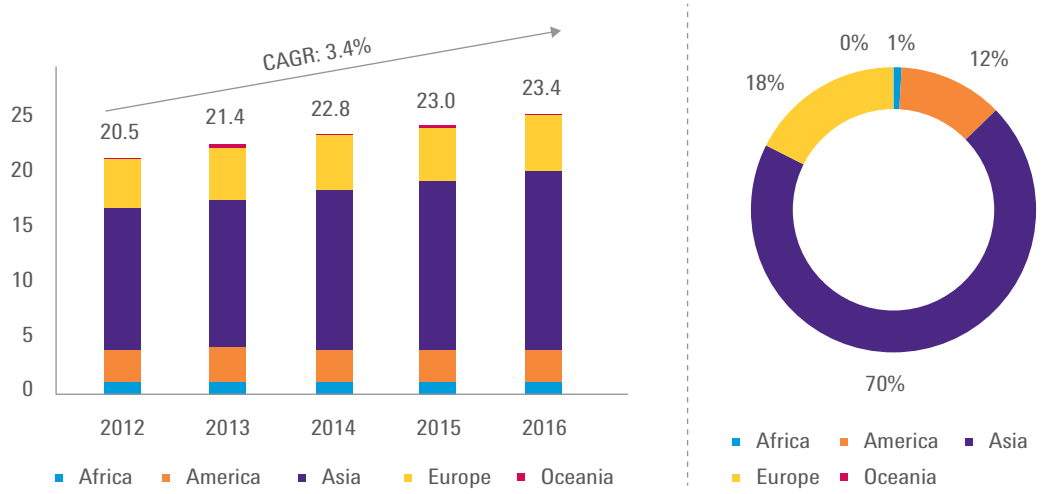
Source: Current IAI statistics, World Aluminium, accessed July 2017; Company Reports

09. KPMG in India's analysis, 2017

Copper

World refined Copper consumption grew at a CAGR of 3 per cent from 2012 to 2016[10], which was mainly driven by increasing consumption in China, the largest consumer. Despite a slowdown in economic activity and weakness in residential construction in China, growth in Copper consumption was mainly supported by an increase in infrastructure spend, particularly on rail and electricity networks and increased manufacturing output of Copper-intensive products. Demand for Copper in the U.S. was spurred by a favourable macro environment underpinned by increased economic growth, rise in manufacturing output and a strong residential and commercial sector.

Global Copper consumption (in million tonnes) and regional share (2016)



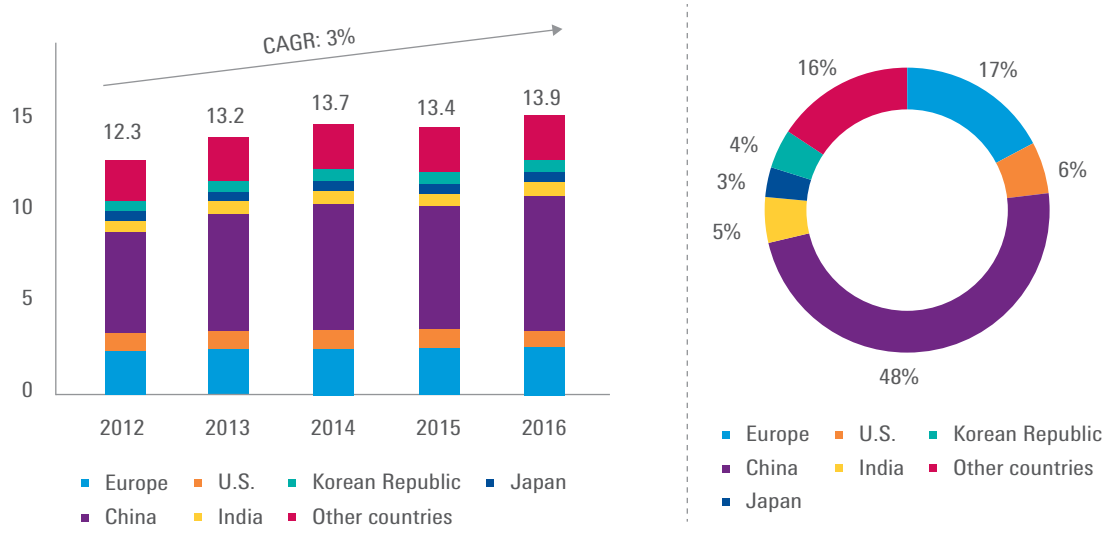
Source: Copper mine, smelter, refinery production and refined Copper usage by geographical area, International Copper Study Group, accessed July 2017

10. Copper mine, smelter, refinery production and refined Copper usage by geographical area, International Copper Study Group, accessed July 2017

Zinc

Zinc is the fourth most widely used metal globally after steel, Aluminium and Copper. The global refined Zinc usage has grown at a CAGR of 3 per cent during 2012 to 2016[11]. A majority of this growth primarily came from China and India, due to the respective government's efforts to boost investment in real estate and infrastructure. United States, the second largest Zinc consuming country, has seen a stagnation in consumption. China, which accounts for 47 per cent of the global demand[12], remains an important factor in Zinc consumption. The subsequent pick-up in manufacturing activity in China has helped in a healthy growth in galvanised steel production, the single largest consumer sector of Zinc.

Global refined Zinc consumption (in million tonnes) and regional share (2016)



Source: Press release- 15 February 2017, International Lead and Zinc Study Group, accessed July 2017

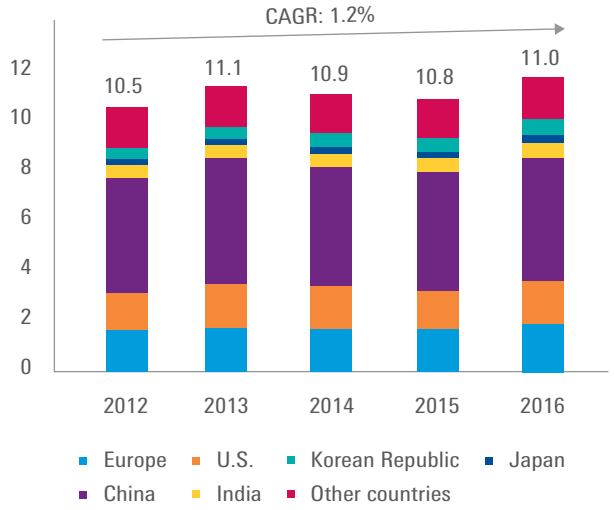
11. Lead and Zinc Statistics, International Lead and Zinc Study Group, accessed July 2017

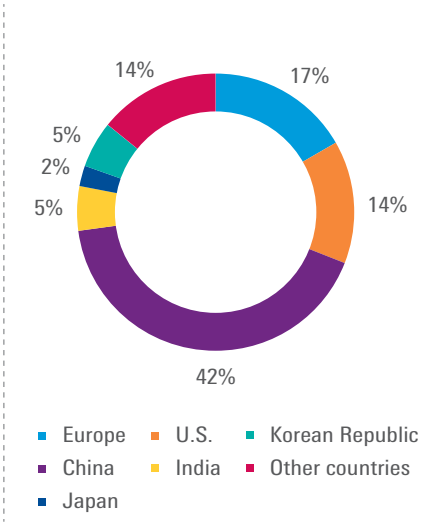
12. Press release- 15 February 2017, International Lead and Zinc Study Group, accessed July 2017

Lead

In Europe and China, two of the largest Lead consumption markets, a strong performance in the automotive sector has resulted in positive demand sentiment for the metal. Further, strong vehicle production along with high penetration of telecom towers contributed to higher demand for Lead. Demand is expected to be supported by factors such as increased production of vehicles, infrastructure development and a heightened focus on renewable energy.

Global refined Lead consumption (in million tonnes) and regional share (2016)





Source: Press release- 15 February 2017, International Lead and Zinc Study Group, accessed July 2017

Globally, the non-ferrous metals industry has seen strong growth due to robust demand from China. However, the recent slowdown in China has destabilised the trend of these metals and profitability of market players. The contribution from other emerging countries are expected to support these metals going forward.

