MESSAGE FROM THE
ICF PRESIDENT

Dear Fellow ICF Members,

I would like to take this opportunity to thank you all for the trustful election that took place during the ICF Congress in Hongkong in October 2016. With great honor and pleasure, I take the responsibility as the President of this prestigious federation.

The Hongkong Congress was exceptional in terms of organization, the good choice of location, quality presentation and tours. The property where the conference took place was remarkable. I would like to thank the previous President Mr. Stuart W. Thorn for his remarkable works and contribution to the federation during his Presidency.

I look forward to see you all during the next ICF Congress scheduled in Barcelona, Spain from the 10th -14th October 2017. In my communication with the members of the standing committee, I understood that they are preparing a very exciting program for the Barcelona Congress, please do not hesitate to attend this Congress with your spouses to benefit from the exciting lectures and the tour programs.

With the support of my two Vice President’s; Mr. Arnaud Poupart-Lafarge and Mr. Richard Stinson, I am confident that we will rise to face the current challenging times and enhance our industry capabilities and take our federation to new heights.

I am thankful to each member of this federation for their valuable contribution and look forward to meeting them again in our upcoming events!

Kindest regards,
Hamid R. Al Zayani

ICF MEMBERSHIP

We are glad to report that Tele-Fonika Kable S.A in Poland has re-joined ICF.
Oil prices had fallen to a 13-year low (US$31/bbl) by January 2016 and mainly have fluctuated between US$45 and $55 per barrel since Q2 2016. Prices in this range are approximately half the hundred-dollar-plus levels that held for several years after the recession of 2009.

In other cable materials, a shortage of optical fibre is causing problems for many telecom cable makers. And new requirements for green and non-halogen materials are spurring changes in cable jacket compounds and other materials in some markets.

**Effect on Cable Prices and Margins**

Lower prices for copper and aluminium generally mean lower material costs for cable manufacturers. These lower costs, however, are generally passed through to the cable customers. As a result, cable makers’ operating margins generally are not directly affected by lower materials costs.

The financial reports of listed companies verify that the recent swings in copper and aluminium prices have not had much effect on operating margins. The shifts in metal prices have caused complications for cable company procurement and sales executives, but have not caused substantial changes in manufacturing or substitution of materials.

Oil prices indirectly affect cable makers. Changes in crude oil prices have a negligible effect on polymer prices, due to the range of additives and the complex formulations of cable-making compounds. Oil prices may affect energy costs a little, but this has not been detrimental for cable factory owners. One indirect effect of lower oil prices, however, is slower growth in the world economy and particularly in oilfield investments. These factors can result in lower demand for some types of cable.

**Fibre prices went up in 2016**

The fibre shortage has caused bare fibre prices to go up. As with conductor materials, however, this does not directly affect the operating margins or profitability of the cable makers. Of course, the fibre shortage causes many problems for cable makers: balancing the needs of different customers, assuring timely deliveries, scheduling large orders, etc. The fibre shortage has spurred development of new fibre-making capacity, which involves large capital investments and additional risk for the fibre and cable makers.

Prices of other raw materials used in cable production – tin, steel, various yarns, gels, insulating materials, etc. – have not changed as much as conductors and oil, and do not have such a great effect on cable sales or profitability.
COPPER PRICES

Amount of Copper Used to Make Cable
In 2016, the global market for all insulated wire and cable totalled US$149 billion. This market in terms of conductor tonnes amounted to 17.5 million tonnes. This quantity includes all conductors. Copper accounted for 14.9 million tonnes, or 85.2% of the total tonnage. This quantity of copper, at the 2016 London Metals Exchange (LME) average price, was worth US$73 billion. The US$73 billion is 49% of the US$149 billion value of the global 2016 insulated wire and cable market. Thus, a ten percent change in the price of copper can cause a five percent change in the insulated wire and cable market’s value. Of course the other 51% will be subject to changes in the prices of aluminium, polymers, energy, and other materials.

Copper prices: a wild ride for 10 years
Copper prices have made financial headlines many times in recent years. LME prices show copper was trading at an all-time high of US$9,855 per tonne in February of 2011. For about four years, prices shifted up and down, but mainly down, reaching US$6,300 in May of 2015. After that, prices showed a sharp and steady descent, until bottoming out with a monthly average of US$4,448 in January of 2016. In other words, prices dropped 55% in about five years.

Factors that affect copper prices include the following:
1.) copper cathode inventory levels, especially in China, which has larger swings in electronics industry production levels, housing starts, infrastructure funding, and other industries.
2.) scrap levels, again especially in China, which currently represents 48% of the world’s copper consumption.
3.) industrial production and housing starts in the world’s large economies, including the US, major countries of W. Europe, China, and India.
4.) mine supply, which can be affected by labour actions, natural disasters, government policies and other disruptions, as well as by mining-company decisions based on current or near-term copper prices relative to copper-production costs.
5.) currency exchange rates, especially the Chinese RMB and the Euro vs. the US dollar;
6.) the positions taken by commodity traders, which can be affected by market dynamics, trading trends in other commodities, perceptions of inflation or deflation, and currency values.

