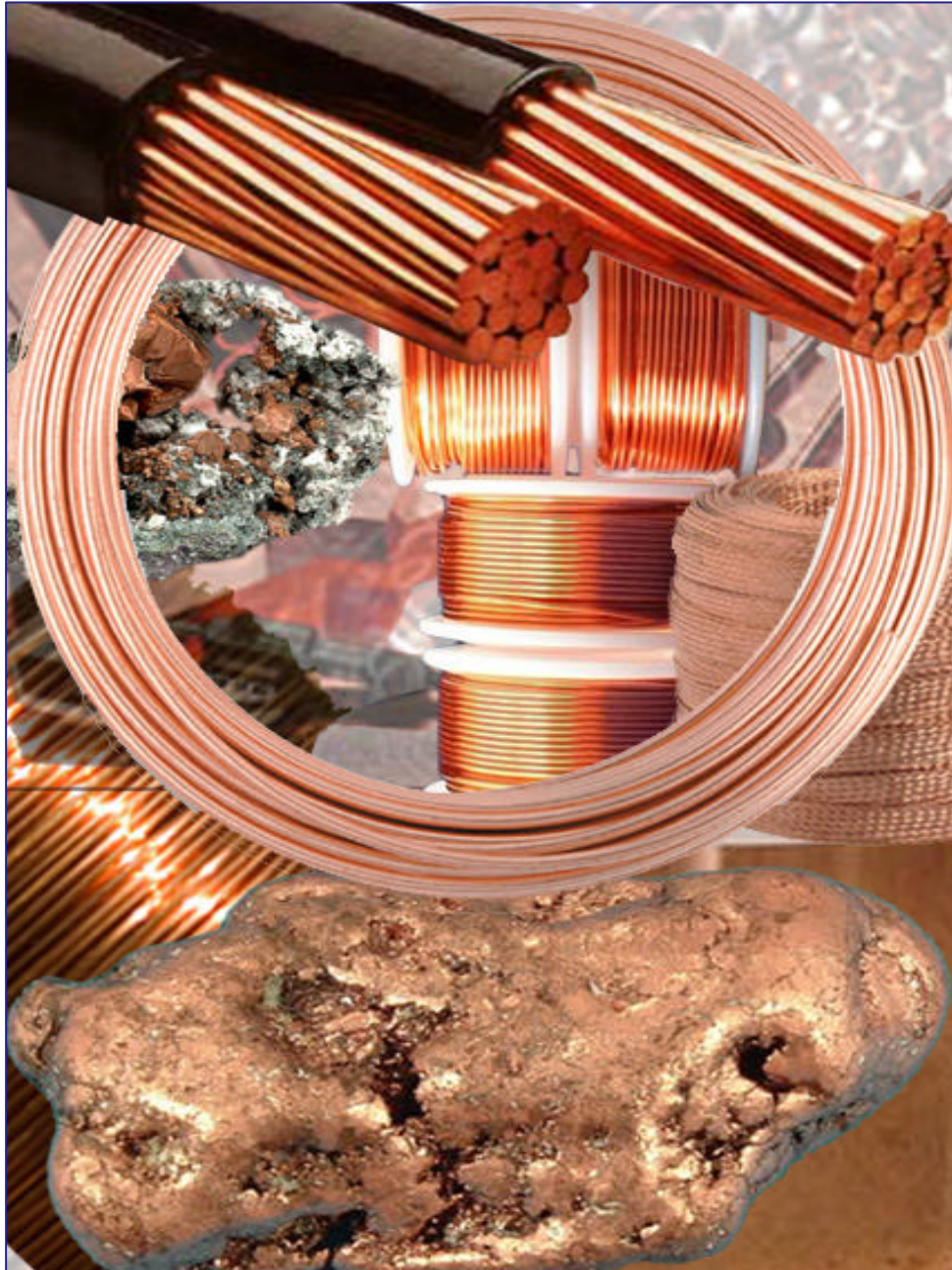


## Base Metals



### Chinese demand to sizzle copper

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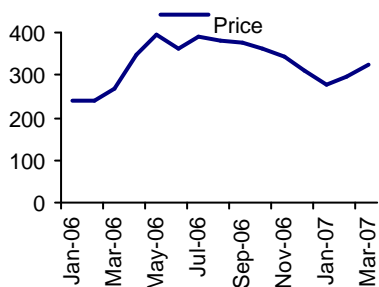
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**April 2007**

### Commodity - Copper

Recommendation	BUY
CMP - MCX	Rs338.4
Target Price	Rs364-380
52 Week H/L	Rs397.8 / 244.8
Avg Volume (Daily)	Rs1940bn
Margin	6%

### Commodity Price Chart



## Investment Case

### China not to take its foot off the pedal soon

The current backwardation situation indicates tight supply scenario prevalent in the industry, which is due to huge demand from the Chinese market. This demand will be driven by investments in the power and construction sector, coupled with robust consumption. Double digit growth rate in the power generation sector over the next five years will support China's copper demand for the year. Demand from construction and consumer durables is expected to be robust during the year, rising at a rate of 18% and 13% over CY2006 respectively. The State Reserve Bureau (SRB) is expected to replenish its stock piles during the year, raising demand forecast for CY2007 by 10.8% - 13.5% to 3.9 - 4.1mn tons.

### Inventory levels not enough to cushion supply cuts

Inventory levels of copper are not enough to cushion any drop in supply. The current inventory levels are approximately equal to 3.5 days of cover as per the demand forecast for CY2007. The average inventory levels maintained throughout the year for CY2005 was 1.2 days and that in CY2006 was equal to just 2.5 days of usage. Though the current levels are higher than that of the last two years, it is much lower than the 21.5 days witnessed in CY2002 and 12.8 days in CY2004. The rise in the demand from China has led to a drastic reduction in the inventory levels in the past one month. The decrease in the inventory levels will support the rally in copper prices.

### Resurgence of Euro Zone led by Germany to consume more copper in CY2007

For the last decade every market player has been talking about the strong demand from the emerging markets like India, Thailand, Brazil and many more. People have agreed to these arguments and today everyone is focusing on this. But in the shadow of the emerging markets the Euro zone has been rising every quarter in the last 2 years. The Euro Zone Gross Domestic Product (GDP) growth was 2.7% in 2006, the best performance since 2000 and is expected to witness a growth of 2.3% in 2007. The GDP and the manufacturing sector in the Euro zone has been rising quarter on quarter indicating to a rise in the demand for the industrial metals. According to ICSG, the demand from Europe is expected to be more than 5mn tons in the CY2007, a rise of 2% from that of CY2006.

### U.S economy moderating, not headed for recession

The US economy has coped very well with the hit to GDP growth from the housing recession. Forecasts that the housing slump would push the broader economy into recession have been wide off the mark. But the direct effect on economic growth is not the only transmission mechanism. The next issue is whether cutbacks in the supply of housing loans could trigger a financial crisis. If so, this would be a genuine threat to the health of the US economy. We assume that the rate tightening cycle is over and the Fed can cut its interest rates as we move into the second half of the year. We assume that the slump in the housing sector has bottomed out and the demand for the metal will remain around current levels.

**Markets back to backwardation:**

According to the ICSG, the concentrates market is likely to come into surplus only in 2008. ICSG estimates that close to 700,000 tons of production was lost in 2006 leading to backwardation in the first three quarters of CY2006. Post February 2007, markets are getting back to backwardation from contango, indicating that the demand for the metal is higher than the supply at the moment. The rise in the demand for metal from China has been responsible for the backwardation in copper. Thus, we believe that the shift from contango to backwardation is the start of a bull run in the short term. Expect prices to move northwards in the next two months with the markets continuing to witness a backwardation scenario.

**Outlook:**

We expect copper prices to remain strong in the near term as inventories are low and consumers are looking for opportunities to buy. A combination of the above factors will support the rise in copper prices. The world demand is expected to rise by 6.4% in CY2007 to 18.11mn tons while the supply is expected to rise by 8% to 18.9mn tons in CY2007. The majority of the rise in the copper supply is expected to come in the last quarter of CY2007 and not before that. Thus, the gap between the demand and supply in the first half of the year is expected to keep prices in the range of US\$7000-7500 in the first three quarters of CY2007.

**Recommendation:**

The bearish phase in copper witnessed in Q4CY2006 was a buying opportunity for the market players. Copper prices are expected to remain firm on account of increased capital flows moving into commodity market and demand is expected to outpace supply. Although an increase in global copper stocks is possible in CY2007, holdings will remain relatively low. While growth in refined copper production is expected to be faster than that of refined copper consumption, majority of the new projects are expected to come online in the last quarter of CY2007 or beyond. We expect the current rise in the seasonal demand from China to push prices towards the US\$8000 and then towards US\$8500 levels in CY2007.

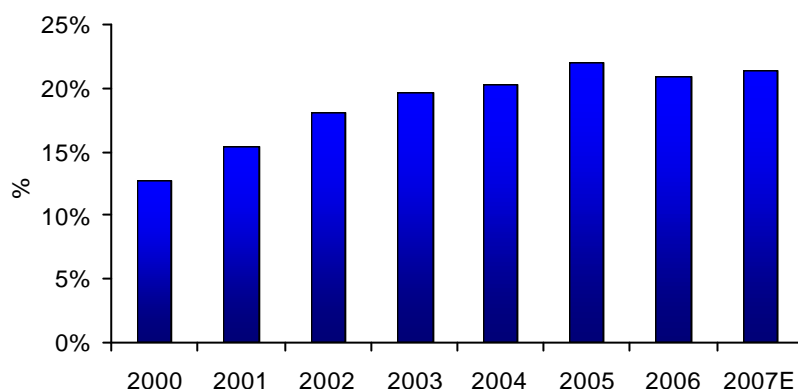
**Technical recommendation:**

The long term trend of copper is positive and the fall witnessed in the last quarter of CY2006 and January 2007 from the high of Rs398 was only corrective in nature. We expect the rally in copper prices will continue further and may see a new high in the next couple of months. MCX COPPER (April) is expected to rise to Rs360 and if this level is broken, prices are expected to rise further to Rs380.

### Has China's hunger for commodities extinguished?

Over the years, China has become a major player in the copper industry. In 2006, it accounted for around 21% of the total global consumption of copper rising from a share of 12% in CY2000. China's copper consumption has more than doubled from 1.8mn tons in CY2000 to 3.6mn tons in 2006, reflecting faster population growth and rising incomes. This in turn, has boosted demand for resource-intensive products such as automobiles, consumer durables, electricity and residential houses.

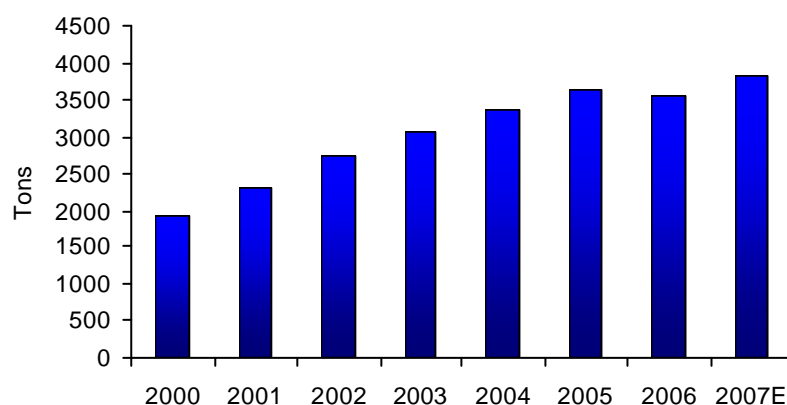
### Chart: China's share of world copper consumption



Source: ICSG, India Infoline Research

China's apparent consumption of copper which grew at a CAGR of more than 15% in the last five years and is expected to continue to drive the global demand for copper over the next three years. Buoyed by the growing urbanization and construction activity, ICSG expects its consumption is expected to grow at a CAGR of 10% during the next three years.