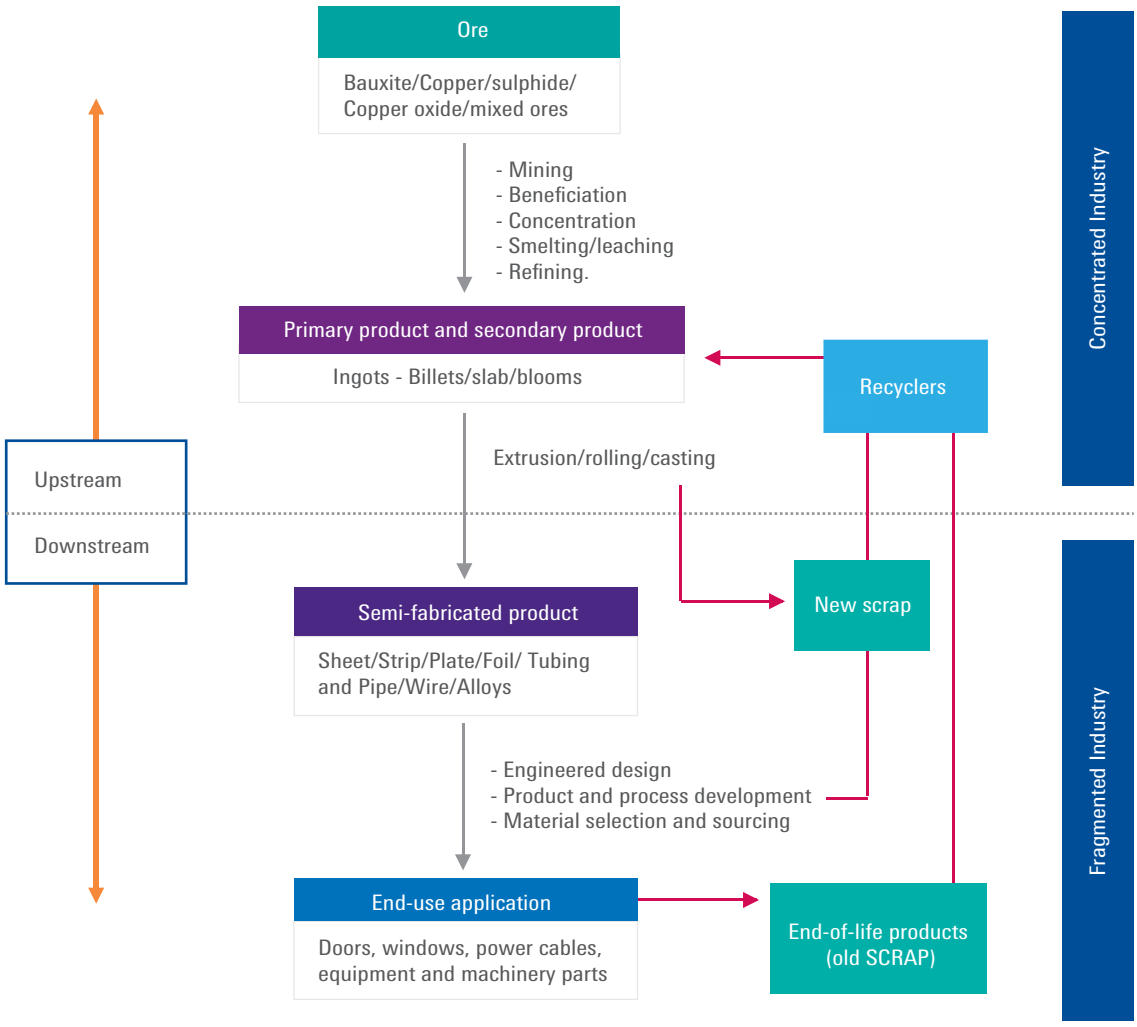
Indian scenario

Over the years, the non-ferrous metals industry has seen healthy growth in India aided by growing end-users demand from the automotive, construction, electrical, consumer durables, packaging, renewable energy and galvanised steel sectors and well-established related industries for access to raw material. However, industry focus and government support is required to bring the non-ferrous metals ecosystem under one umbrella to help companies improve performance and stimulate industry environment.

Industry landscape

The non-ferrous metals industry encompasses a range of productive activities throughout the value chain. As we go upstream in the value chain, the industry is more organised and there are only a few major players that dominate this industry. But as we go downstream across the value chain, the industry becomes extremely fragmented and unorganised.

Non-ferrous metals industry value chain



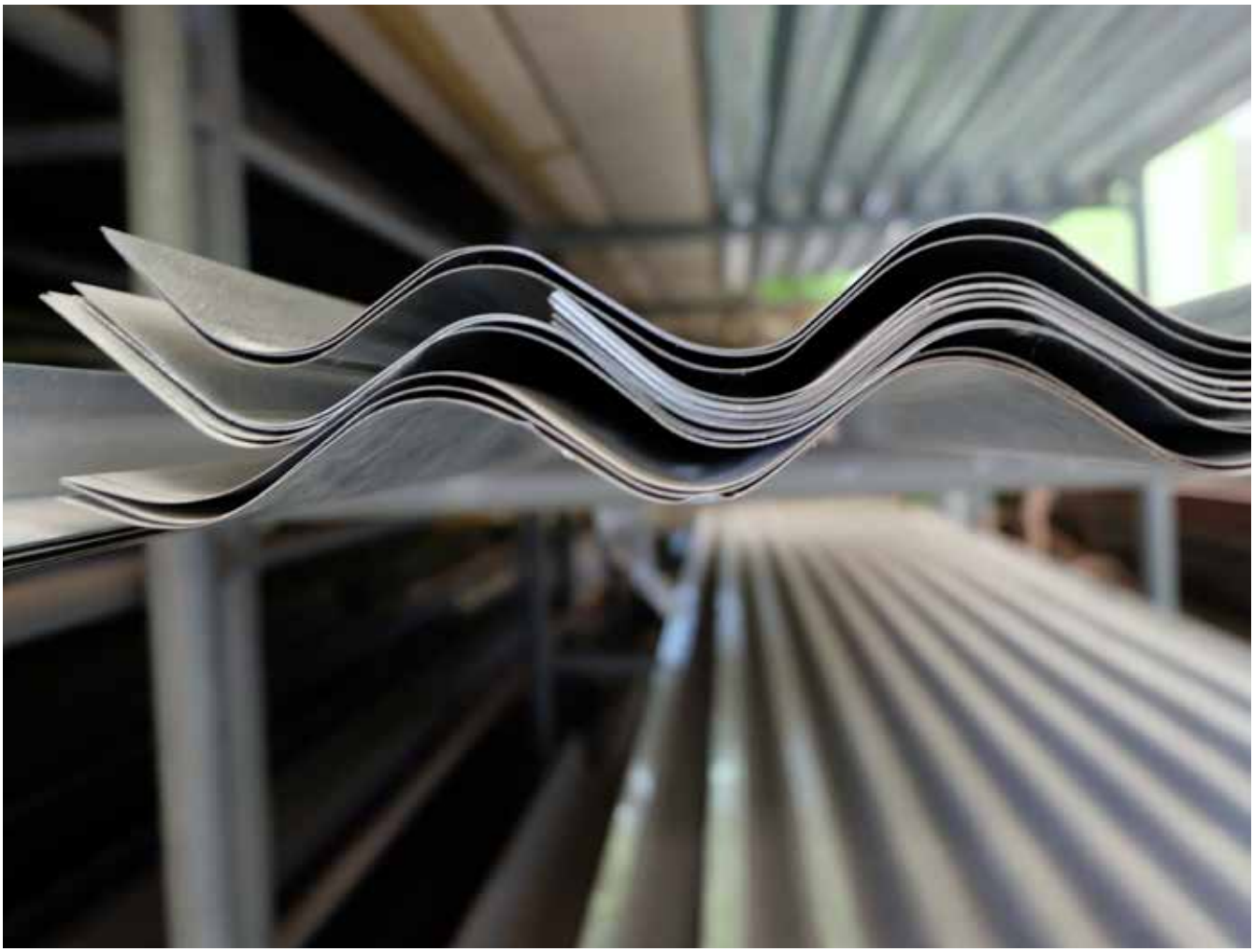
Source: KPMG in India's analysis, 2017

The non-ferrous metals industry comprises two major segments: Primary segment and secondary segment. The primary segment refers to players manufacturing metals from respective ores with partial presence in selected downstream/value added products. On the other hand, the secondary segment comprises the recycling industry (which manufacturers metal from scrap) as well as a large number of downstream players manufacturing various value added products.

The primary metals industry is highly consolidated with very few large players that have dominated the market. This is mainly because the primary segment is capital, resource and energy-intensive. The primary segment currently has four big players which contributes to the majority of the production of Aluminium, Copper, Lead and Zinc.

The secondary segment plays an important role in this highly competitive and fragmented industry, with large number of players both in the organised and unorganised segments. With economic growth expected to continue on its upward trend, demand and consumption of metals such as Aluminium, Copper, Zinc, Lead could increase which can enable the downstream industry to grow rapidly in the near future, as it deals directly with the end-users application. However, the industry needs to tackle the challenges around the local environment and improve the quality and quantity of products by upgrading technology to match the growing demand.

The recycling industry is an important part of the overall ecosystem and required for the long-term sustainability of the industry. In India, though the non-ferrous industry has been developed over the decades, but the recycling industry with modern facilities is still at a nascent stage, dominated mainly by unorganised players. India has only 10-15 large organised players in the recycling sector which is very low compared to other countries such as China and the Middle East



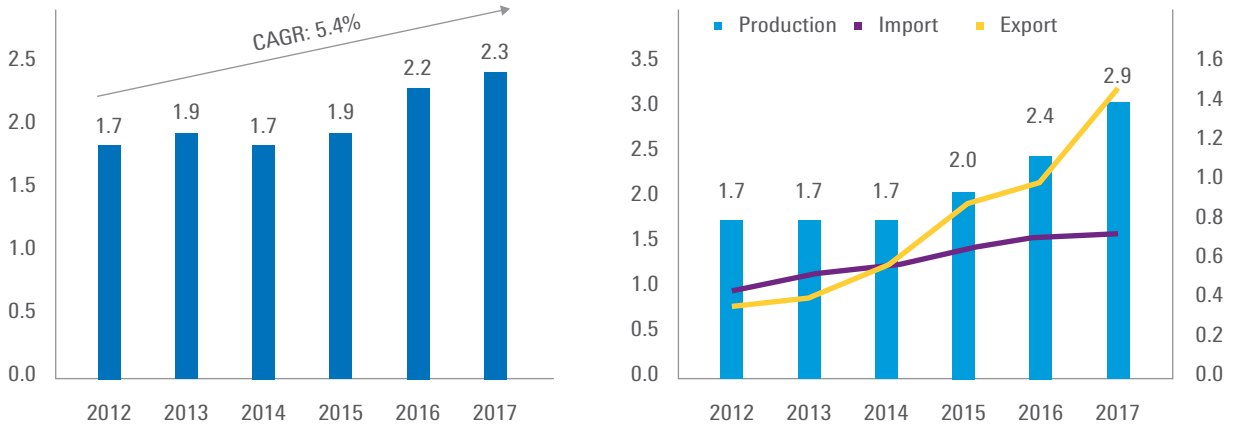
Non-ferrous metals industry dynamics in India

The demand for non-ferrous metals in India is greatly influenced by key end-use sectors such as automotive, electricals, consumer durables, packaging, renewable energy, building and construction, galvanised steel, etc. which have grown at a healthy pace over the past five years. As far as supply is concerned, domestic primary metals supply is largely sufficient to meet the demand and gaining considerable significance in the export market. However, certain metals are characterised by import, especially downstream products such as Copper wire, Aluminium foils, etc. because of various reasons including the undeveloped downstream industry, global competition and quality availability.

Aluminium

During 2011-12 to 2016-17, the demand for Aluminium posted a CAGR of 5.4 per cent[13] led by healthy growth recorded by the electrical and automotive sectors which constitutes 60-65 per cent[14] of the total consumption of Aluminium.