### Chart: China's copper consumption



Source: ICSG

The recent fall in copper prices were on prospects of a decrease in the demand for copper from China. Traders have been selling copper on the sharp year on year decline in Chinese copper imports, which indicate a decline in copper demand. But when we look at the consumption of copper in China over the year we come to a different conclusion. We witnessed a selloff in the last quarter of CY2006 continuing into January on a sharp year on year decline in Chinese imports, leading to suggestions that the copper demand from China, the largest consumer was decreasing.

Chart: China's total copper imports

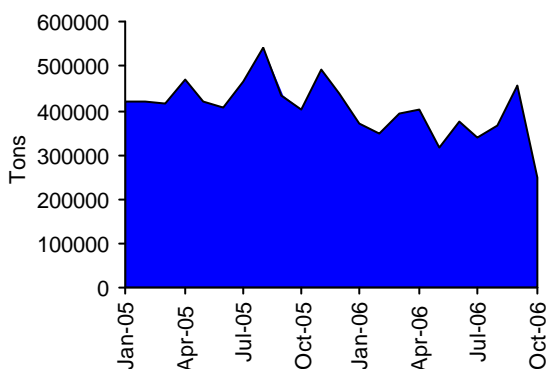
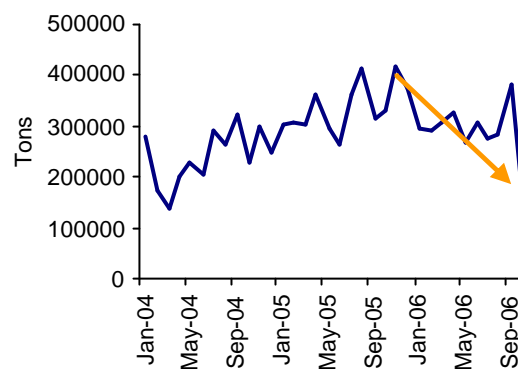


Chart: China's copper concentrate imports



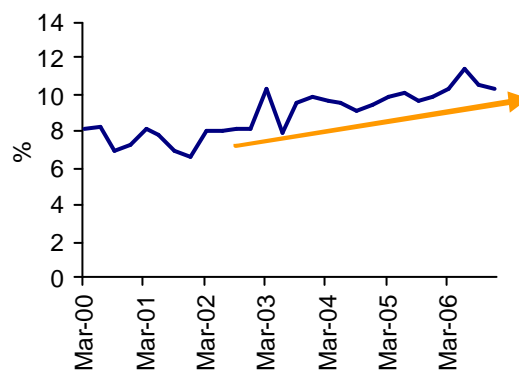
Source: Bloomberg

The two charts above show a decline in imports by China until the month of November 2006. Copper concentrate imports in China were 177,936 tons, the lowest in the last two years, a drop of around 57% from the 417,144 tons imported in November 2005. Looking at the graph above, many believe that the double digit growth achieved in China over the last two years was under threat was slowing down CY2007. But the industrial manufacturing figures released during the period indicate a varied view. It shows that the economy is still booming and on course for a double digit growth this year too. Though the industrial production figures are indicating a dip from the highs of May 2006, it is still around the average growth rate achieved in the last two years. The GDP too has been growing at double digits since the last four quarters. If you think that the dip in the last quarter is indicating a slowdown in the Chinese economy, remember that the numbers are on a strong 2005 economy base.

Chart: China's GDP Q-o-Q



Chart: China's Industrial production M-o-M



Source: Bloomberg

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In CY2006, China's Gross Domestic Product (GDP) grew by 10.4% and according to IMF estimates, it is expected to rise further by 9.2% in CY2007. The performance of the copper consuming sectors in China in CY2006 and its expectations in CY2007 are listed below:

**Table: Performance of major copper consuming sectors in China**

Sector	CY2006 Description	CY2007 Estimate
<b>Construction</b>	Construction industry saw a growth of 20.3% in CY2006, reaching US\$152.9bn.	In CY2007 the sector is expected to grow at 18%.
<b>Power</b>	Total installed capacity rose to 622GW in CY2006, up 20.3% from the previous year.	Installed capacity is expected to grow to 720GW in CY2007 and 10% a year until 2009.
<b>Electronics</b>	China's telecom market has 461mn mobile phones and 368mn fixed-line phones as on January 2007.	The number of mobile phones is expected to grow by 60mn and fixed-line phones by 10mn in CY2007.
<b>Automobile</b>	China's auto industry sold 7.22mn vehicles, an increase of 25% over CY2005.	It is expected to sell around 8mn. Units in CY2007.
<b>Consumer durables</b>	Retail sales reached US\$0.951 trillion in CY2006, up 13.6% in CY2006 and the biggest Y-o-Y increase since CY1997.	Consumer goods sales are expected to surge by 13% to US\$1.075 trillion in CY2007.

**Source:** China Building Materials Industry Association, China's Ministry of Commerce, China's 10<sup>th</sup> and 11<sup>th</sup> 5-year plan, China's Ministry of Information Industry.

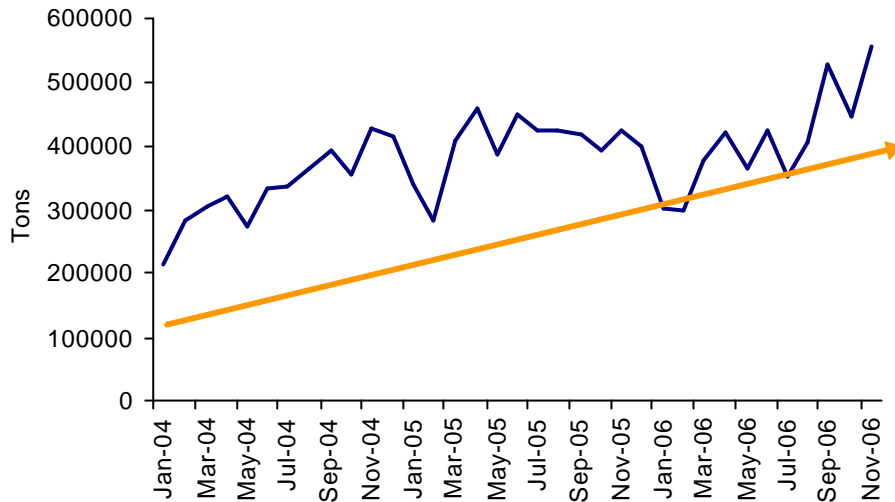
### Do the facts and figures listed above show any signs of the economy slowing down or the economy moderating?

Given that the apparent consumption data is contradictory with the headline economic data, the divergence is clearly explained by the destocking. We believe that the demand for the metals has in fact increased and not decreased in the year 2006. The decrease in the apparent decrease in demand can be because of the following reasons:

- √ Destocking by the State Reserve Bureau (SRB)
- √ Usage of more scrap to produce copper

The SRB is believed to have destocked heavily and released 200,000-400,000 tons of copper into the market to meet the demand from the user industries.

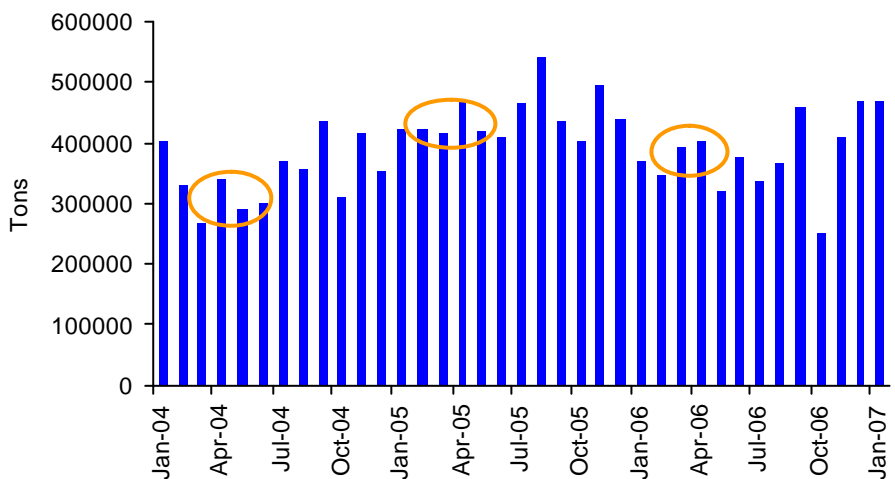
Chart: Copper scrap imports into China



Source: Bloomberg

Further, in CY2006 the usage of scrap to produce refined copper has increased due to high concentrate prices. The use of scrap last year has increased around 400,000 tons. Copper scrap imports increased to its highest level in a month in the last five years to 554,419 tons in November 2006. High prices of copper concentrate led to a 10% rise in imports of copper scrap in the second half of CY2006.

Chart: China's copper imports



Source: Bloomberg

Hence, we believe that the year CY2007 is expected to witness a rise in the demand for the metal from China. The rise in imports in the last two months has provided evidence that destocking has ended and the demand from the end users will lead to a rise in the demand for the metal. Also, with the advent of summer in China, the demand for copper from the refrigerating industry will increase. Over the years the period of March-May has witnessed a rise in the demand for the metal. The air conditioning industry saw a growth of 13.33% in CY2006 to 85mn units and is expected to further rise by 10%. The ICSG expects copper consumption in China to rise by 7.07% from 2006's consumption of 3,566,000 tons to 3,816,000 tons in CY2007.

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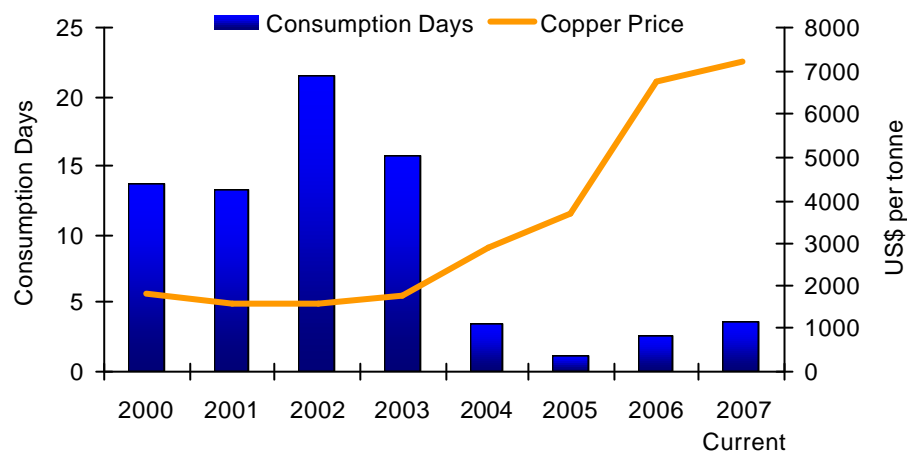
But we expect the demand for copper in the CY2007 to be higher than the forecast by the ICSG. We expect the SRB to replenish its stocks sold last year, raising the demand forecast for CY2007 to be around 4,000,000 tons. Thus, we expect that the hunger for the metals from China to remain intact and not reduce in the time to come. The bull rally in the metals pack led by China's resurgence in the world economy is on and we expect prices to remain around the \$7000 mark in the first half of CY2007.



**Low inventory levels**

The inventory on the LME has not improved to levels wherein one can feel secured. The current inventory level of 178,075 tons is approximately 3.5 days of cover as per the demand forecast for CY2007. At a glance the figure will bring in concerns in the readers mind, but when you compare with the levels we reached in 2006 the reading changes. In June 2005, stocks on the LME fell to as low as 25,525 tons, which is less than a single day's demand as per the demand of CY2005. The average inventory levels maintained throughout the year for CY2005 was 1.2 days and that in CY2006 was equal to just 2.5 days of usage. Though the current levels are higher than that of the last two years, it is much lower than the 21.5 days witnessed in CY2002 and 12.8 days in CY2004.

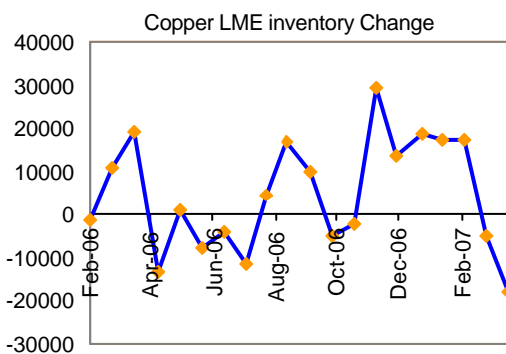
**Chart: Copper Price Vs. LME inventory in consumption days**



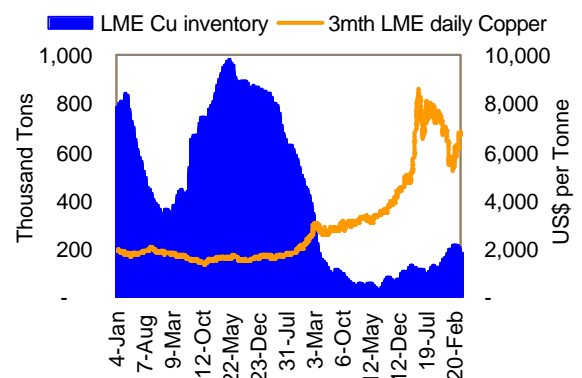
Source: Bloomberg, ICSG, India Infoline Research.

The key concern for the bulls is that while demand is clearly improving on the back of restocking activity out of Asia, new deliveries of copper into LME warehouses are not only keeping pace with demand, but actually exceeding demand. This is illustrated in the chart below and shows that other than for a brief period in mid January the flow of metal to the warehouse system have favored lower prices, especially given that the overall stock level is relatively comfortable in relation to demand. But since mid-February the scenario has changed as the rise in the demand from China has led to outflows from the LME warehouses.

**Chart: Copper inventory change M-o-M**



**Chart: LME inventory Vs. 3-month copper prices**



Source: Bloomberg

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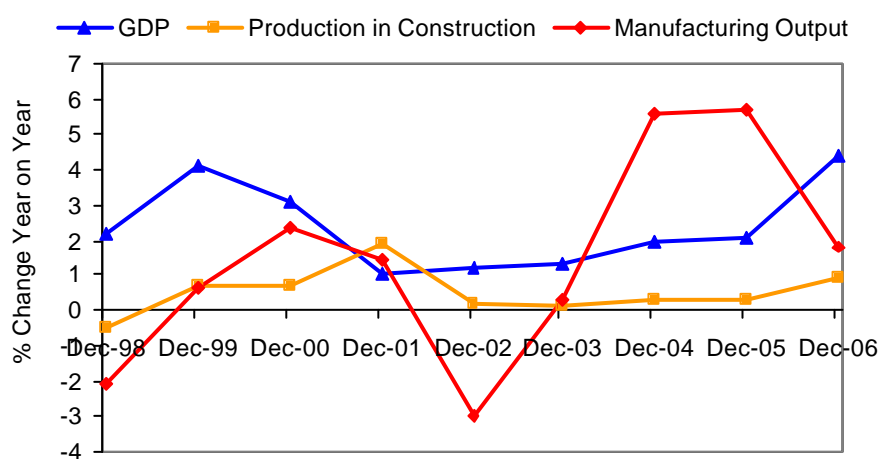
The drop in inventory levels authenticates our view of a rise in the demand from China in the last two months. The inventory levels of copper are at levels not enough to cushion any supply disruption from mines. Though the current level on inventory/ demand per day is higher than that of CY2006, the rise in the demand from China has led to a reduction in the inventory levels in the past one-month. The decrease in the inventory levels will support the rally in copper prices. Any supply disruption will witness a drastic reduction in the inventory levels. Hence, we expect prices to remain high for the first part of the year as we expect the supply to catch up with demand not before the second half of the CY2007.

**That the demand for emerging markets is on the upswing is a known fact. But has anyone given a thought about Euro-Zone?**

For the last decade, every market player has been talking about the strong demand from the emerging markets like India, Thailand, Brazil and many more. People have agreed to these arguments and today everyone is focusing on this. The Gross Domestic Product (GDP) and the manufacturing sector in the Euro zone has been rising quarter on quarter indicating to a rise in the demand for the industrial metals. But in the shadow of the emerging markets the Euro zone has been rising every quarter in the last 2 years. It has been growing at a steady pace and the ICSG expects demand from Europe to remain steady around 5,000,000 tons in the CY2007.

According to Eurostat's first estimate, the Q-o-Q growth rate of real GDP in the Euro Zone for the fourth quarter of 2006 was 0.9%. The annual rate of Eurozone growth climbed to 3.3% in the fourth quarter of 2006 and 2.7% in 2006, which was the best performance since 2000 and up from 1.4% in 2005. Both domestic demand and exports in the Euro Zone made significant contributions to this growth, confirming the sustained and broad-based nature of the current expansion. The information on economic activity from various confidence surveys and indicator-based estimates supports the assessment that economic growth has continued into 2007.

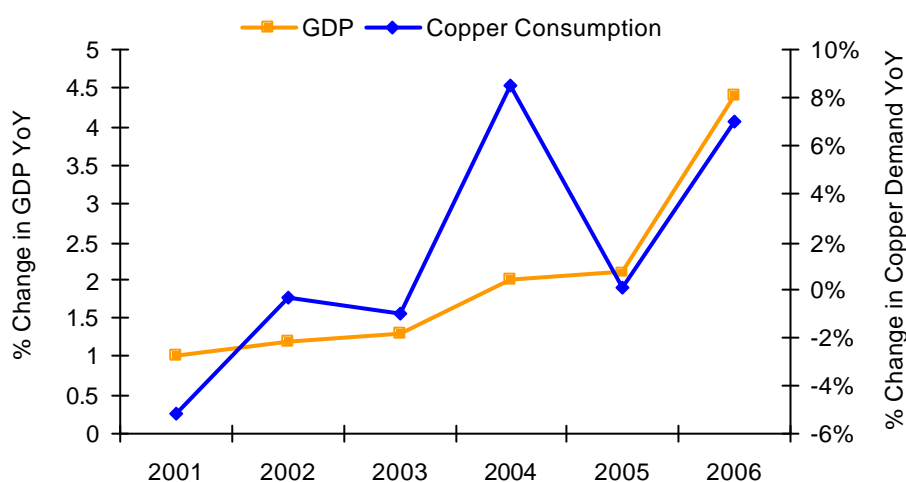
**Chart: Euro-Zone economic indicators**



Source: Bloomberg

Looking ahead, conditions remain in place for the Euro Zone economy to grow solidly. Global economic growth has become more balanced across regions and while moderating somewhat, remains robust, providing support for Euro area exports. Domestic demand in the Euro zone is expected to maintain its relatively strong momentum. Investment is expected to remain dynamic, benefiting from an extended period of very favourable financing conditions. Consumption should also strengthen further over time in line with developments in real disposable income as employment conditions continue to improve. This outlook for economic developments is also reflected in the new ECB staff macroeconomic projections, which foresee average annual real GDP growth in a range of 2.4% and 2.9% in 2007 and between 2.1% and 2.9% in 2008.

**Chart: Euro Zone Vs. Copper demand in Europe**



Source: Bloomberg

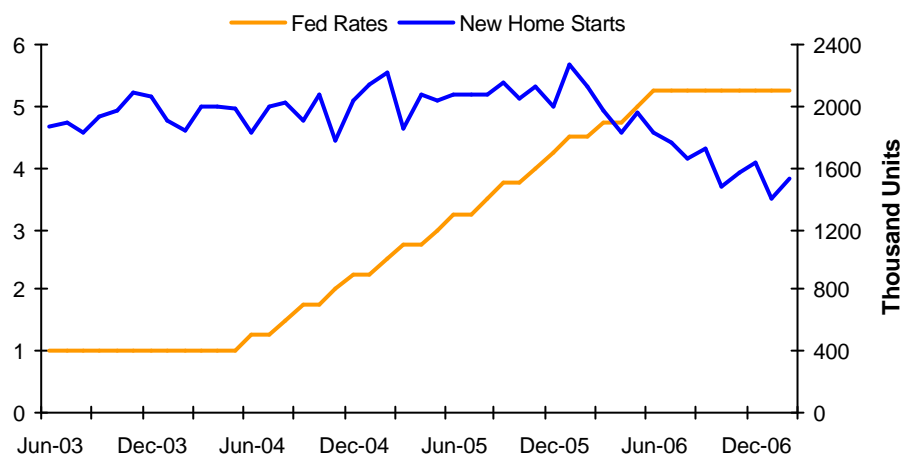
Growth in Europe during 2006 was stronger than for many years. Overall, GDP growth was about 2.7% with good contributions from most regions. Significantly, for commodity demand, fixed investment was a major contributor to economic activity growing at more than 5%. The overall measure of unemployment of 7% for the Euro zone is now lower than at any time since the series began in CY1995. Leading indicators of growth suggest relatively firm business and consumer confidence and point to solid growth in the key components of GDP including investment next year. However, the European Central Bank remains concerned about inflation and are expected to raise interest rates further in 2007. On balance, growth in excess of 2% is expected in 2007 by the IMF for the region as a whole.

Thus a bullish scenario in the Europe markets majorly from the German economy will help the demand stay around the current levels.

### Is the Sub-Prime event a leading indicator of the housing bubble burst?

New housing starts in a month fell to its lowest level in the last five years in January. This added to the 13% fall witnessed in the new housing starts in the CY2006. The month of March saw some shivers flowing through out the Wall Street as market players feared a housing bubble burst. The news of the second largest U.S sub prime lender (who lend to people who do not qualify for loans from mainstream lenders), New Century financial teetering on the edge of bankruptcy, sparked fresh fears about whether turmoil in the sector could spread and dampen the U.S economic growth.

**Chart: Fed fund rates Vs. New home sales**



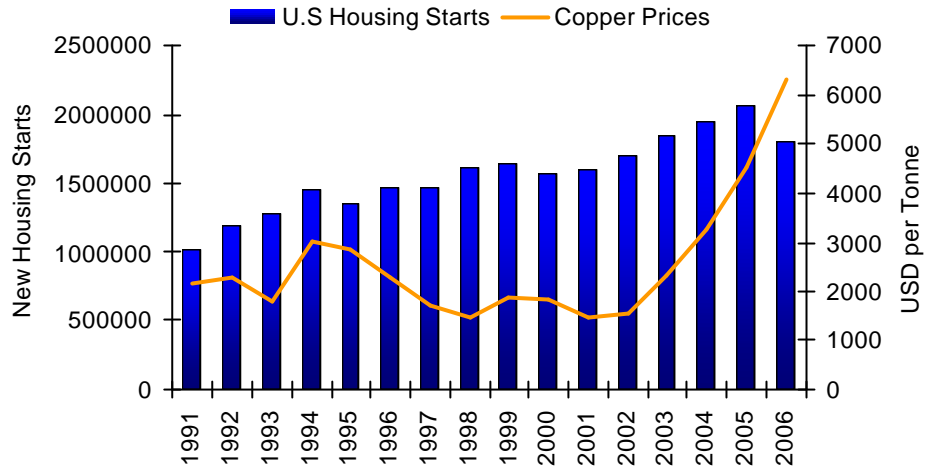
Source: Bloomberg

The rapid decline of New Century, the latest in a wave of problems at US sub-prime lenders raised concerns that problems could spread in the \$US8000bn mortgage industry and to other parts of the capital markets. At least 20 companies in subprime mortgage lending have gone out of business in recent months as defaults and foreclosures have risen in the wake of rising interest rates and falling U.S. house prices in the past year. The rise in U.S. interest rates between 2004 and 2006 brought an end to the ability of home owners to refinance their mortgages at lower interest rates, gasoline prices rose to record levels in 2006, and savings rates went negative, leading to questions of how the U.S. consumer was going to be able to continue to increase spending. Now a lot depends on how well the buying power of the U.S. consumer holds up through the shakeout in the housing market.