Demand – Supply of primary Aluminium (All figures in million tonnes)



Source: Aluminium-Indian Minerals Yearbook 2015 Vol. II - Reviews on Metals and Alloys (Final Release),Indian Bureau of Mines, accessed July 2017; Commodity wise Import –Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017; Company data

Primary Aluminium demand is generally met through domestic supply but there is considerable import of downstream products from China and the Middle East. Many players in Aluminium downstream industry are suffering from a lack of proper infrastructure and technology to efficiently process the raw material into high-quality products.

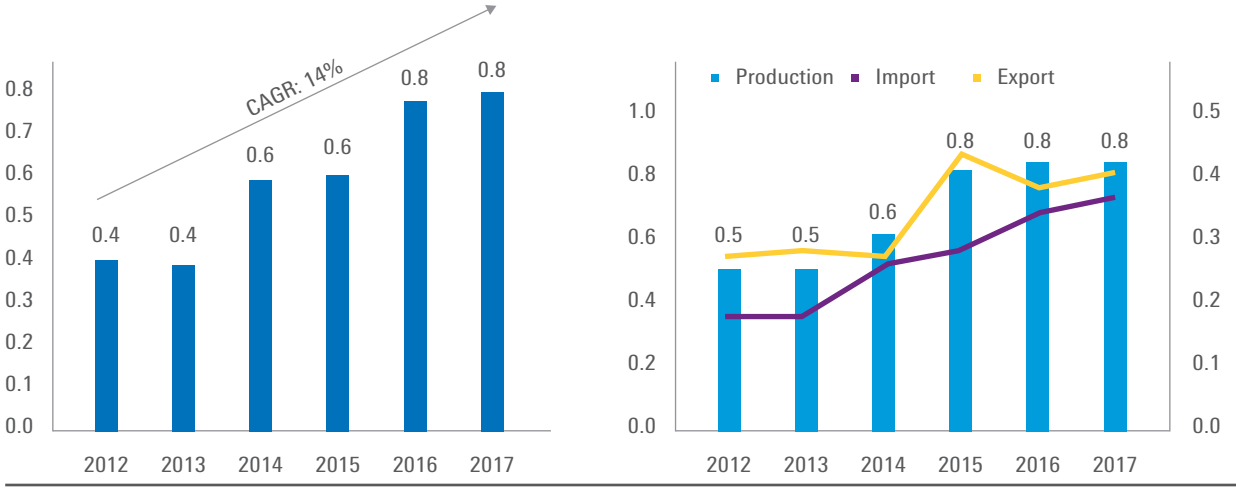
Significant capacity addition has taken place over the past five years due to implementation of various capacity addition plans by the major players. During 2011-12 to 2016-17, capacity has increased from 1.9 million[15] tonnes per annum to 4.1 million tonnes per annum. As the capacity grew at a much faster rate vis-à-vis demand, export has risen at a CAGR of 30 per cent[16] during the period that has transformed India from being a net importer to a net exporter of Aluminium.

Copper

Demand for primary Copper has grown at a CAGR of 14 per cent over the past five years owing to the robust growth in the electrical sector and consumer durables.

13. Aluminium-Indian Minerals Yearbook 2015 Vol. II- Reviews on Metals and Alloys (Final Release),Indian Bureau of Mines, accessed July 2017; Commodity wise Import –Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017; KPMG in India's analysis, 2017
14. Aluminium-Indian Minerals Yearbook 2015 Vol. II- Reviews on Metals and Alloys (Final Release),Indian Bureau of Mines, accessed July 2017
15. Aluminium-Indian Minerals Yearbook 2015 Vol. II- Reviews on Metals and Alloys (Final Release),Indian Bureau of Mines, accessed July 2017; Vedanta Resources Plc, Production Release for the Fourth Quarter and
16. Full Year ended 31 March 2017, 11 April 2017, accessed August 2017; Hindalco Investor Presentation –Q4 FY17, accessed July 2017

Demand-Supply of primary Copper (All figures in million tonnes)



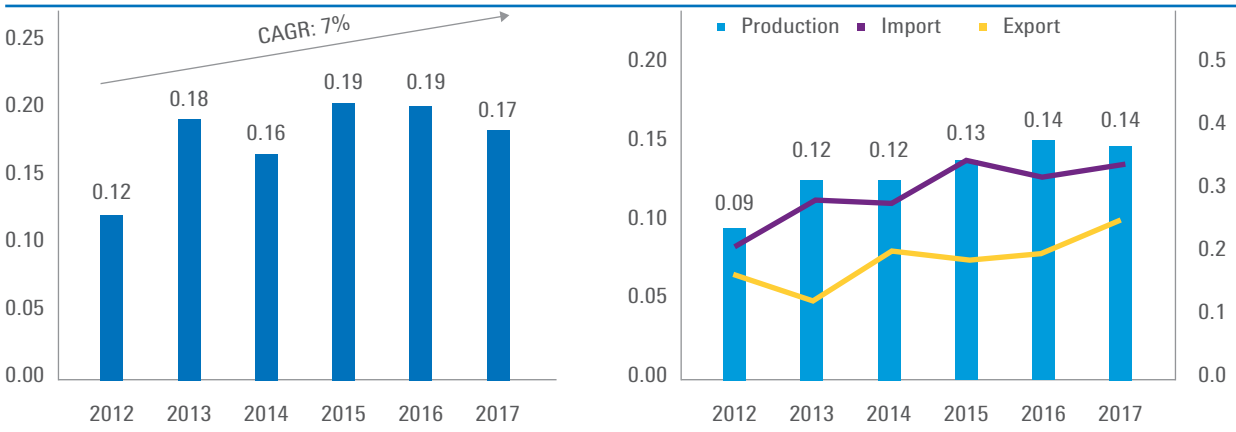
Source: Copper-Indian Minerals Yearbook 2012 to 2015 Vol. II - Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017; Monthly Summary on Non Ferrous Minerals and Metals, Ministry of Mines, Government of India, accessed July 2017; Commodity wise Import – Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017; Company data

Although India is a net exporter of Copper, there is a significant proportion of import of downstream products. Many players in the Copper downstream industry faces challenges such as outdated technology, improper infrastructure, high set up cost, high funding cost and lack of skilled professionals. During 2011-12 to 2016-17 Copper imports constituting mainly downstream products and alloys, have trebled growing at a CAGR of 15.4 per cent.[17]

Lead

The batteries industry constitute 70-75 per cent[18] of the total consumption of Lead in India which is generally used in the automotive and industrials sector. Demand for primary Lead has grown at a healthy pace of 7 per cent CAGR[19] during 2011-12 to 2016-17, which has led to an increase in production levels and capacity utilisation in the primary Lead industry. In addition to primary production, a majority of the demand is met through secondary production which accounts for around 85 per cent[20] of the total production. India is a net importer of Lead but there has been an increase in primary and secondary production which has led to 10.3 per cent[21] CAGR in exports bridging the gap between the import and export numbers.

Demand- supply of primary Lead (All figures in million tonnes)



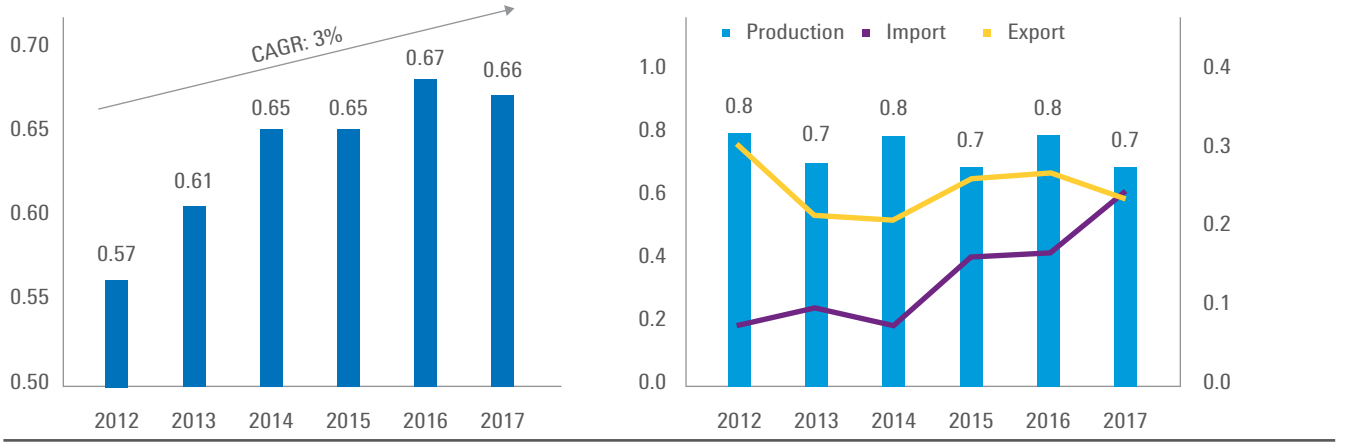
Source: Lead-Indian Minerals Yearbook 2012 to 2015 Vol. II - Reviews on Metals and Alloys (Final Release),Indian Bureua of Mines, accessed July 2017; Lead-Indian Minerals Yearbook 2012 to 2015 Vol. II - Reviews on Metals and Alloys (Final Release),Indian Bureua of Mines, accessed July 2017; Monthly Summary on Non Ferrous Minerals and Metals, Ministry of Mines, Government of India, accessed July 2017; Commodity wise Import – Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017; Company data

17. Commodity wise Import –Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017
18. Lead-Indian Minerals Yearbook 2015 Vol. II- Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017
19. Lead-Indian Minerals Yearbook 2012 to 2015 Vol. II- Reviews on Metals and Alloys (Final Release),Indian Bureau of Mines, , accessed July 2017; Monthly Summary on Non Ferrous Minerals and Metals, Ministry of Mines, Government of India, accessed July 2017
20. Secondary Lead and Zinc Industry- Global and Indian Scenario, India Lead Zinc Development Association, accessed July 2017
21. Commodity wise Import –Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017; KPMG in India's analysis, 2017