The reason for focusing on the housing sector is due to the following:

**“The U.S market represents around 13% of the global refined copper consumption and the U.S construction sector accounts for almost 50% of the copper demand in the U.S”.**

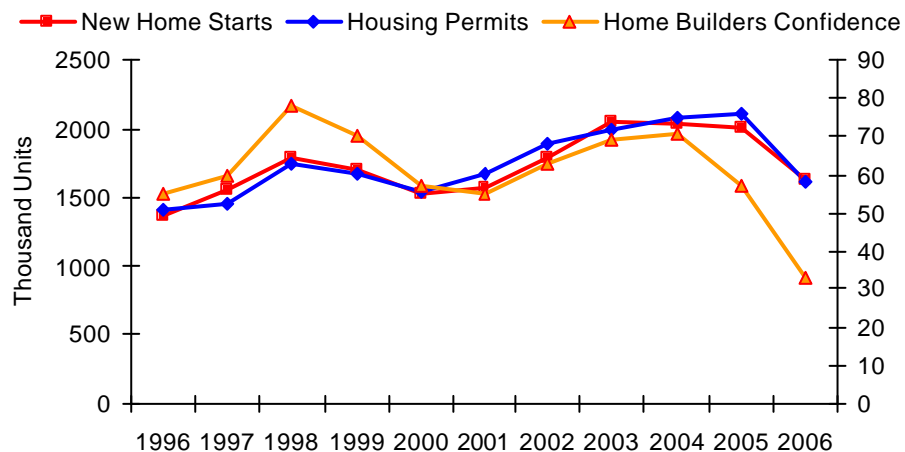
Chart: U.S housing starts and copper prices



Source: Bloomberg

In 2006 the housing market turned away from the record-setting pace of the recent past. Even with this decline, 2006 was still one of the better years in the history of the data series and many of the key indicators were among the best 10 values ever reported. This trend was especially true for single-family housing; building permits had their fifth best year, starts and new home sales had their fourth best year, existing home sales had their third best year, and completions set a new annual record. The mortgage interest rate was low about 60 basis points higher than the all-time low set in 2003. Although the overall economy grew, for the first time in several years, housing was not a contributor to that growth. In 2006, real gross domestic product grew by 3.4%, but residential fixed investment (housing) declined by 4.2%, subtracting 0.26 percentage point from the overall growth rate.

Chart: Housing Data

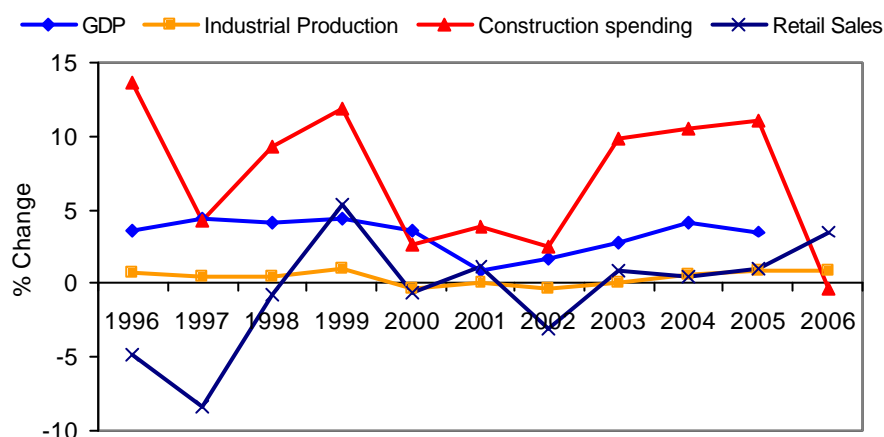


Source: Bloomberg

Housing starts totaled 1,800,700 units in 2006, down 12.9% from the record set in 2005. In 2006, construction was completed on 1,978,200 new housing units, up 2.4% from 2005. This value is the third highest annual number for total completions. The National Association of Home Builders/Wells Fargo Housing Market Index averaged 42.1 points in 2006, down 25.1 index points from 2005. The 2006 value is the third lowest annual value in the 22-year history of this attitude survey.

Affordability declined in 2006 due to rising interest rates and higher home prices. The family earning the median income had 106.0% of the income needed to purchase the median-priced existing home in 2006, down 5.8 percentage points from 2005 and about in the middle of the affordability indexes reported during the 34-year history of the National Association of Realtors affordability series. The composite index indicates that the family earning the median income had 109.3 percent of the income needed to purchase the median-priced existing single-family home using standard lending guidelines. This value is up 6.2 points from the third quarter of CY2006 and up 2.8 points from the fourth quarter of 2005.

**Chart: U.S economic indicators**



Source: Bloomberg

The ongoing meltdown in the sub-prime mortgage market would not matter, except for those directly involved. As the bubble was forming, first-time homebuyers were able to get access to credit on un-creditworthy terms and speculators riding the same started to enter the markets. But the rate hikes took out the shine of the investments, leading to a downfall. But recently it is destabilizing, as those who require perpetual asset price appreciation to make book are forced to sell to make book. Such is the reality that presently in the U.S. residential property market; the market has flipped from a sellers' market to a buyers' market of only the creditworthy.

Looking forward to CY2007 the picture is not clear. The US economy has coped very well with the hit to GDP growth from the housing recession. Forecasts that the housing slump would push the broader economy into recession have been wide of the mark. But the direct effect on economic growth is not the only transmission mechanism. The next issue is whether cutbacks in the supply of housing loans could trigger a financial crisis. If so, this would be a genuine threat to the health of the US economy. We assume that the rate tightening cycle is over and the Fed can cut its interest rates as we move into the second half of the year. We assume that the slump in the housing sector has bottomed out and the demand for the metal will remain around current levels as that of CY2006.

### Contango to Backwardation

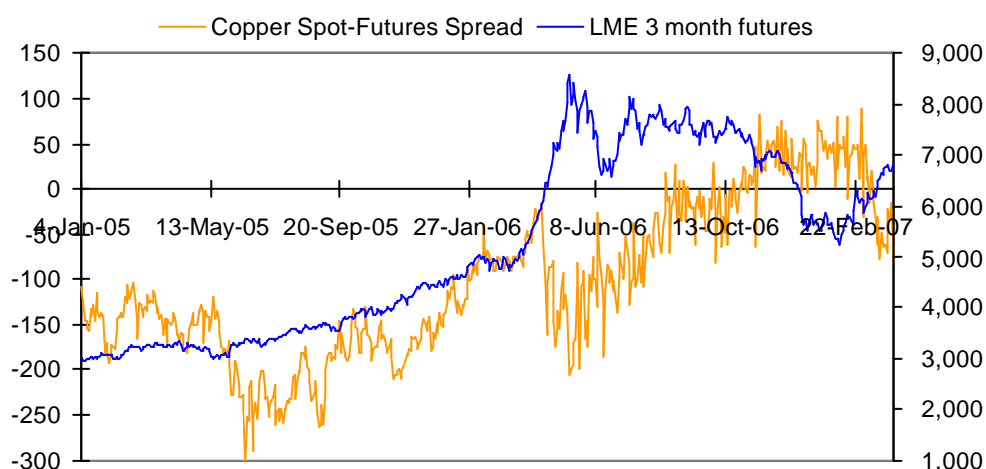
Backwardation and Contango are two terms used to describe trends in the prices of a futures contract over time. Contango is the norm and it is where the price of a commodity farther in the future is higher than the price of that commodity nearer in the future. Backwardation is the reverse, where cost of a commodity in the distant future is less than that in the near future.

*Basically*, for any non-perishable commodity, contango is the norm because of arbitrage: the price of a commodity one year from now should be today's price plus the "cost of carry," that is, the cost to store that commodity from now until the future delivery date, including the relevant time-value of money.

Backwardation, is the reverse of contango, is indicative of supply shortages in today's spot market because if there is any spare capacity for production it would be used to take advantage of today's higher prices, resulting in those prices declining.

The graph of copper prices versus the spread between the three month forward price and the spot price on the LME indicates a neagtive correlation. The futures prices dipped from the peak of US\$8800 to a low of US\$5200 and the spread rose from a negative US\$205 to US\$88 in the last one year. The reason for high spot prices last year was because of the supply disruptions of concentrate from mines all over the world. In 2006, the market for copper concentrates faced severe shortage, leading to a rise in the prices of copper. The concentrates market is likely to come into surplus only in 2008. real and potential supply disruptions in mines due to strikes, accidents, etc have also not helped the cause. It is estimated that close to 700,000 tons of production were lost in 2006 due to the above factors. Thus the market was having a backwardation scenario for most of the first three quarters of CY2006. But in the last quarter of CY2006 supplies from most of the mines were back to noramal and the demand from China reduced. This rise in the supply lead to a rise in the inventory levels inturn leading to a shrink in the spread.

**Chart: Copper Spread Vs. futures price**

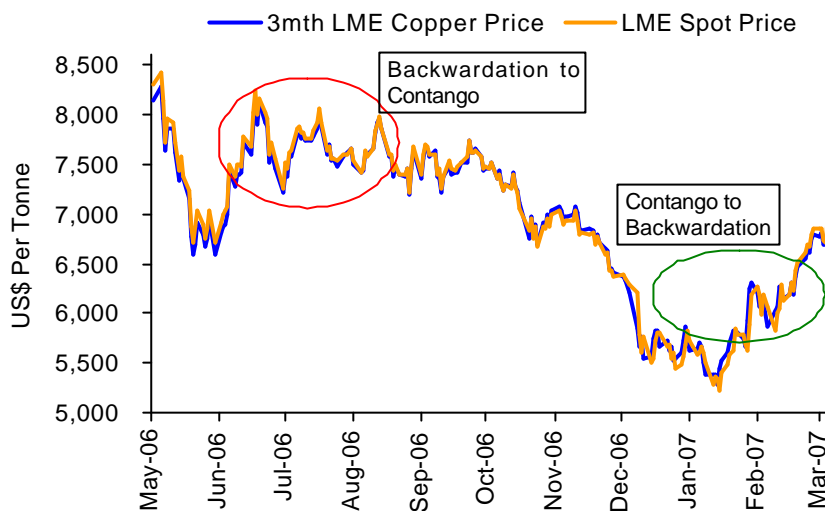


Source: Bloomberg, India Infoline Research

Post February 2007 markets are getting back to Bacwardation from contango, indicating that at the moment the demand for the metal is higher than the supply. The rise in the demand for metal from China has been responsible for the backwardation in copper.

Backwardation is indicative of current supply shortages, but also of the assumption that these shortages are only a short term market inefficiency and will eventually be corrected. However, should the copper market switch from backwardation to contango without a significant decline in current prices, that will suggest that the market has accepted the copper supplies will increasingly decline in the future and hence that the commodity will get increasingly expensive. For this reason, we believe that the switch from backwardation to contango will be the market indicator that the production is not only here, but perhaps more importantly the demand for the metals is increasing.

**Chart: Copper spot and 3-month prices**



Source: Bloomberg

Thus we believe that the shift from contango to backwardation is the start of a bull run in the short term. Expect prices to move northwards in the next two months with the markets continuing to witness a backwardation scenario.



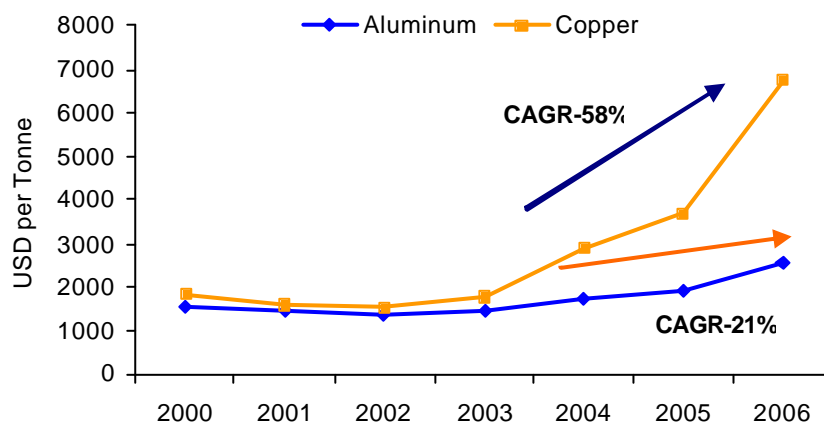
### Substitution effect:

Copper spot prices in the last 3 years have risen by 300% as compared to its substitutes whose prices have risen by a mere 80% for aluminum and 54% for PVC. When the price of a material rises, basic economic theory suggests that purchasers of the material will look to alternative materials that can deliver equivalent performance at a lower cost. Though the principle is simple, in practice material substitution is not straightforward, as users are not able to switch from one material to another without having to overcome some additional hurdles. For many types of cable there are substantial technical problems in switching between copper and aluminum conductors.

Aluminum can be said to be the best substitute for copper in many applications. The reason is the similarity in the properties of the two metals. Aluminum can be used as a substitute for copper in various products such as electrical power cables, electrical equipment, automobile radiators and cooling/refrigerating tubing. In some applications, titanium and steel are used in heat exchangers. Optical fibre is used in the place of copper in some telecommunication applications. Plastic also substitute copper in water pipes, plumbing fixtures and various structural applications.

But what appears to be at the moment is that, aluminum is eating into copper's market larger than any other substitute. Copper is currently much more expensive than aluminum in terms of US\$/ton. As the price of copper has recently moved ahead much faster than the price of aluminum, the ratio of copper and aluminum prices has increased. The simple comparison of the two metals in terms of price per tonne is in some respects misleading, since aluminum is a much lighter metal than copper (2.7 g/cm<sup>3</sup> compared to 8.9 g/cm<sup>3</sup>), though its conductivity is lower (61% of copper). For many cable applications, a more meaningful comparison of the metals is the cost per unit conductance; on this basis a tonne of aluminum is close to 2.0 times as effective as a tonne of copper.

**Chart: Aluminum and copper spot prices**



Source: Bloomberg

Copper also goes head to head with aluminum in power utilities. Aluminum's light weight is its one advantage in current-carrying applications and it is used almost exclusively in overhead transmission and distribution cable. The advent of high temperature superconductors, today's hottest technical area, opens new vistas of possibility. Superconductors need to be surrounded by "shunt" materials, which can carry heavy currents around faults that occasionally occur in the superconductor. The mini-materials battle between copper and aluminum for the best such material for current-technology superconductors such as niobium-titanium has been won by copper. Superconductivity could be an important new market for copper, particularly in transmission lines, energy storage devices, and other applications not yet contemplated. Thus the substitution effect at higher prices is leading to a drop in the demand for copper.

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Automotive applications, copper's third largest market, is the source of the most serious current substitution threat, aluminum in the radiator. Telecommunications, on the other hand, has dropped from the number 2 spot to number 4 in less than a decade. Fiber optics is the popular explanation for this dip, but in fact it accounted for little of it prior to 1990. Other technological factors are responsible, such as subscriber and the use of wires of smaller cross-section. Optical fibers are indeed a real threat for the future; however, whether that threat is realized may depend more on cost factors than technical considerations.

The cost factor has resulted in replacement of copper by aluminum for electrical conductors. However, aluminum conductors require special protection and cannot be used as replacements for copper in certain critical applications. For example, the Canadian Electrical Code allows only the usage of copper conductors in fire alarm and fire pump circuits. We expect the substitution effect will be witnessed this year, but not a major scale because of the complexities involving aluminum in electrical equipment.

## Technical outlook:



Source: Tele Data Solutions

The copper current month contract prices traded firmly in the last one month and made a high at Rs335. Prices are expected to move up further this week with support at Rs324 and only then Rs310 levels. The immediate resistance is seen at Rs347 levels. Only after break Rs347 level prices are expected to test 370 and then 390 in the short term. Market has breached 23.6% retracement at 335 levels (130.4-398.75 movement). Since prices are trading above the support at 297 and 324, further upside movement can be seen in the market. The momentum indicators are trading towards over bought as the RSI is at 0.80 levels. Prices are expected to go up further as the moving averages (Exponentials-9 & 18 days) are trading below the daily price chart. Also, copper prices are firmly above their long term moving averages of 100 and 200 days.

The long term trend of copper is positive and the fall witnessed in the last quarter of CY2006 and January 2007 from the high of Rs398 was only corrective in nature. We expect that the rally in copper prices will continue further and we may see a new high in the next couple of months. **MCX COPPER (April) is expected to rise to Rs360 and if this level is broken, prices are expected to rise further to Rs380.**

## Background

### History:

Copper, one of the oldest commodities known to man, is a product whose fortunes directly reflect the state of the world's economy. It is the world's third most widely used metal, after iron and aluminum, and is primarily used in highly cyclical industries such as construction and industrial machinery manufacturing.

We need to keep in mind that copper does not have the same economic fundamentals as precious metals. Copper, said to be the first metal known to man, is not a store of value like gold and silver. Even though many of today's global fiat currencies are circulated in copper, it is not valuable in this sense. Copper or copper alloyed coins are common because it is cheap metal and there has historically been an abundance of it.

The name copper is derived from the Greek work 'chalkos'. It is also related to the Greek mythology as it is said that it was associated with the goddess Venus. Copper is an element, reddish brown in color, having atomic number 29 and pertaining to the scientific symbol 'Cu'. Coming from the same family of silver and gold, this element is a highly ductile and malleable element and a very good conductor of electricity. It occurs in various minerals on earth and it also forms the part of a lot of alloys. Copper also has characteristics that it is a creep and corrosion free metal and all of its so very useful features make it an element on which the world's economy directly depends. Copper is a very important element and the oldest known commodity in the world that directly affects the world's economy.

Copper is one of the most useful metal since 7000 years & the first metal used by man in any quantity. The earliest workers in copper soon found that it could be easily hammered into sheets and the sheets in turn worked into shapes which became more complex as their skill increased. After the introduction of bronze, a wide range of castings also became possible. But copper and its principal alloys, bronze and brass, have always been more than a means of decorative materials during the middle Ages and the successive centuries through the Industrial Revolution and on to the present day. It is the best low cost conductor of Electricity; as a result Electric Industry uses about 60% of copper produced.

### Types of Copper:

Copper is present in the environment in a variety of forms. It can be found in sulfide deposits (as chalcopyrite, bornite, chalcocite and covellite), in carbonate deposits (as azurite and malachite), in silicate deposits (as chrysocolla and diopside) and as pure native copper. Copper also occurs naturally in humans, animals and plants.

Copper is one of the most recycled of all the metals. Recycled copper (also known as secondary copper) cannot be distinguished from primary copper that is, copper originating from ores, once reprocessed. Copper is shipped to fabricators mainly as cathode, wire rod, billet, cake (slab), or ingot. Through extrusion, drawing, rolling, forging, melting, electrolysis, or atomization, fabricators can form wire, rod, tube, sheet, plate, strip, castings, powder, and other shapes. These copper and copper-alloys are then shipped to manufacturing plants that make products to meet society's needs.

## Manufacturing Process

### Copper Production from Ore to Finished Product

From its original home buried underground in a mine to its use in a finished product such as wire or pipe, copper passes through a number of stages. When it is recycled it can pass through some over and over again. Below is quick description of the path. Copper is mainly found associated with sulphide and oxide minerals. These two types of minerals require different productive processes. The sulphide minerals first go through crushing and milling, followed by a classification process to obtain the copper concentrate (containing 18-45% of copper). Alternatively, copper can be leached out of the ore.

### Conventional copper Extraction process:

#### Mining

Copper can be extracted from its ore by:

##### ➤ Traditional mining

- √ Underground: sinking a vertical shaft into the Earth to an appropriate depth and driving horizontal tunnels into the ore.
- √ Open pit: 90% of ore is mined by this method. Ores near the surface can be quarried after removal of the surface layers.

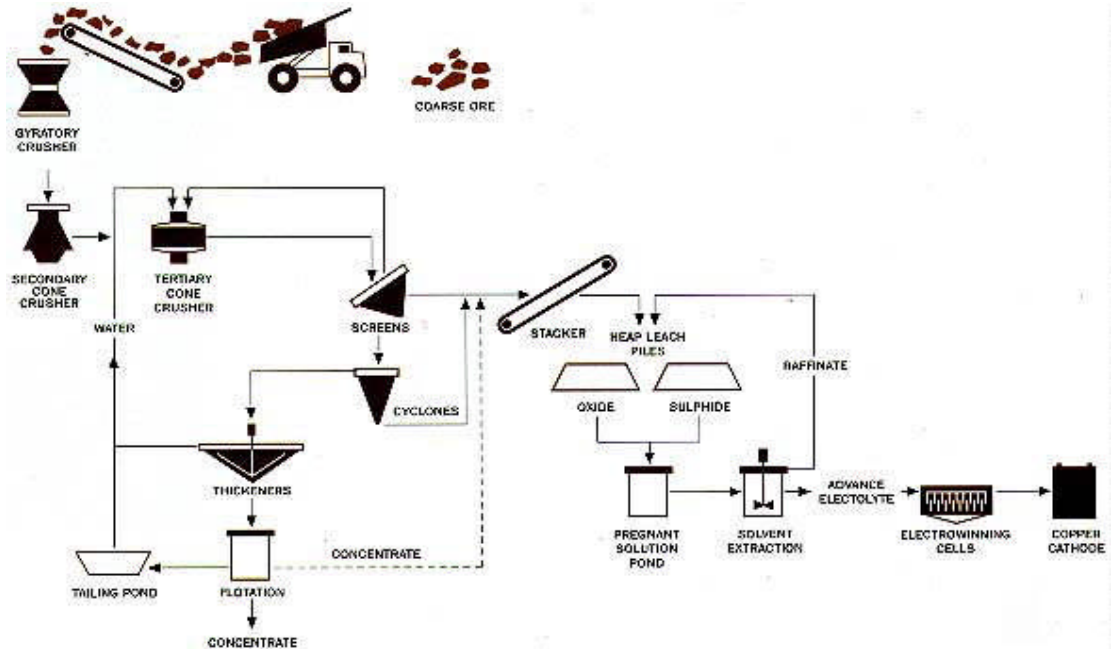
##### ➤ Leaching

The ore is treated with dilute sulphuric acid. This trickles slowly through the ore dissolving copper to form copper sulphate. The copper is recovered by electrolytic refining. Advantages of this process are:

- √ much less energy is use than in traditional mining
- √ no waste gases are given off
- √ it can be used on ores with as little as 0.1% copper - for this reason, leaching extraction is growing in importance.

A typical ore contains only 0.5% to 2.0% copper. It is a measure of the value of copper that it is worth extracting it from such small concentrations. The ore is a mixture of minerals and rock (called **gangue**). The ore is crushed, ground and then enriched (concentrated) by Froth Flotation. The powdered ore is mixed with special paraffin oil which makes the copper mineral particles water repellent. It is then fed into a bath of water containing a foaming agent which produces a kind of bubble bath. When jets of air are forced up through the bath, the water repellent copper mineral particles are picked up by the bubbles of foam. They float to the surface making froth. The unwanted waste rock (gangue) falls to the bottom and is removed. The froth is skimmed off the surface and the enriched ore (mainly the copper mineral) is taken away for roasting. The mixture of water, foaming agent and paraffin is recycled. After this stage the enriched ore now contains about 25% copper by mass.

Chart: Copper Extraction process



Source: [www.copper.org](http://www.copper.org)

### Smelting

At the smelter, the copper concentrate goes through four processes:

#### ➤ The smelting furnace:

The concentrate is smelted, instantly converting the ground-up rock into a molten liquid that is 2300 degrees Fahrenheit and looks like molten lava from a volcano. This produces a combination of matte (a mixture of copper, sulfur and iron) and slag (a dense, glassy material mostly iron and silica). This molten mix is tapped (poured in a controlled way) out of smelting furnace and enters the slag settling furnace. Due to different densities, the matte settles down through the slag. Slag is then disposed of on the slag dump. Matte contains 58-60% copper. The matte is tapped from the slag settling furnace and flow into a ladle that is picked up by an overhead crane and poured into the converter.