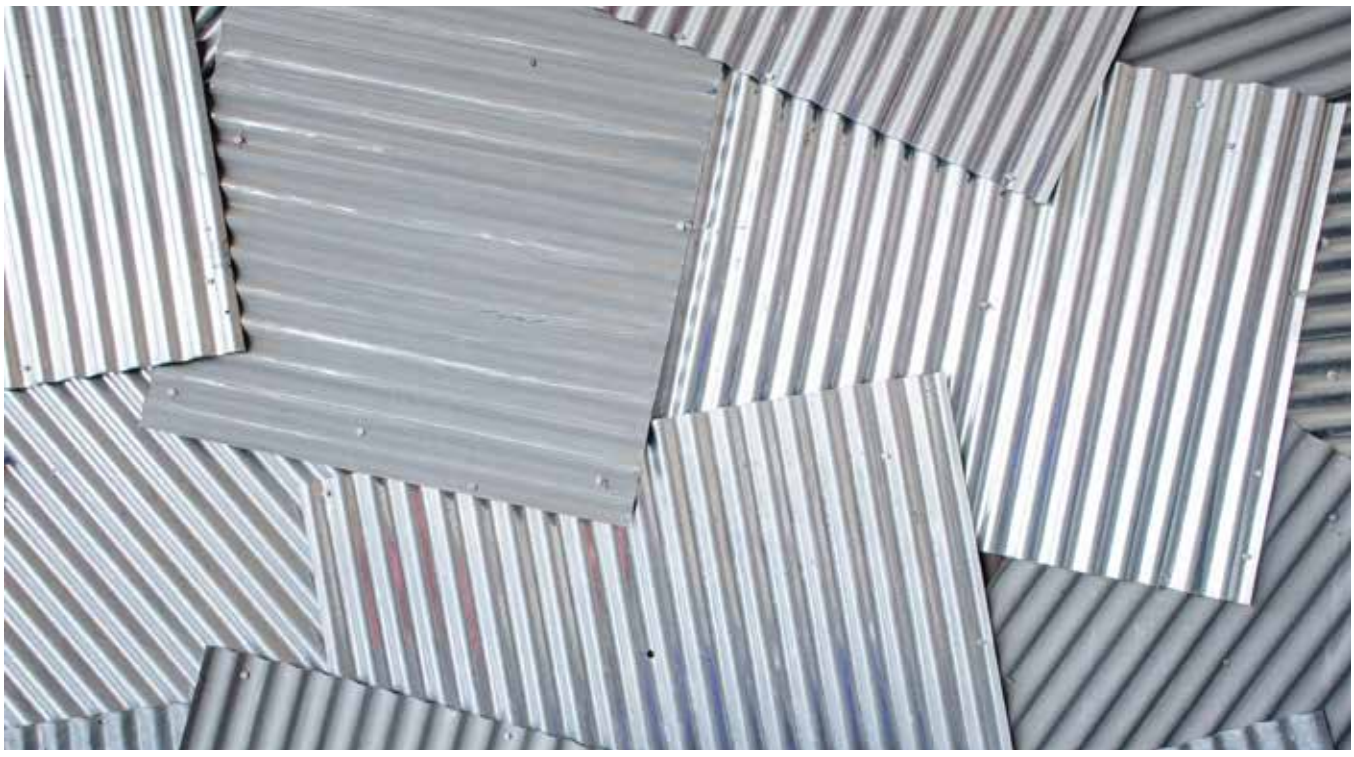
Zinc

Demand for primary Zinc in India is based on the growth of the steel market which accounts for 70 per cent of the total demand[22]. It is mainly used in galvanising and coatings of iron and steel to protect it from corrosion. During 2011-12 to 2016-17, demand for Zinc has grown at a CAGR of only 3 per cent[23] mainly because of a surge in imports of galvanised steel. In order to control imports, the government has imposed minimum import duty on certain steel products, in addition to safeguard duty and anti-dumping duty. In 2016-17, India's imports of galvanised and coated steel has reduced by 47 per cent[24] compared to the previous year owing to these supportive government policies. Other government initiatives such as 'Smart Cities', modernisation of railways, and the construction of highways is expected to boost the infrastructure industry which uses galvanised steel for durability and endurance. This is likely to pave the way for increased Zinc consumption in India in the coming years.

Demand-supply of primary Zinc (All figures in million tonnes)



Source: Zinc-Indian Minerals Yearbook 2012 to 2015 Vol. II- Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017; Monthly Summary on Non Ferrous Minerals and Metals, Ministry of Mines, Government of India, accessed July 2017; Commodity wise Import – Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017; Company data

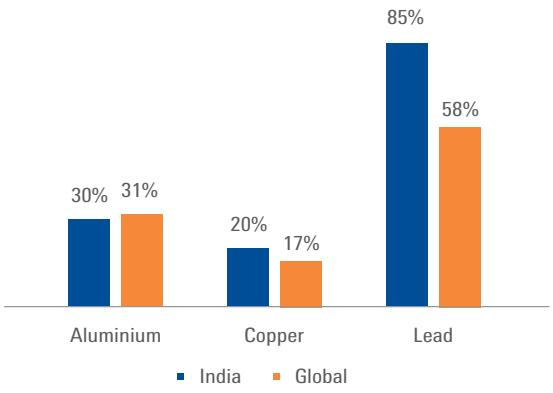


22. Zinc-Indian Minerals Yearbook 2015 Vol. II- Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017
23. Zinc-Indian Minerals Yearbook 2012 to 2015 Vol. II- Reviews on Metals and Alloys (Final Release),Indian Bureau of Mines, , accessed July 2017; Monthly Summary on Non Ferrous Minerals and Metals, Ministry of Mines, Government of India, accessed July 2017
24. Import, export, availability, stock & apparent consumption, Ministry of Steel, accessed July 2017, KPMG in India's analysis, 2017

Growing contribution from the recycling industry

Apart from primary metals, India has witnessed strong growth from the recycling industry. The growing emphasis on environment conservation and sustainable development has increased the focus on metals recycling. With time, the share of recycling in the total metal production has increased significantly and is almost in parity with the global level.

Share of the recycling industry



Source: ICSG Press Release, ICSG, July 2017/ July 2017; ILZSG Press Release, ILZSG, July 2017/ July 2017; Global Mass flow Model 2016, International Aluminium Institute, April 2017/July 2017; Secondary Lead and Zinc Industry- Global and Indian Scenario, India Lead Zinc Development Association, accessed July 2017

The secondary production of metals through recycling requires significantly lower resources as compared to the requirement for primary production and contributes significantly to meet the total demand of non-ferrous metals in India.

Total Size of non-ferrous metals industry (2016-17) (All figures in million tonnes)

Metals	Primary production	Recycling share	Total production	Total demand
Aluminium	2.86	30%	4.09	3.48
Copper	0.79	20%	0.99	0.96
Lead	0.14	85%	0.93	0.96
Zinc	0.65	-	0.65	0.66

Source: ICSG Press Release, ICSG, July 2017/ July 2017; ILZSG Press Release, ILZSG, July 2017/ July 2017; Global Mass flow Model 2016, International Aluminium Institute, April 2017/July 2017; Aluminium, Copper, Lead, Zinc -Indian Minerals Yearbook 2012 to 2015 Vol. II- Reviews on Metals and Alloys (Final Release),Indian Bureau of Mines, accessed July 2017; Monthly Summary on Non Ferrous Minerals and Metals, Ministry of Mines, Government of India, accessed July 2017; Commodity wise Import –Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017; Secondary Lead and Zinc Industry- Global and Indian Scenario, India Lead Zinc Development Association, accessed July 2017

India, with its huge population generates vast volumes of non-segregated scrap, of which a significant portion constitutes metals that can be reused. However, the utilisation of this unaccounted scrap is very low as the Indian metals recycling industry, including the scrap collection segment, is highly unorganised. The absence of the metals scrap recycling ecosystem and any domestic legislation and laws that apply to the industry are major obstacles to the growth of the Indian metals scrap recycling sector. As the supply side for metals scrap in India is not adequate to meet the demand, India imports a significant quantity of metals scrap.

Raw material availability

Availability of raw material is one of the most important factor for the development of any industry. India's non-ferrous metals industry has abundant reserves including various minerals such as bauxite, Lead and Zinc ore which provides huge potential for the respective industries towards their future development. However, India has a relatively low share in good quality Copper ore reserves.

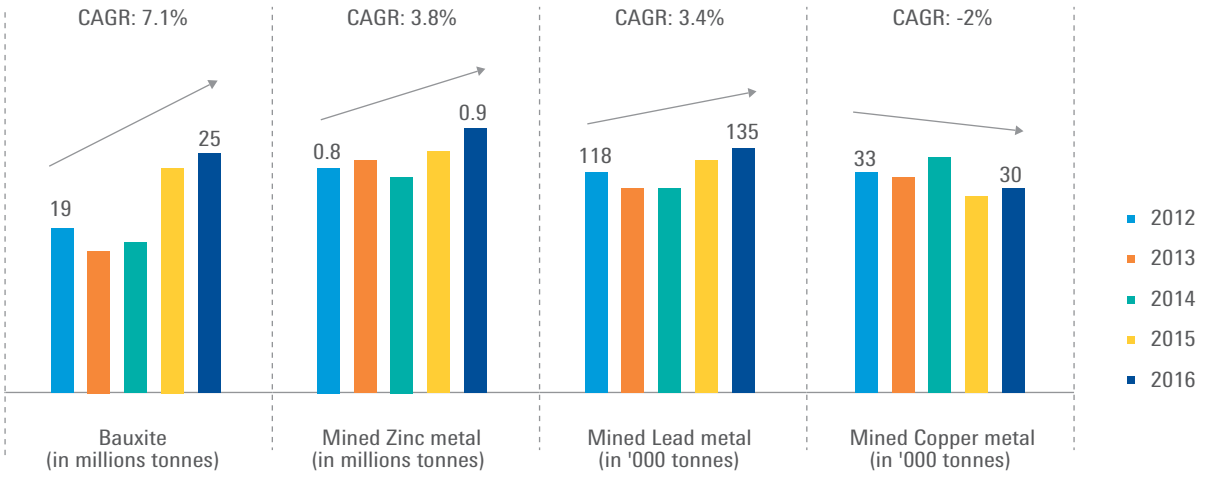
India's share in global mineral reserves

Mineral	Global Reserve (million tonnes)	India Reserve (million tonnes)	India Share (%)
Bauxite	28000	590	2.10
Copper ore	720	3	0.40
Lead ore	89	2.2	2.47
Zinc ore	200	10	5.00

Source: Mineral commodity Summaries 2016, U.S. Geological Survey, https://minerals.usgs.gov/minerals/pubs/mcs/2016/mcs2016.pdf, Pg. 23, 96, 192 Copper-Indian Minerals Yearbook 2015 Vol. II- Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017;

In order to fulfil the increasing demand of the non-ferrous metals industry in India, there has been a continuous rise in indigenous ore production. Bauxite, Zinc and Lead ore have seen an upward trend in production whereas Copper ore production is on the decline mainly because of lack of good quality ore in India.

Raw material production



Source: Commodity Statistics and Information, U.S. Geological Survey, https://minerals.usgs.gov/minerals/pubs/commodity/, accessed August 2017; Copper-Indian Minerals Yearbook 2012 to 2015 Vol. II- Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017; Company data

While the Indian non-ferrous metals industry is equipped with sufficient manufacturing capabilities, healthy demand and visionaries/ leaders, there is a need to develop other aspects such as skilled workforce, newer technologies, infrastructure availability and funds at reasonable cost. Development on these aspects is of paramount importance in order to achieve sustainable growth in the future.

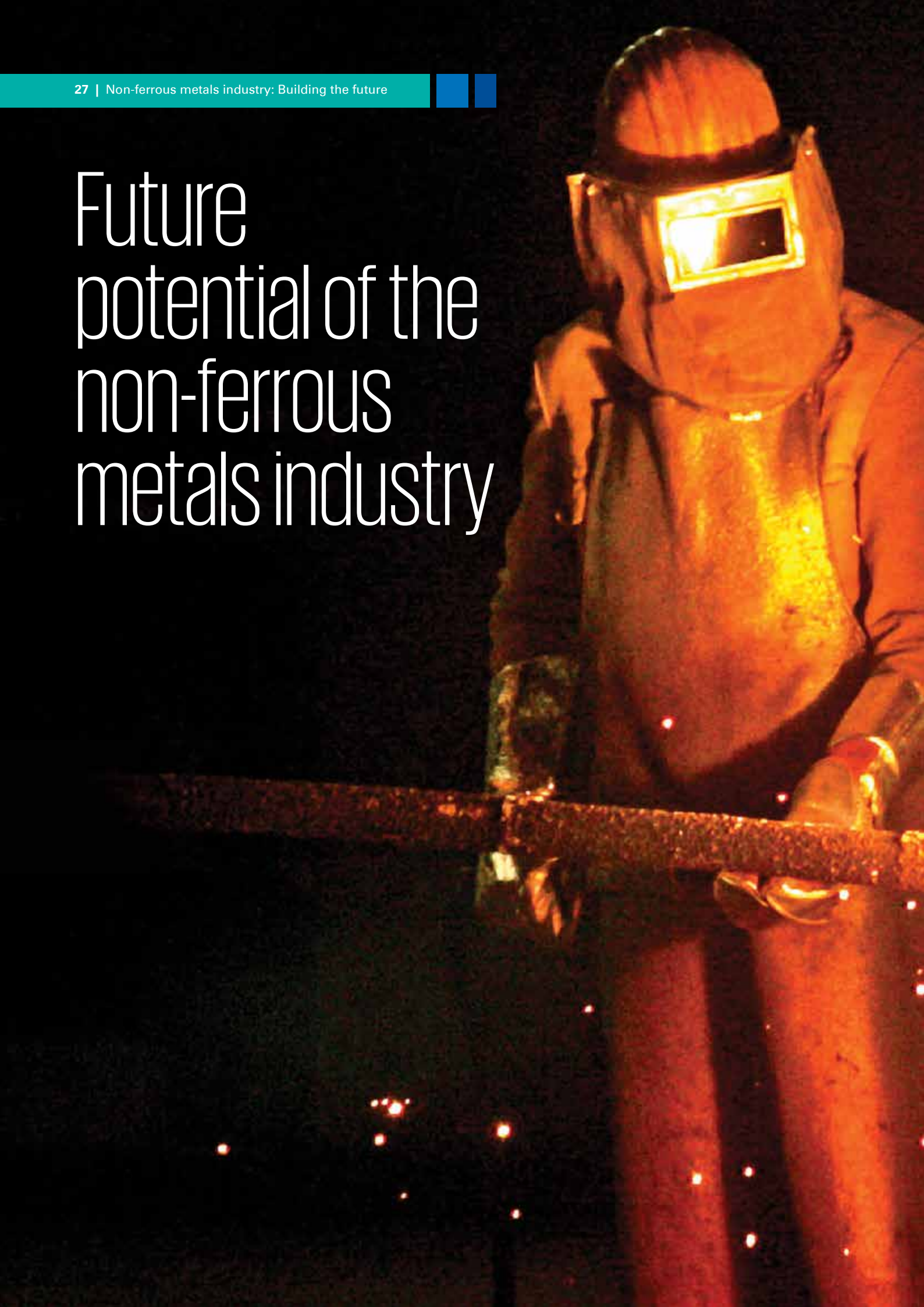
Need for government support

In order to promote 'Make in India' and subsequently increase the contribution of the manufacturing sector, strong government support is required for the non-ferrous metals industry which supplies the building blocks to many industries.

Non-ferrous metals industry is facing the following challenges for which government support is required to provide a level playing field to the players for healthy growth in the coming years.

1. Significant import of various metal products, especially from China
2. Development of organised scrap collection and segregation
3. Development of recycling technology
4. The small and fragmented nature of the downstream industry with many players facing challenges such as low capacity utilisation, outdated technology, lack of proper infrastructure, high cost of funding, lack of qualified personnel, high set up cost, etc.
5. Also, a rationalised duty structure is needed to promote the industry across the value chain.
6. Induction and promotion of appropriate technologies indigenously or through joint ventures is required to be promoted for preparation of downstream products and alloys.

Future potential of the non-ferrous metals industry



Key ingredients for the growth of the non-ferrous industry are strong demand, availability of raw materials, high entrepreneurial quotient of the country, development of the ancillary industry, technology, etc. The prevalence of most of these ingredients in India, provides strong and sustainable growth potential for the non-ferrous metals industry.

In terms of demand, India has strong potential given that the country is expected to be among the fastest growing large economies. Per capita consumption of non-ferrous metals in India is very low as compared to both developed and developing economies, thus leading to tremendous growth potential in the years to come.

Furthermore, the boost to the Indian manufacturing sector due to the government's campaign 'Make in India' is expected to provide an impetus to non-ferrous metals consumption.

Per capita consumption of non-ferrous metals (Kgs)

Source: ILZSG, Copper-Indian Minerals Yearbook 2012 to 2015 Vol. II- Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017;, Aluminium: the strategic metal industry A 'core industry', Aluminium Association of India, accessed July 2017; India, is it the next China?, Vedanta Resources PLC, http://www.vedantaresources.com/media/175363/asia_mining_congress_-_tom_albanese.pdf, Pg. 5, accessed August 2017

The 'Make in India' initiative has provided a boost to investments by allowing 100 per cent FDI in major areas of the infrastructure sector such as railways, roadways, ports and inland waterways, aviation, and power. Favourable investment policies will facilitate the growth in the sector which can increase the demand of non-ferrous metals as this sector consumes these metals in large volumes. Further, the enhanced growth in the 25 identified sectors due to the initiatives and policy changes under 'Make in India' is expected to have a direct positive impact on the non-ferrous metals industry as these metals have widespread applications in these sectors.

The table shown below indicates the extent of impact of these specific sectors on the demand for major non-ferrous metals.

Impact of sectors on non-ferrous metals demand

Sectors	Aluminium	Copper	Zinc
Automotive	High	Medium	High
Aviation	High	High	Medium
Biotechnology	Low	Low	Low
Chemicals	Medium	Medium	Medium
Construction	High	High	High
Defense manufacturing	High	High	High
Electrical and Electronics	High	High	Medium
Food Processing	High	Medium	Low
IT and BPM	Low	Low	Low
Leather	Medium	Low	Low
Media and Entertainment	Low	Low	Low
Mining	Low	Low	Medium
Oil and Gas	High	Medium	Medium
Pharmaceuticals	Medium	Medium	Low
Ports	High	High	High
Railways	Medium	Medium	High
Renewable energy	Medium	High	High
Roads and highways	Low	Low	Medium
Space	High	Medium	Medium
Textiles and garments	Medium	Medium	Medium
Thermal	High	High	Medium
Tourism	Low	Low	Low

Key: High Impact; Medium Impact; Low Impact

Source: KPMG in India's analysis, 2017

Even though non-ferrous metals find applications across the spectrum, there are a few key sectors that contribute to the vast chunk of the consumption. These sectors, namely transport (automotives), electricals and construction have widespread application of the non-ferrous metals and are major drivers of consumption-led growth. Additionally, the steel sector consumes the majority of Zinc produced for the process of galvanisation.[25]