#### ➤ The converter

The matte goes to the converter where most of the remaining iron and sulfur is removed by blowing air into the mixture. The resulting product is blister copper that is more than 98% pure copper. The converter is then rolled and the molten copper is poured from the converter into a ladle and transported by the overhead crane to eth anode furnace.

#### ➤ The anode furnace

The blister copper is poured into furnace where additional refining is performed to prepare the copper to be poured into anodes. The refining is completed by adding air and natural gas to the mixture.

#### ➤ The anode casting wheel

Copper from the anode furnace is then poured into copper molds to produce anodes. Anodes are slabs of copper that are about 2 inches thick, 3 feet wide and 3 ½ feet tall. The anodes weigh about 750 lbs. each and are about 99% pure copper. They are then shipped to a refinery where they undergo even more refining.

### Refining:

Even though the anodes from the smelter are 99% pure copper, they still contain too many impurities for the strict demands of wire manufacturers. These impurities have a negative effect on the drawing capability of copper. Therefore, the anodes are sent to an electrolytic refinery to remove these impurities. The term electrolytic is used along with a solution (or electrolyte) to refine the anodes into a saleable copper product.

The anodes are suspended in a solution of sulphuric acid and copper sulfate between the two starter sheets (thin sheets of copper). As an electric current is passed through the tanks, the copper from the anodes is dissolved in the solution and plates on to the starter sheets. After 14 days, the starter sheet has accumulated enough copper to be removed from the tank, rinsed with water and bundled. It is now called a cathode and is 99.98% pure copper. The copper cathodes are ready to be sent on to be processed into the copper products we use everyday. The used anodes are melted, re-cast into new, full sized anodes and returned to the refinery to go through the process again. During the refinery process, some impurities dissolve into the solution and are recovered, such as nickel. Other impurities don't dissolve and settle to the bottom of the tank. These impurities are silver, gold, platinum, selenium and tellurium, and they are recovered and sold as by products.

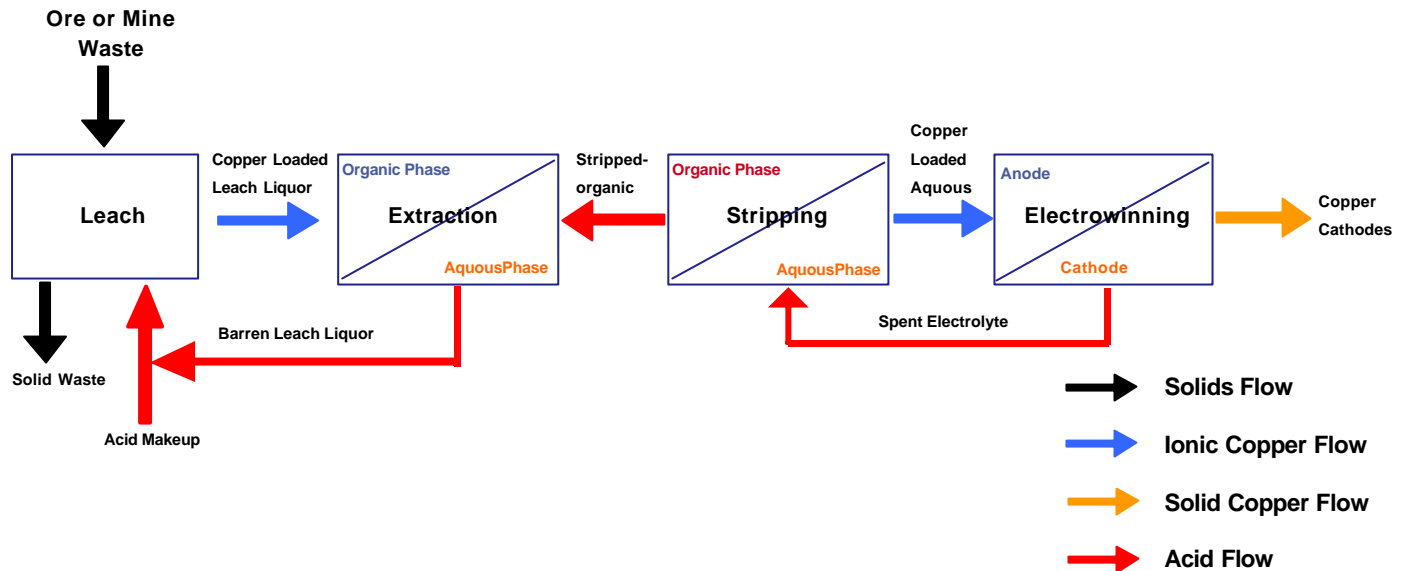
### Cathode is converted into:

- √ Wire Rod - Coiled rod about 1/2" in diameter is drawn down by wire mills to make pure copper wire of all gages.
- √ Billet - 30' logs, about 8" diameter, of pure copper are sawed into these shorter lengths which are extruded and then drawn as tube, rod and bar stock of many varied sizes and shapes. Rod stock may be used for forging.
- √ Cake - Slabs of pure copper, generally about 8" thick and up to 28' long, may be hot and cold rolled to produce plate, sheet, strip and foil.
- √ Ingot - Bricks of pure copper may be used by mills for alloying with other metals or used by foundries for casting.

### Solution extraction / Electrowinning process (SX/EW)

The SX/EW Process is a hydrometallurgical process since it operates at ambient temperatures and the copper is in either an aqueous environment or an organic environment during its processing until it is reduced to the metal. Because of its dependence on sulfuric acid, the SX/EW Process is at present not a substitute for, but rather an adjunct to conventional smelting. However, it is also applicable in locations where smelter acid is not available by the purchase of sulfuric acid or the manufacture of sulfuric acid from sulfur or pyrite. In addition, it offers the opportunity to recover copper from an entirely different set of ores and mining byproducts than is possible by smelting; namely, oxidized materials. These may be mined copper minerals that are in oxidized form - minerals such as Azurite ( $2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_3$ ), Brochantite ( $\text{CuSO}_4$ ), Chrysocolla ( $\text{CuSiO}_3 \cdot 2\text{H}_2\text{O}$ ) and Cuprite ( $\text{Cu}_2\text{O}$ ), residual copper in old mine waste dumps whose sulfide minerals have been oxidized by exposure to the air or sulfidic copper minerals that have been oxidized by another new technology - *bacterial leaching*. In addition, the process can be used to extract copper in situ. That is, without removing the material from the waste pile or from the ground. The net result of the use of this process is that copper can be produced from sources that in the past would have gone untouched, thus reducing the reliance on conventional ore bodies. Further, the process is capable of removing copper from waste materials where otherwise it would have been considered a contaminant to the environment. In the United States, for example, copper is considered to be a toxic material released to the environment once it is mined under Emergency Planning and Community Right-to-Know Act (EPCRA) and the Environmental Protection Agency's Toxic Release Inventory (TRI). Copper mine dumps and flotation tailings constitute a significant inventory of copper that is considered to be a contaminant to the environment under TRI.

Chart : Solution extraction / Electrowinning process



Source: [www.copper.org](http://www.copper.org)

The SX/EW process, itself, has very little environmental impact because its liquid streams are very easily contained, There is no effluent inasmuch as all impurities are returned to the site where they originated and the sulfuric acid is eventually neutralized by the limestone in the ore body or waste dump where it is deposited as calcium sulfate (gypsum) - a very insoluble substance.

The process involves leaching the material with a weak acid solution. This solution, known as *pregnant liquor*, is recovered and then contacted with an organic solvent, referred to as the extractant, in the solvent extraction stage (SX). Here the copper is extracted away from the aqueous phase leaving behind most of the impurities that were in the leach solution. Since the copper ion is exchanged for hydrogen ion, the aqueous phase is returned to its original acidity and recycled to the leaching step of the process. Meanwhile, the copper-bearing organic phase is *stripped* of its copper by contacting it with a strongly acidified aqueous solution at which time the copper is moved to the aqueous phase while the organic phase is reconstituted in its hydrogen form. The copper-bearing aqueous phase is advanced to the *electrowinning* (EW) stage of the process while the barren organic phase is returned to the extraction stage of the process. In the electrowinning stage of the process the copper is reduced electrochemically from copper sulfate in solution to a metallic copper cathode. Electrowon copper cathodes are as pure as or purer than electrorefined cathodes from the smelting process. Thus they are well received by the market.

Whereas the conventional process requires an estimated 65 MJ/kg of energy (not including scrap recycling) the SX/EW process requires an estimated 15 MJ/kg (from heap or dump leaching) to 36 MJ/kg. (From mined and crushed ore). Another advantage of the process is its low capital investment requirement relative to the smelting process and its ability to be operated economically in a small scale. In China, for example, where copper deposits are not plentiful and tend to be small, there are 40 to 50 "mom & pop" leaching operations involving SX/EW.



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**Bacteria leaching:**

A second technology that has aided in the production of environmentally clean copper is that of bacterial leaching or bioleaching. This is used as an adjunct to the SX/EW process in situations where sulfide copper minerals must be leached. Modern commercial application of bacterial leaching began in the 1950s at Kennecott's Bingham mine near Salt Lake City, Utah. It was noticed that blue copper-containing solutions were running out of waste piles that contained copper sulfide minerals - a condition that should not have happened in the absence of powerful oxidizing agents and acid. On investigation it was found that naturally occurring bacteria were oxidizing iron sulfides and the resulting ferric sulfate was acting as an oxidizer and leachant for copper sulfides. These bacteria were given the name - ferroxidans for their action in oxidizing iron sulfides. A second set of bacteria were also identified and given the name - thiooxidans for their action in oxidizing sulfur to yield sulfuric acid.

Bacterial leaching, combined with SX/EW, offers a method of exploiting small ore bodies with a minimum of capital investment. Most commercial operations leaching copper from ore dumps are located in the Southern Hemisphere in Australia, Chile, Myanmar and Peru. The process consists of injecting the material to be leached with cultivated strains of appropriate bacteria and maintaining conditions that are conducive to their effective operation and propagation. Air, for instance, is blown into the heap through air lines situated under the leach pad. Since these naturally-occurring bacteria are present nearly everywhere, they undoubtedly play a role in all acid leaching operations; however, these are not considered bacterial leaching since neither cultivated bacteria nor air are added and acid is applied. While copper bacterial leaching thus far has been confined to the leaching of ore, pilot plant tests are underway for the leaching of chalcopyrite concentrates that would normally be processed by smelting.

**Conclusion:**

The SX/EW process has provided the copper industry with a tool that makes the extraction of copper from its ores significantly more environmentally friendly than by the use of the conventional smelting process. While the SX/EW process was adopted by the industry to take benefit from the sulfuric acid that the smelting process produced steps are being taken to divorce the two.

### Properties of Copper:

- √ Excellent conductor and non-magnetic
- √ Malleable and ductile
- √ Excellent alloying characteristics
- √ High resistance to corrosion
- √ Recyclable
- √ Excellent heat transfer
- √ Essential nutrient and biostatic

### Properties and Application of Copper and copper alloys:

Property	Industry/Type of Application
Aesthetics	Architecture, sculpture, jewelry, clocks, cutlery.
Bactericide	Door hardware, marine internal combustion engines, crop treatments.
Biofouling resistance	General, hydraulic and marine engineering, metalworking, aerospace, power generation, shipbuilding, offshore oil and gas platforms.
Corrosion resistance	Plumbing tubes and fittings, roofing, general and marine engineering, shipbuilding; chemical engineering, industrial processes including pickling, etching and distilling; domestic plumbing, architecture, desalination, textiles, papermaking.
Ease of fabrication	All of the above plus printing.
Electrical conductivity	Electrical power generation, transmission and distribution, communications, resistance welding, electronics.
Environmental friendliness	Essential for health of humans, animals and crops
Fungicide	Agriculture, preservation of food and wood.
Low temperature properties	Cryogenics, liquid gas handling, superconductors.
Mechanical strength/ductility	General engineering, marine engineering, defense, aerospace.
Non-magnetic	Instrumentation, geological survey equipment, minesweepers, offshore drilling.
Non-sparking	Mining and other safety tools, oxygen distribution.
Elasticity	Electrical springs and contacts, safety pins, instrument bellows, electronic packaging.
Thermal conductivity	Heat exchangers and air-conditioning/refrigeration equipment, automotive radiators, internal combustion engines, mining.