25. Zinc-Indian Minerals Yearbook 2015 Vol. II- Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017

End-use consumption share of non-ferrous metals

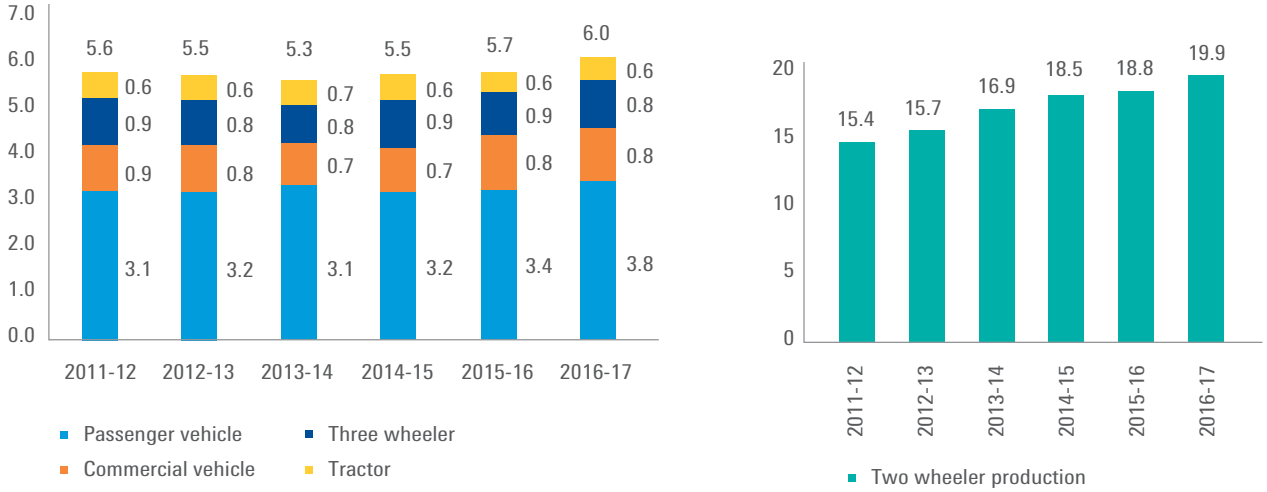
Source: Aluminium, Copper, Lead, Zinc-Indian Minerals Yearbook 2015 Vol. II- Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017

Transport/Automotive sector

The automotive sector in India is a major contributor to the economy and comprises of several segments such as two wheelers, passenger vehicles, commercial vehicles and three wheelers. Demand in the Indian automotive industry still relates to increases in earnings and the price of fuel in addition to interest rates as a majority of car purchases in India are credit financed.

The automotive sector has witnessed robust growth over the last decade. However, the growth rate has moderated in recent years due to the temporary effects of an economic slowdown.

Automotive production (excluding two wheelers) (LHS) and two-wheeler production (RHS) (in million units)



Source: Automobile Production Trends, SIAM, April 2017/ July 2017

The growing long-term demand has caused a strong influx of investments into the different segments of the industry. Also, automotive manufacturing remains one of the main driver of the 'Make in India' initiative and the government has undertaken several major initiatives listed below:

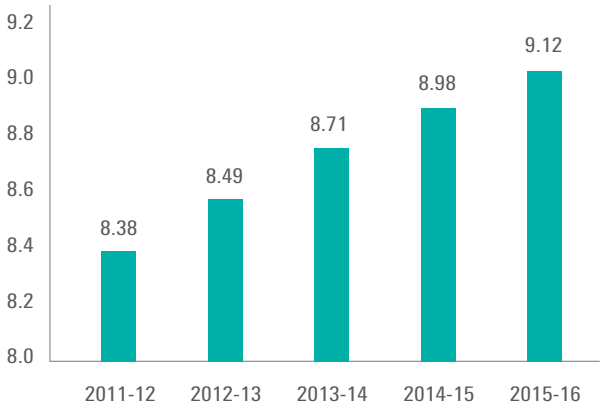
- The 'Automotive Mission Plan 2026' (AMP 2026) aims to develop the Indian automotive industry and seeks to increase the net exports along with promoting safe, comfortable and efficient mobility
- The FDI policy 2016–20 to allow 100 per cent FDI for the auto component sector to promote foreign investment and technology in the automotive sector
- The National Automotive Testing and R&D Infrastructure Project (NATRiP) programme is focussed on low-cost manufacturing and product development solutions
- Differential GST for electric automotives to increase adoption of electric vehicles in India.

The Indian automotive industry is expected to witness strong growth of over 10 per cent in the long-term. Apart from the government reforms, the other factors such as easing of finance costs, the economy's recovery from the recent moderation, increased earnings and consumer confidence can boost automotives sales in India. Additionally, the sector is expected to witness several new technologies such as self-driven cars, hybrid/electric cars and lightweight (Aluminium) body cars for fuel efficiency. The adoption of these new technologies is expected to increase the consumption rate of non-ferrous metals as compared to their current usage.

Construction sector

The construction sector, comprising real estate, industrial construction and infrastructure segments is a key driver for the overall growth of the Indian economy. The infrastructure and industrial construction segments are heavily influenced by economic growth as well as the policies and initiatives by the government for infrastructure upgradation. The construction sector accounted for 7.8 per cent of the country's GDP in 2015-16 and was the second largest employment generating sector employing around 35 million people.[26]

Construction value (in lakh crore INR)



Source: India GDP data at 2011-12 prices, Central Statistics Office – Ministry of Statistics Program Implementation, accessed July 2017

26. Make in India: Construction sector, Make in India website http://www.makeinindia.com/sector/construction, accessed July 2017

The sector is generating high levels of interest from domestic as well as foreign investors and has witnessed several major investments in the recent past. The government too has placed a strong emphasis on the development of the infrastructure, has undertaken several initiatives and instituted policy reforms to provide an impetus to the industry.

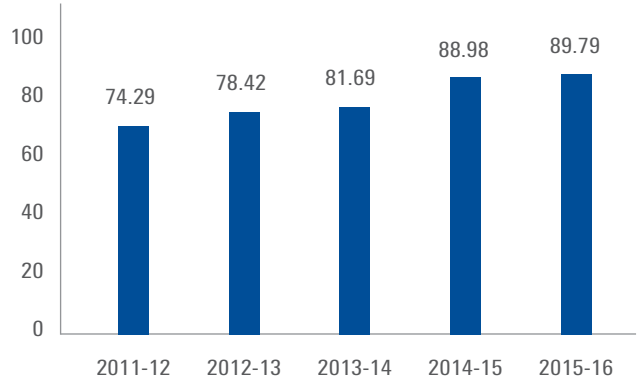
- Strong focus on Prime Minister Krishi Sinchayee Yojana (PMKSY) and Accelerated Irrigation Benefits Programme (AIBP)
- The Ministry Of Urban Development has outlined plans in six states under the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) scheme, to improve basic urban infrastructure over 2016-17 to 2019-20
- Development of 100 smart cities across the country
- The government's FDI policy outlined in 2015 allows 100 per cent FDI in construction under the automatic route.

India had an urban housing shortage of 18.8 million dwelling units[27] at the time of the government's launch of the 'Make in India' initiative and its focus on affordable housing is expected to be a growth driver for the construction industry. The Indian construction industry is expected to demonstrate healthy growth over the long-term.

Electrical sector

The electrical sector consists of machinery and equipment for the generation, transmission and distribution of electricity. The increase in industrial development, rapid urbanisation and infrastructure developments and government initiatives for electrification of villages has resulted in healthy growth in the sector.

Installed electricity generation capacity (GW)



Source: Annual Report 2015, Central Electricity Authority, accessed July 2017

The transmission and distribution sector has also grown along with the power capacity additions, and the growth rate is expected to increase in the future. The sector has been receiving significant interest from both the public and private players with several investments made in the sector:

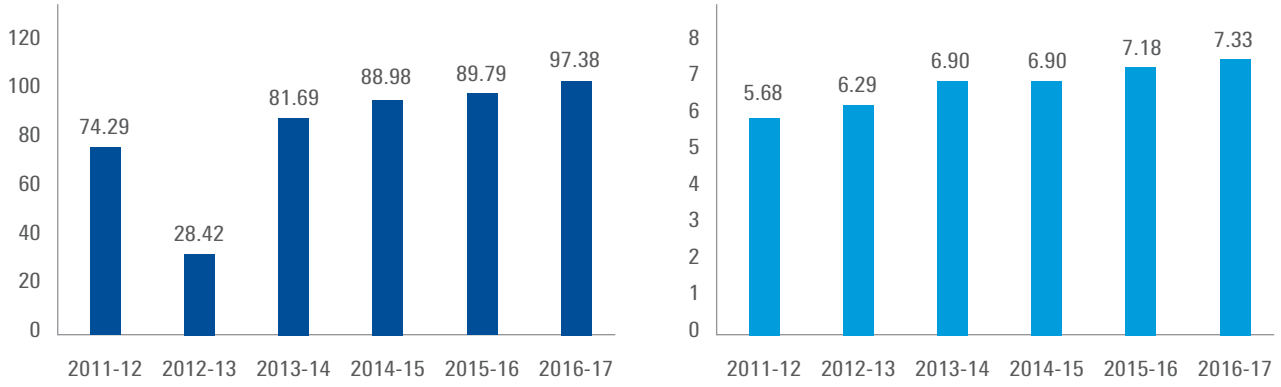
The government has targeted a generation of two trillion kWH of energy by 2019. This would involve doubling the current production capacity to provide uninterrupted power supply for industrial, commercial, residential and agricultural use. The increase in generation capacity can be accompanied by corresponding increases in the distribution and transmission facilities. The additions in capacity in the generation, transmission and distribution facilities is likely to lead to an increased demand for non-ferrous metals. Also, in order to achieve India's renewable energy target of adding 175 GW of renewable energy by the year 2022, the government has taken steps such as providing a 10-year tax exemption for solar energy. The solar energy sector is further expected to support the demand for non-ferrous metals.

27. Make in India: Construction sector, Make in India website http://www.makeinindia.com/sector/construction, accessed July 2017

Galvanised steel sector

The steel sector contributes around 2 per cent[28] to India's GDP with India being the world's third largest producer of steel in 2016. India's comparatively low per capita steel consumption coupled with increasing consumption from sectors such as construction and manufacturing is expected to provide strong growth opportunities for the Indian steel sector.

Total crude steel production (LHS) and GP/GC sheets/ coils production (RHS) (in million tonnes)



Source: Annual Report 2016 – 17, Ministry of Steel, accessed July 2017

The steel sector is one of the most important contributors to India's manufacturing output and India has made every effort to continuously upgrade and modernise its facilities. The sector has seen several major investments in the recent past. The Government of India has undertaken many initiatives and implemented policies to provide an impetus to the steel industry.

The Indian steel sector including galvanised steel is poised to experience accelerated growth due to the rising consumption from the infrastructure and industrial sector. The low per capita consumption of steel in India, coupled with government initiatives and rising investments offers the potential for growth in the industry. The government has an ambitious target of achieving 300 million tonnes of steel capacity by 2025.