## Uses:

### Construction:

It's hard to imagine a building without copper. Surely, the modern home, office or manufacturing plant would not be as comfortable, as functional, or as electrically or thermally efficient without it!

Copper is used extensively in building wire, water piping, gas tubing, roofing, architectural building design, heating and air conditioning systems, interior and exterior artwork, doorknobs, lightning rods, faucets, and even fire sprinkler systems. In fact, the building products sector demands more copper every year than any other market sector.

Copper is an important structural component in many buildings.

Copper has become widely adopted as a safe, economic material for water services. In the USA, about 80% of all plumbing tube is copper; in the U.K., the figure approaches 100%. Plumbing tube and fittings comprise the second-largest use of copper, after electrical applications. Copper tubing is light and strong enough for the pressures involved and other stresses in the installations. It is easy to cut, bend and join and can therefore be installed quickly and reliably, usually outlasting the building it serves. It inhibits the growth of many microorganisms and has been shown to be the most hygienic material for potable water supplies. It is unaffected by hot water and this fact, plus copper's high thermal conductivity, makes it ideally suited for use in central heating systems.

The suitability of the metal as a roofing material has been proved over the centuries. The essential attributes of good long-life roofing material include an attractive appearance, high corrosion resistance, minimum maintenance requirement and good economy. Copper combines all of these qualities better than any other weathering material and is therefore an excellent choice for a roof covering. Taking first cost and maintenance costs over the first fifty-year period of a roof, copper is amongst the cheapest materials to use.

### Electronics and communication:

The vast majority of electrical applications call for the use of conventional high-conductivity copper and these applications account for the more than 60% of all newly refined copper produced. Unless otherwise identified, it is this type of copper that is most often referred to in the descriptions of applications that follow.

#### Copper Cabling:

Copper has higher electrical conductivity than all metals except silver. It is for this reason that it is used in commercial and domestic buildings to provide the energy-efficient, safe, electrical distribution systems upon which we all rely. Copper wire is strong enough for the purpose, yet fully ductile when bending is needed. It does not react with modern insulation materials. It retains a low contact resistance throughout its long life, even when tarnished, and connections remain safe. Copper also has relatively high creep strength, meaning that connections made in screwed terminals do not relax over time, or when the operating temperature is reached.

#### Domestic Uses:

The amount of high conductivity copper used in domestic buildings has increased steadily to keep up with the demands posed by the growing number of electrical and electronic appliances in use. Older buildings, and even some new ones, are often not fitted with enough branch circuits, let alone outlets, to cope with this high demand.

### Industrial Machinery:

Copper and its alloys are present wherever industrial machinery and equipment are found. Due to their durability, machinability and ease of casting with high precision and tolerance, copper alloys are ideal for making products such as gears, bearings, and turbine blades. Copper's superior heat transfer capabilities and ability to withstand extreme environments makes it an ideal choice for heat exchange equipment, pressure vessels, and vats. In situations where explosions are feared, copper-alloyed safety tools, such as hammers, axes, pliers, and screwdrivers are typically specified. These tools are non-sparking, high strength, non-magnetic, and corrosion resistant. The corrosion-resistant properties of copper and its alloys (e.g., brass, bronze, copper-nickel) make them especially suitable for use in demanding environments. Oil platforms, coastal power stations, and vessels, tanks, and piping exposed to seawater all depend on copper's corrosion resistance for protection. Because of the versatility and excellent corrosion resistance of copper alloys, they are specified in many engineering applications, including valves, pumps, heat exchangers, radiators, valve guides, hydraulic tubing, bolting, mining wagon brakes, and plastic molding dies. The continuous availability of a high quality electrical power supply is essential to the economy of a business. Power failures can mean loss of data and customer confidence. When electrical installations are being designed, either for new buildings or to upgrade existing buildings, it is vital that power quality, reliability, resilience, energy efficiency, proper grounding (earthing) and future load growth are taken into consideration.

Due to its durability and malleability, copper finds applications in gears, bearings, and turbine blades. Its heat transfer capabilities make it an ideal choice for heat exchange equipment, pressure vessels and vats. Vessels, tanks and piping exposed to seawater, propellers, oil platforms and coastal power stations all depend on copper's corrosion resistance for protection.

### Transportation

Cars, aeroplanes, high speed trains, submarines, subway cars, trolleys, buses, construction vehicles and even space shuttles all depend on copper to get people where they need to go. And since transportation is becoming faster and more electronically complex, increased amounts of copper will be necessary to increase the efficiency and effectiveness of engines, heat exchangers, electronic devices, and electrical and power systems. All major forms of transportation depend on copper to perform critical functions.

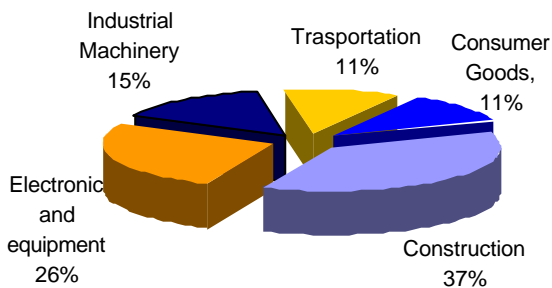
Copper-nickel alloys are used on the hulls of boats and ships to reduce marine biofouling thereby reducing drag and improving fuel consumption. Motors, wiring, radiators, connectors, brakes and bearings: Today's average size automobile contains about 27.6 kilograms of copper and a Boeing 747-400 contains 4,000 kilograms.

Copper's superior thermal conductivity, strength, corrosion resistance, and recyclability make it ideal for automotive and truck radiators. New manufacturing technologies, processes and innovative designs will expand the penetration of copper in this market, as the resulting new copper-based radiators are lighter, smaller and more efficient.

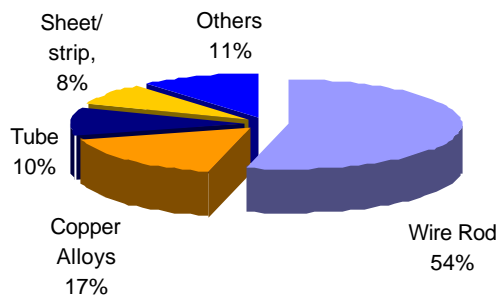
**Consumer Goods:**

From home furnishings and clothing, to handicrafts, jewelry, and even musical instruments, civilizations have crafted many different types of goods from copper for thousands of years. In recent years, copper has played a major role in home electronic products. From electrical wires and contacts to the fastest computer chips available, copper benefits our lives behind the scenes - making electronic equipment run faster, operate cooler and last longer. Today, copper is used in these and other consumer products, such as coffee tables, dining tables, chairs, benches, lamps, lighting fixtures, picture frames, mirrors, fireplace equipment, kitchen ware and sculptures. From the beginning of civilization copper has been used by various societies to make coins for currency. Computers, electrical appliances, decorative brassware, and locks and keys are some of the more common products exploiting copper’s advantages. In areas known to be copper deficient, copper is used by farmers to supplement livestock and crop feed.

**Chart: World Copper consumption**



**Chart: Copper first use classification**



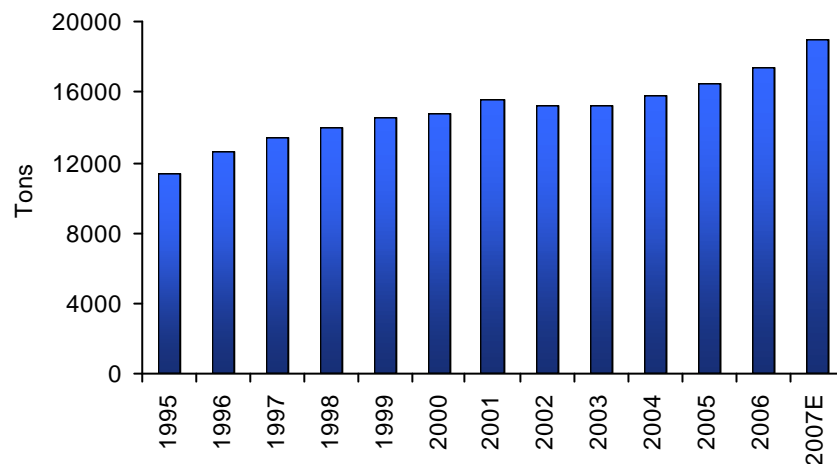
Source: ICSG

## World Copper Production

### Mine Production

World copper production has been rising at a rate lower than that of demand in the last five years. According to the ICSG in the last five years, copper mine production rose by a CAGR of 2.16% from 13.625mn tons in CY2001 to 15.166mn tons in CY2006 against a CAGR of 2.87% in case of global refined consumption.

**Chart: World mine production**



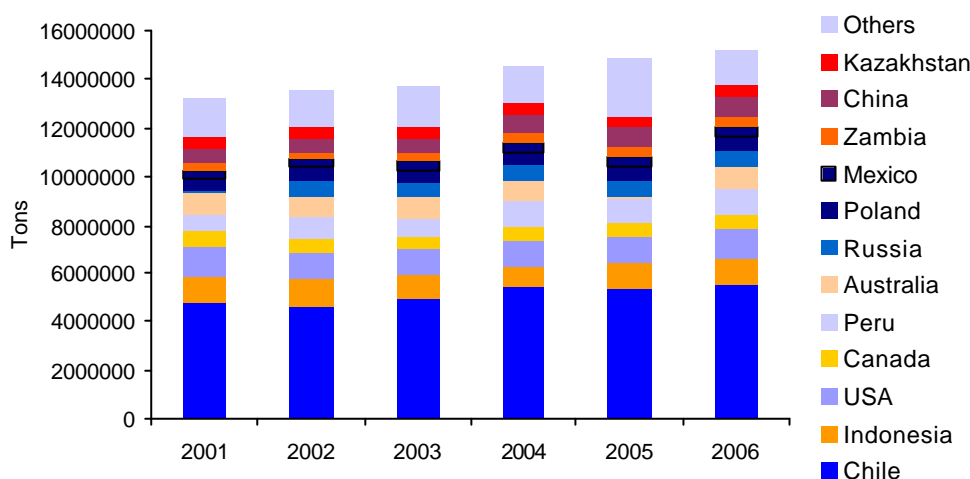
Source: ICSG

The ICSG stated that world mine production increased by 291,000 tons in CY2006 and is expected to rise by 1.038mn tons to 16.204mn tons in CY2007. In the first eleven months of 2006, disruptions associated with labor disputes and other events (such as rockslides) are estimated to have resulted in around 600,000 tons of lost production (equivalent to around 3% of global production). Global copper mine production was relatively unchanged year on year, as higher production in Zambia and China was offset by lower production in Indonesia and Mexico. Production in Indonesia was adversely affected by the mining of lower grade ore at Freeport's Grasberg mine. In Mexico, production was negatively affected by labor disputes at Grupo Mexico's Cananea and La Caridad mines. As a result, for the majority of 2006, global copper stocks remained low. Despite the continued likelihood of disruptions to supply because of labor disputes and a shortage of copper concentrates, world refined production is forecast to increase in 2007 by nearly 5%. The ICSG decreased its forecast for mining supply in CY2006 to 15.166mn tons in October from 15.48mn tons in February as a result on the ongoing supply disruptions in the mines. The various copper reserves around the world are mentioned below:

**Table: Copper reserve**

Country	Reserves(tons millions)	Reserve Base (tons millions)
Chile	140	360
United States	35	70
Indonesia	35	38
Peru	30	60
Poland	30	48
Mexico	27	40
China	26	63
Australia	24	43
Russia	20	30
Zambia	19	35
Kazakhstan	14	20
Canada	7	20
Other Countries	60	110
<b>Total</b>	<b>470</b>	<b>940</b>

Source: Icra

**Chart: World mine production country-wise**

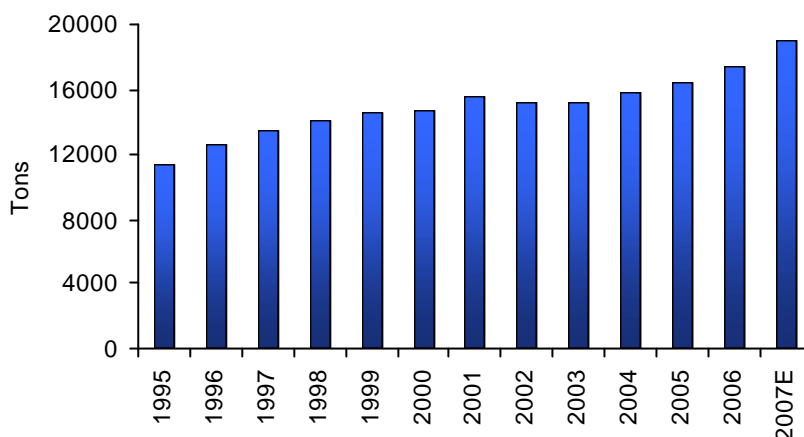
Source: ICSG

Increasing less than 2% in 2006, the ICSG forecasts global mine production in CY2007 to increase by 7% to 16.2mn tons. Phelps Dodge's Cerro Verde mine expansion in Peru (an increase of approximately 200 000 tons a year) and BHP Billiton's Spence project in Chile (200 000 tons a year) are expected to ramp up to full production in 2007 after being commissioned in late 2006. In addition, a number of relatively small projects in Zambia, Peru, the Democratic Republic of Congo and the United States are also expected to commence production in CY2007.

**Refining Production:**

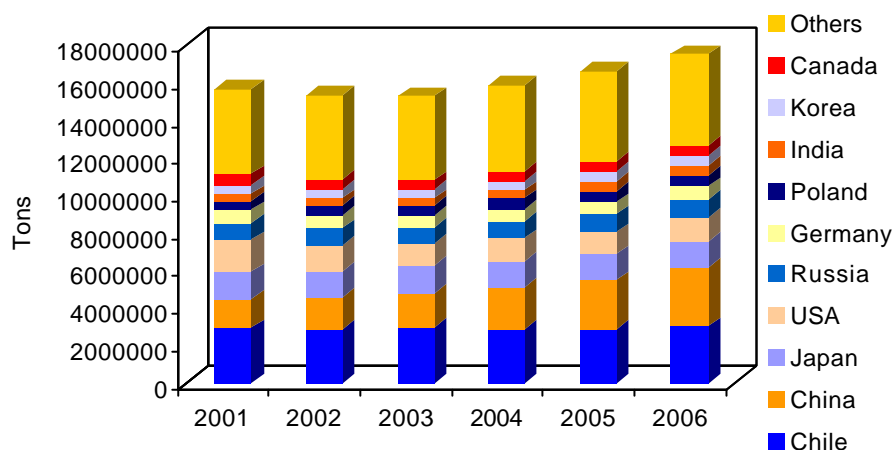
The world's refining production has grown at a faster rate than that of mine. Refining capacity over the past decade has outpaced the rise in mining output. Refining production rose by a CAGR of 2.28% in the last five years as compared to 2.16% during the same period. According to ICSG in CY2006, world production of refined copper increased by 995000 tons to 17.441mn tons. The 6% rise in refined production was led largely by the rise in production from India, China and Japan. China's share of the global refined copper production has increased from 9% in CY1996 to almost 18% in CY2006. Similarly, India, which minutely contributed to the world production a decade ago has increased its share in global refined production to 3.8% in 2006.

Chart: Refined copper production



Source: ICSG

Chart: Country-wise world refined production



Source: ICSG

Low copper mine production in 2006 forced a number of refineries to draw down copper concentrate stockpiles. Reflecting this, further disruptions to mine production in 2007 may restrict refined copper production in some countries.

The ICSG forecasts world refined production in 2007 to increase more than 8% to 18.96mn tons, largely through higher output in China and Chile. In China, Jiangxi Copper has announced plans to expand its Guixi smelter plant by 300 000 tons to a capacity of 700 000 tons a year toward the end of 2007.

According to the Chilean Copper Commission, copper production in Chile is expected to increase by around 6% to around 5.7mn tons. BHP Billitons' Escondida sulfide leach project in Chile (180,000 tons a year) is expected to ramp up to full production in CY2007 after commencing production in mid-2006. In addition, Antofagasta's Los Pelambres plant expansion (an increase of 34,000 tons), also in Chile, is expected to be completed in the second quarter of CY2007.

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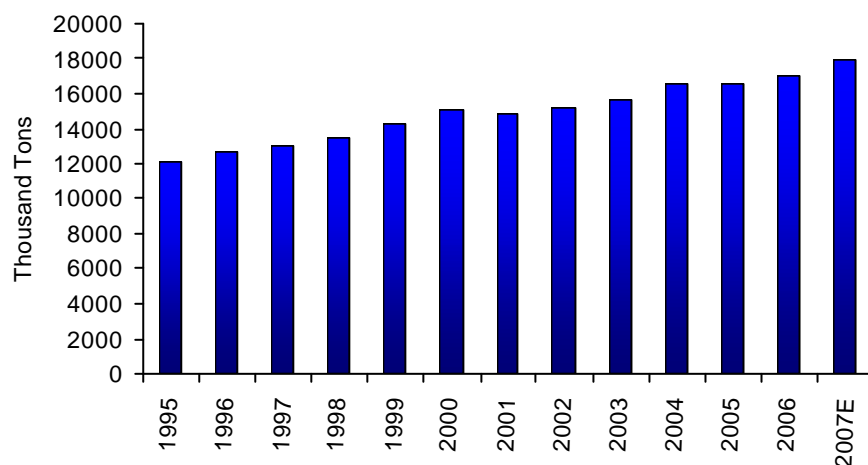


## Copper Refined Consumption

Where is this demand for copper coming from? Worldwide the demand for the metals has been increasing, but particularly from the industrialization and urbanization in BRICs nations in the last five years. People around the world are striving for western world levels of comfort and consumption, which in turn drives the demand for the commodities. Every sector in the economy, the housing sector, the electronic industry or the automobile industry, all of them have witnessed a rise in the demand from the BRIC nations. GDP and investments are rising in the developing economies faster than expectations as people work towards bringing a North American/ European standard of living to their families. The growing economies of Asia will need to consume pits of commodities to realize the dream of urbanization, industrialization and consumerism. However, the growth in demand for copper is not restricted to these fast growing emerging economies.

According to ICSG, world copper consumption of Copper in CY2006 was 17.02mn tons, up by 3.08% above 2005's total copper consumption of 16.51mn tons. The largest copper-consuming nations have long been the industrialized countries with large manufacturing bases. Since the 1990's, the trend has been toward increased consumption by the Asian countries, particularly Japan, South Korea and Taiwan, mainly to support export oriented fabrication industries. More recently, China has indicated significant growth as it built new rod and brass mills for its increased domestic copper needs. The industrialization of developing economies in Asia and the drive to improve standards of living in the region fuelled the demand for copper over the last 10 years. In CY2007, the ICSG forecasts world copper consumption to increase by a further 5.07% to 17.884mn tons, largely because of continued strong demand from China and India.

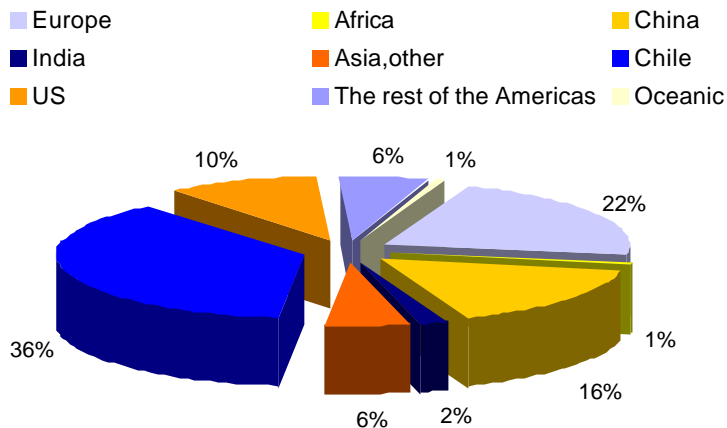
**Chart: World copper consumption**



Source: ICSG

According to ICSG in CY2006, global copper consumption rose year on year by 3%, reflecting increased copper consumption in the United States and Germany. Growth in copper consumption in the second half of 2006 was due to China, as increase in apparent consumption (production + net imports ± stock change) growth in China recovers after destocking by consumers and the State Reserves Bureau in the first half of CY2006. The ICSG forecasts global copper consumption to be 17.9mn tons in CY2007, with China being the major driver of consumption growth. China's copper consumption is forecast to increase by 10% in CY2007, based on strong growth in infrastructure development and rebuilding of stocks.

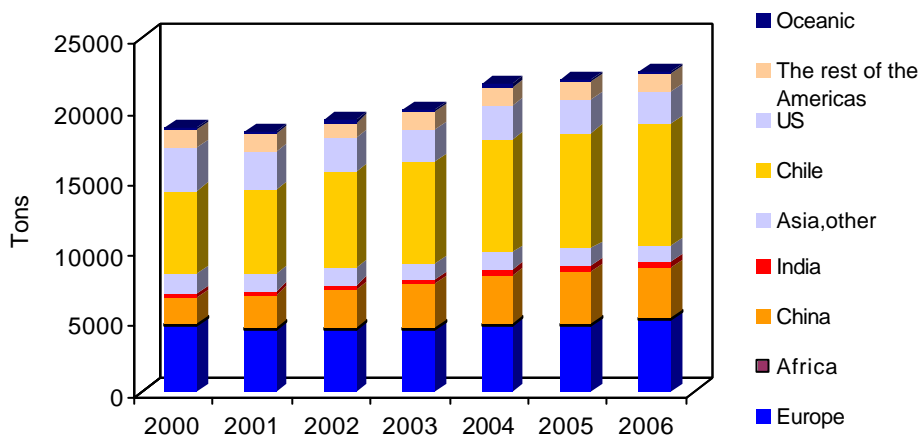
Chart: World copper consumption in 2006.



Source: ICSG

China's apparent copper consumption declined year on year by 2% in the CY2006. Over this period, it is estimated that the State Reserves Bureau sold in excess of 200,000 tons of copper from strategic stockpiles to both the domestic market and the London Metal Exchange. Consumer destocking also occurred, with copper fabricators (producers of final copper products such as copper strip, sheet, rod, bar, tubes and wire) reducing their stocks of copper rather than purchasing copper on the spot market. In addition, higher copper prices have resulted in an increase in the use of scrap metal in fabrication. China's domestic copper recycling increased year on year by an estimated 400,000 tons.

Chart: World copper consumption yearly



Source: ICSG

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For CY2007, however, China's copper consumption is forecast to rise, underpinned by strong demand from continued industrialisation, urbanisation and the expansion of electric power grids. After the considerable drawdown of stocks in China by consumers and the State Reserves Bureau in CY2006, any further destocking is likely to be limited. Despite rising in the first half of CY2006, copper consumption in the United States declined for the second half of the year and is expected to drop marginally in response to declining growth in construction and vehicle manufacturing. Production of passenger and commercial vehicles in the United States declined year on year by nearly 5% in the 2006. In the construction industry, new residential home sales declined year on year by 13% in CY2006. In CY2007, growth in US copper consumption is forecast to decline. Housing starts and permits (usually leading indicators of future US residential construction activity) declined year on year by 5% and 7% respectively in CY2006. Higher mortgage interest rates are also expected to restrict growth in US housing demand in CY2007.

The ICSG expects that global demand for copper is likely to grow at a marginally faster pace than that seen in the last 5 years (2001-2006) when global demand increased by a CAGR of 2.70%. According to the ICSG, over the next three years global demand is expected to increase from the present 17.02mn tons to 19.18mn tons in CY2009 at a CAGR of 4%.

# India Infoline



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