Additionally, the galvanised steel sector which is a major consumer of Zinc is expected to witness increased growth rates due to accelerated growth in sectors such as construction, automotives and consumer durables. The growth in the galvanised steel sector is expected to be a major contributor towards increased demand for Zinc.

26. Contribution of Steel sector to India's GDP, Press Information Bureau – Ministry of Steel, Government of India, November 2016/ August 2017

Other end users sector

While the above are just a few large end use segments of Non-Ferrous Metals, there are numerous range of application areas in multiple other end use sectors with this list expanding with new developments. Packaging is a major sector that is exploiting Aluminium consumption in pharmaceutical and processed foods industry due to its environmental friendliness compared to plastics and its ability to take any shape. The large and growing middle class along with the organised retail industry in India is fueling growth of the packaging industry which can increase the consumption of Aluminium. Whereas, consumer durables is another industry which finds wide applications of non-ferrous metals such as Aluminium and Copper mainly in Air conditioners, refrigerators, fans and washing machines.

Demand for these metals is expected to be driven by Air conditioners and refrigerator segment due to growth in personal disposable income and rise in usage penetration going forward.

Renewable energy is also a growing sector which consumes non-ferrous metals like Aluminium, Copper, and Lead, etc. Due to increased thrust of government on renewable source of power, solar energy is expected to see unprecedented growth in terms of capacity addition which can lead to a step change in demand for non-ferrous metals such as Copper, Aluminium and Lead in the renewables segment. Demand for these metals from this sector is expected to grow due to non-renewable generation capacity addition in future.

New development in the applications of non-ferrous metals

The non-ferrous metals industry is witnessing a paradigm shift in the way metals will be consumed in the future. With steady growth in demand, producers should move beyond traditional strengths in the electricals, automotive and building segments and shift to emerging applications offered by defence and aerospace, hybrid and electric vehicles, railways, etc.

Defence and Aerospace

Aluminium is widely used in making various ammunition components, parts for missiles and missile batteries, tanks, and components in aircrafts and satellites. Due to its ability to withstand high and low temperature, vibration load and radiation, Aluminium finds wide acceptance in the defence and aerospace sectors. A growing number of emerging applications in both these sectors make Aluminium the metal of choice in the future.

A growing middle income group and airfare rationalisation by airlines are key growth drivers for the aviation market which is increasing passenger traffic and subsequently driving demand for aircrafts including its maintenance and repair operations. This is likely to boost the demand of Aluminium as it accounts for 60-80 per cent[29] of aircraft weight. Defence being a key strategic area is drawing more attention from the central government. The government is trying to boost defence manufacturing in India by giving more opportunity to Small and Medium Enterprises (SMEs) under the 'Make in India' campaign, apart from easing FDI norms and increasing its allocation in the budget. One of the biggest challenge in producing good quality grade alloys in defence and aerospace is technology and infrastructure related constraints. The need of the hour is to establish modern facilities in India or to form joint ventures with foreign companies for advanced manufacturing. Many companies have already started investing in setting up dedicated facilities for manufacturing of defence and aerospace components using high end alloys of Aluminium which pave the way for the increased usage of Aluminium in India.

While Aluminium finds its usage in wide applications such as aircrafts, missiles, spacecrafts and small warships, there are other non-ferrous metals which find relevance in many applications such as Copper in ammunitions, rockets and high explosive anti-tank shells, Zinc in ship building and Lead in batteries, ammunition and radio equipment.

Hybrid and Electric Vehicles (HEVs)

The government launched the National Electric Mobility Mission Plan (NEMPP) 2020 in 2013 to promote hybrid and electric vehicles and work towards achieving fuel security in India. There is an ambitious target to achieve sales of 6-7 million units of hybrid and electric vehicles by the year 2020. To achieve this target, the government has launched Faster Adoption & Manufacturing of Hybrid and Electric Vehicle under NEMPP 2020, which focusses on the development of indigenous technology and enhance the Research and Development (R&D) capability to develop and manufacture components, demand creation, pilot projects and enhancement of charging infrastructure.

Aluminium and Lead are the two metals that are expected to potentially benefit due to the increasing usage of hybrid and electric vehicles. Using Aluminium in HEVs means lower fuel consumption, reduced CO2 emissions and reduced demand for raw materials since a high proportion of end-of-life product used are recycled. Usage of Lead has essentially been in batteries, and it has been the source of power for starting, lighting and ignition (SLI) for the automotive industry for over a century.

Railways

Growing industrialisation in the country has increased freight traffic over the last decade which has in turn increased the demand for wagons. During 2011-2016, the demand for wagons has grown at a CAGR of 18 per cent[30] and the freight traffic is expected to significantly due to government investments and private sector participation, which could create more demand for wagons in the future.

29. Government policies driving Aluminium usage in auto industry – Metal World January 2015, Aluminium Association of India, http://www.Aluminium-india.org/pdf/govt-policies-driving-alu-usage-in-auto-industry-prof-k-s-s-murthy-Hon-Gen-Secretary-AAI.pdf, Pg. 2, accessed July 2017

30. Statistical Summary- Indian Railways, Ministry of Railways, accessed July 2017; KPMG in India's analysis, 2017

The government has also taken various initiatives to boost this sector through its 'Make in India' initiative such as easing of FDI norms, allocation of funds for 2700-km Dedicated Freight Corridor projects, etc. Also, the coaches of the proposed high-speed train between Mumbai and Ahmedabad are intended are intended to be made of Aluminium as the light-weight train uses less energy and moves faster in comparison to steel coaches[31]. Hence, there are sufficient opportunities for Aluminium to become the next raw material for railway wagon-making as it has several benefits over steel i.e. it is lightweight, is resistant to corrosion, can be continuously recycled, has a high strength to weight ratio and is environment-friendly.

Other application areas

Healthcare

Aluminium is finding increasing application in various areas of the healthcare industry - in medical cases, trays and general hospital and devices due to its intrinsic sustainable qualities (light weight, recyclability, strong, non-toxic, and it accepts many type of finishes).

Solar panels

Aluminum extrusions can be used to create a thorough framework for solar panels in a variety of situations, including frames, supports and connectors as it is lighter than other metals, making them easier to transport and assemble in remote locations.

Refrigerator and Air conditioner (AC) segment

Copper is widely used in this segment. Owing to low penetration of ACs in India, the segment has witnessed a significant growth in the past Leading to healthy growth in the demand for Copper, which is expected to continue the growth momentum. In the refrigeration segment, demand for Copper is expected to be driven by a growing need of visi-coolers, deep freezers, water coolers and cold storage facilities.

Radiation shielding

Due to its high density, Lead is used in various forms of radiation shielding. For example, metallic Lead is used in shielding of a container for radioactive materials, Lead sheets are used in rooms where x-ray machines are installed and Lead powder is incorporated into plastic and rubber sheeting as a material for protective clothing.

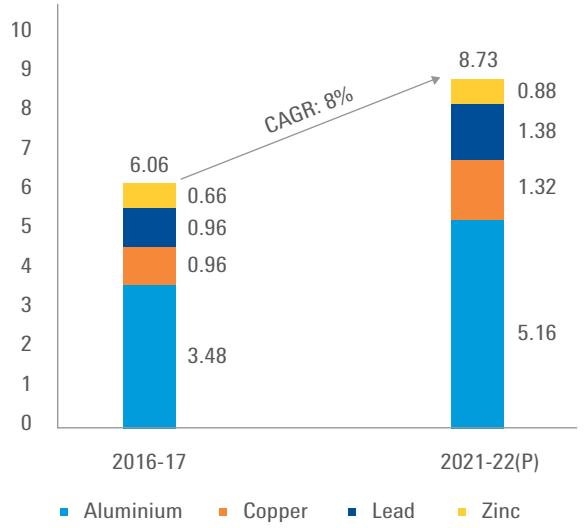
Marine application

Aluminium finds applications in shipbuilding and fabrication of components in offshore platforms due to its unique properties such as corrosion resistance, light weights superior mechanical properties, high recyclability etc. Manufacturers have utilized these properties in design of ships and boats with high-speed capability, long life, high payloads, low maintenance costs, and high recycle value. Many high-speed patrol and military boats in service worldwide are built with mono-hulls and topsides of aluminum alloys.

Thus, considering the strong economic prospects, a thrust on manufacturing sector growth, the expected growth in key end-use segments and advent of new application areas, the demand for non-ferrous metals is expected to witness strong growth in future

31. Global tender for procuring 300 Aluminium coaches shortly , The Economics Times, http://economictimes.indiatimes.com/industry/transportation/railways/global-tender-for-procuring-300-Aluminium-coaches-shortly/articleshow/54389472.cms, accessed August 2017

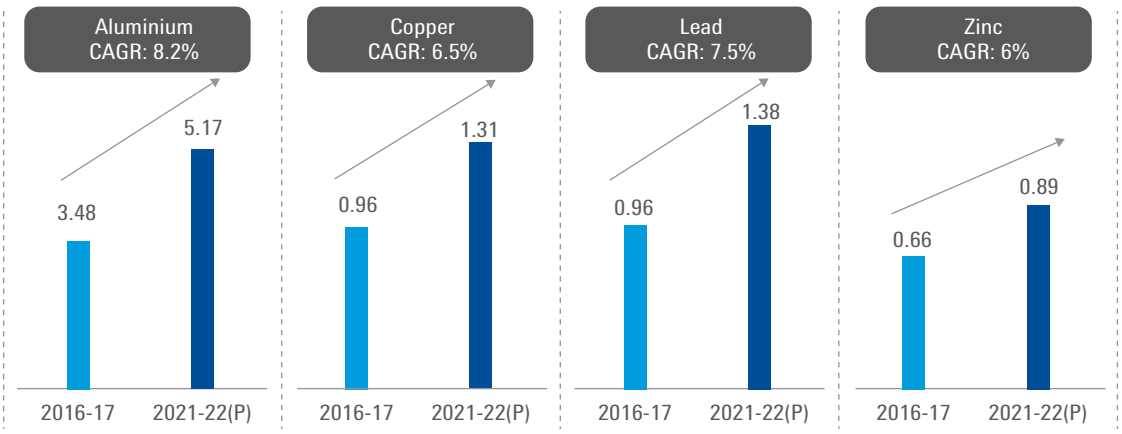
Non-ferrous metals consumption growth (in million tonnes)



Source: Aluminium, Copper, Lead, Zinc-Indian Minerals Yearbook 2012 to 2015 Vol. II- Reviews on Metals and Alloys (Final Release),Indian Bureau of Mines, , accessed July 2017; Monthly Summary on Non Ferrous Minerals and Metals, Ministry of Mines, Government of India, accessed July 2017; Commodity wise Import –Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017; Company data, KPMG in India's analysis, 2017; Secondary Lead and Zinc Industry- Global and Indian Scenario, India Lead Zinc Development Association, accessed July 2017

Demand for non-ferrous metals is expected to grow at a CAGR of 8 per cent in the next five years till 2021-22 due to healthy demand from the automotive, electrical and galvanising steel sector along with some other new application areas such as defence and aerospace, hybrid and electric vehicles, railways, etc.

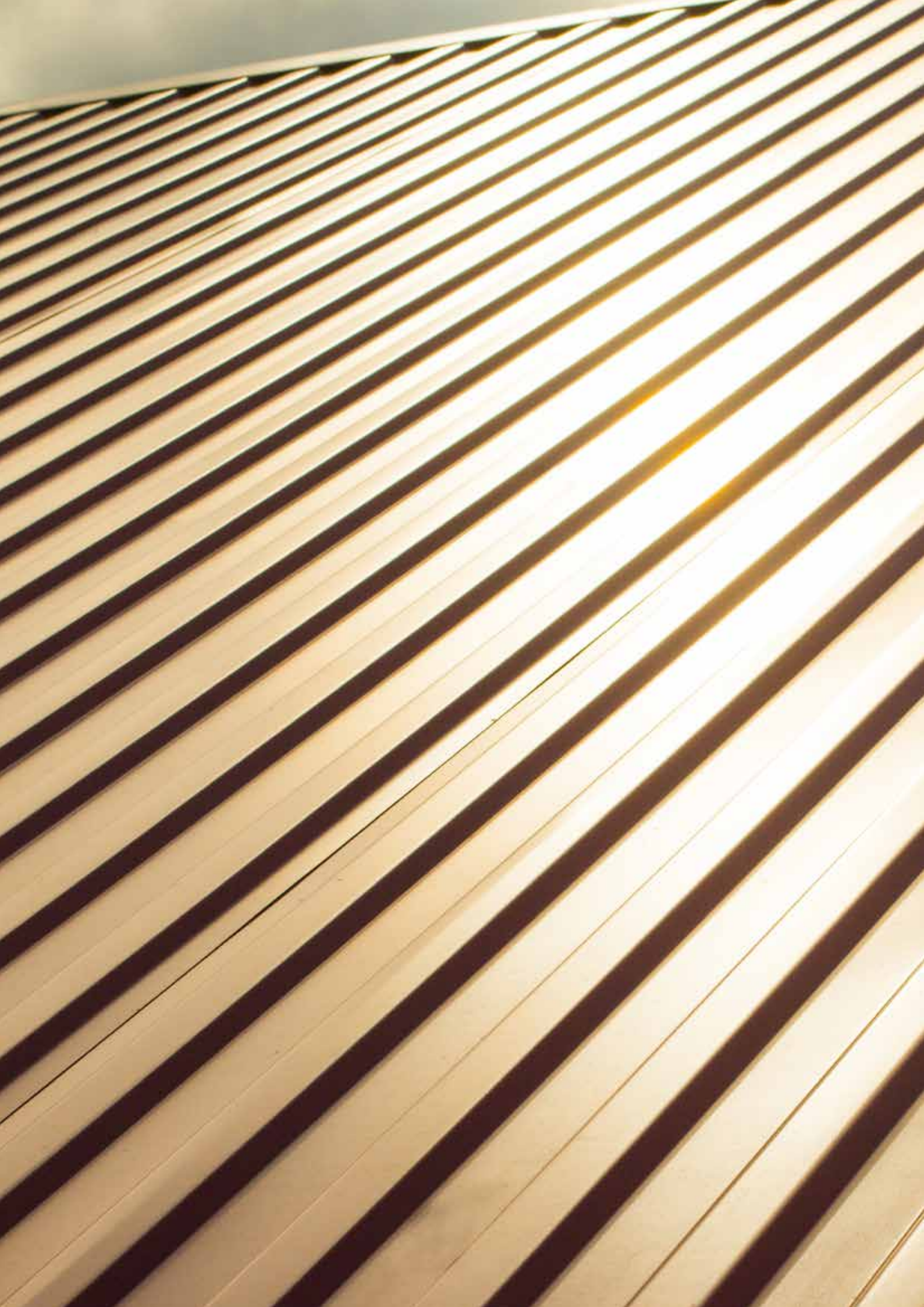
Metal-wise demand forecast (All figures in million tonnes

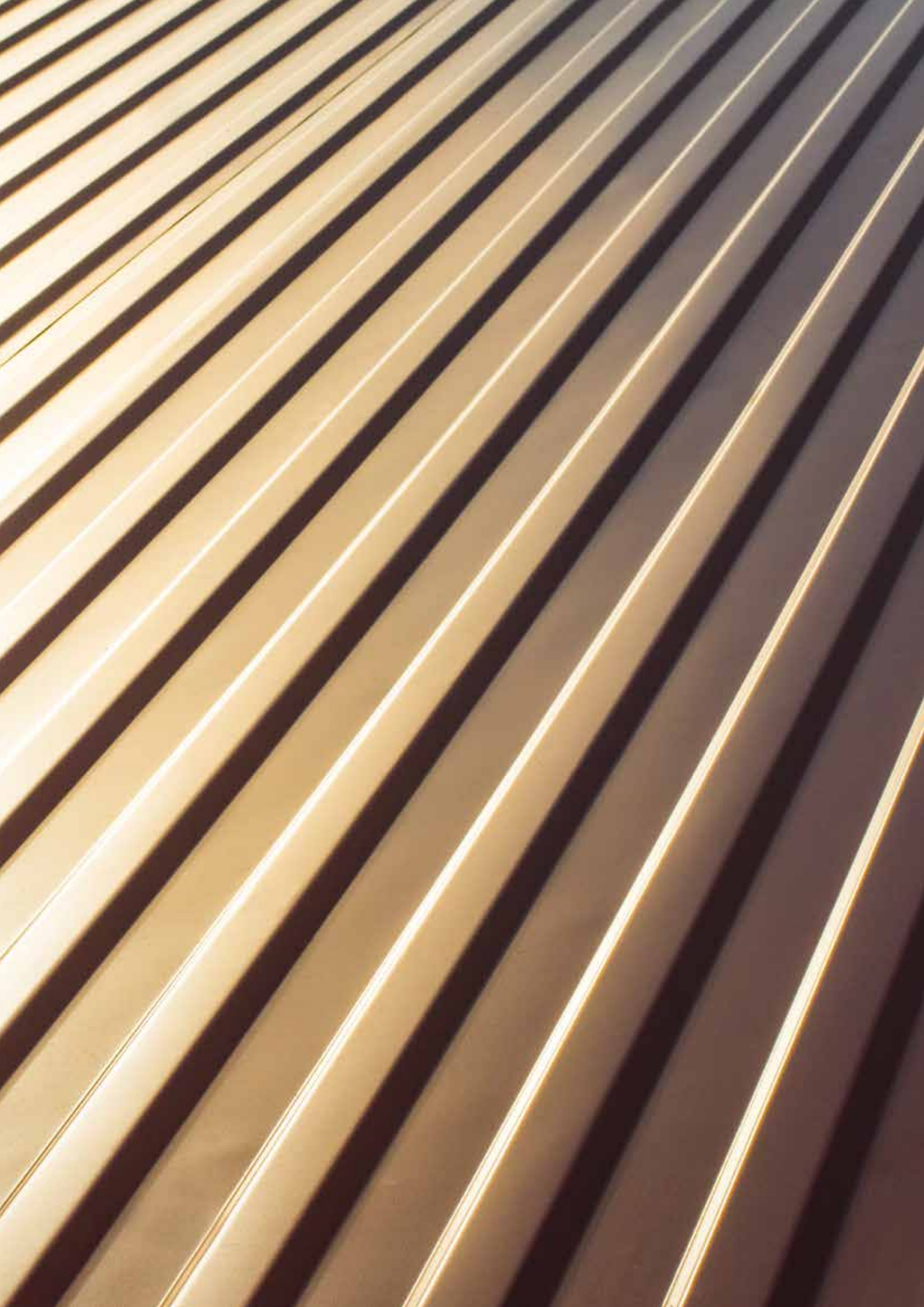


Source: Aluminium, Copper, Lead, Zinc-Indian Minerals Yearbook 2012 to 2015 Vol. II- Reviews on Metals and Alloys (Final Release),Indian Bureau of Mines, , accessed July 2017; Monthly Summary on Non Ferrous Minerals and Metals, Ministry of Mines, Government of India, accessed July 2017; Commodity wise Import –Export, Export Import Data bank, Directorate General Foreign Trade, http://commerce.nic.in/eidb/default.asp, accessed July 2017; Company data, KPMG in India's analysis, 2017; Secondary Lead and Zinc Industry- Global and Indian Scenario, India Lead Zinc Development Association, accessed July 2017

While the demand for Aluminium, Copper and Lead is expected to grow faster at a CAGR of 8.2 per cent, 6.5 per cent and 7.5 per cent respectively, the demand for Zinc is expected to be relatively slower. The growth in Aluminium and Lead is expected to be driven by high growth in the automotive segment, while the government's thrust through electrical sector reforms augurs well for both the Copper and Aluminium industry as the electrical sector[32] is the largest consumer of these two metals.

32. Aluminium, Copper -Indian Minerals Yearbook 2015 Vol. II- Reviews on Metals and Alloys (Final Release), Indian Bureau of Mines, accessed July 2017





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