COPPER PRICES FELL BELOW US$ 5,000 / T IN 2016
(3-month average price, LME Grade A, US$/tonne)

![Copper Prices Chart](chart-image)
Cyclicality in supply-demand balance
In past years, the copper industry’s balance of supply and demand has shown some cyclical behaviour, with prices running up during periods of strong demand and tighter supply. The economic growth in China and the country’s copper demand was a key factor in the prolonged cycle of high prices from 2011 to 2015. Softening of China’s demand in 2015 and the build-up of stocks contributed to the 2015 price declines.

Reasons for the 2015-2016 price drop
The price erosion in H2 2015 and early 2016 resulted from excess supply, weak demand in China and elsewhere, a strong dollar, cost deflation, and sell-off of commodity-investment funds. The weak commodity trading affected a broad range of metals, oil, coal, and other commodities, not just copper. The weaker demand and excess supply of copper was expected to persist through 2016, keeping prices low.

Prices recovered sooner than expected
For most of 2016, copper prices ranged from US$4,500 to US$5,000 per tonne. In November 2016, the LME price jumped to US$5,920. Prices remained strong in early 2017, topping US$6,000 in February, and averaging US$5,907 in March. The jump in November is attributed to stronger-than-expected growth in China’s demand in H2 2016. Also, commodity traders began taking a more long-term perspective, driving copper trading prices to a new range.

Supply side was stable in 2016
Mine output remained stable through most of 2016 and is not expected to increase in 2017. Despite some disruptions at large mines late in 2016, the year on the whole experienced fewer disruptions than any year in the previous decade. The low prices in early 2016 spurred miners to cut costs and pursue efficiency, but it did not cause significant mine closures.

So the main reasons for the Q4 2016 and Q1 2017 price recovery are stronger demand, especially in China, and the shift of speculative money from short positions to long positions in commodity trading.

Factors in the near-term forecast
The market situation in 2016 delayed or reduced investments from some mining companies. The lower investments could be a factor in lower excess supply in the coming years. With this correction in the supply imbalance, prices will stabilize and head back up. But the investor confidence and the price jump experienced in November of 2016 are not expected to be a recurring trend in 2017.

The price forecast for 2017 and 2018 reflects a mix of positive and negative factors. One factor that could serve to keep prices high is the unusual situation in which the world’s three largest copper mines are experiencing disrup-
In 2016, the global total of refined copper production was 22.1 million tonnes. The amount of copper used to produce insulated wire and cable was 14.9 million tonnes. This means that wire and cable production used 68% of the refined copper produced in 2016. With aluminium, the wire and cable industry uses a much smaller fraction of the world’s total production.

Factors that may contribute to downward pressure on prices include the increased availability of scrap, which has been observed in early 2017. Another factor exerting upward pressure on prices is the outlook for stronger economic growth and industrial production in China during 2017.

Copper prices in 2017 and beyond
Monthly average prices are expected to remain in a range of US$5,500 to US$6,000 per tonne for 2017, with the year-long average close to US$6,000. Prices will move upward in 2018, averaging US$6,300 per tonne for the year, and then shifting to levels above US$7,000 per tonne by 2020.

ALUMINIUM PRICES

Role of Aluminium in Cable Production
In 2016, world production of aluminium totalled 58.9 million tonnes. The amount of aluminium used in insulated wire and cable was 2.6 million tonnes. In the case of aluminium, insulated wire and cable production represents about 4% of the world’s annual production level.

In addition to the 2.6 million tonnes of aluminium in insulated wire and cable, another 5.9 million tonnes of aluminium were used to make bare overhead conductor in 2016. This brings the total wire (insulated or un-insulated) and cable consumption of aluminium to 8.5 million tonnes. This total is 14% of the world’s total aluminium production in 2016. The use of aluminium in construction and transportation accounted for 42.9 million tonnes of aluminium consumption in 2016, or about 73% of aluminium production.

COPPER PRICES VARY MORE THAN THOSE OF ALUMINIUM

(USS/tonne, LME 3-month price)
Cable Industry and Conductor Prices
What this means is that the wire and cable industry is a significant consumer of copper and can affect copper prices. With aluminium, on the other hand, the wire and cable industry is a small consumer. Other industries have a much greater effect on aluminium prices. Also, aluminium is used for a minor percentage of wire and cable, so changes in aluminium prices have less effect on the overall cable market than copper price changes.

In many electrical cable applications, either copper or aluminium could be used as the conductor. Of course, copper and aluminium differ in terms of many key characteristics, including mechanical properties, conductivity, corrosion, density, and price. Of these characteristics, price is the one that can vary from year to year or month to month. Thus the factors in other industries, such as construction and transportation could affect aluminium prices, which in turn could affect the substitution of aluminium for copper in some types of cable.

Aluminium has narrower price range
The trend in aluminium prices over the past four years is somewhat parallel to that of copper prices. Aluminium prices, like copper prices, were high in 2010 and 2011, then began a four-year period of gradual and uneven price declines. Again, like copper prices, aluminium prices decreased more sharply in 2015, reaching a low of US$1,450 per tonne in December of 2015. Aluminium prices increased steadily through 2016 and Q1 2017, reaching US$1,960 in March of 2017. This price is similar to prices at the end of 2014, before the downturn in 2015.

Factors affecting aluminium prices
Many of the factors affecting copper prices also affect aluminium prices – demand in China, international trade with China, commodity trading, exchange rates, trends in construction, and stocks of raw materials. But there also are several factors affecting aluminium that do not affect copper: vehicular production; smelter capacity, and environmental policies that affect smelter operations.

China’s smelters and pollution controls
The output level of China’s smelters is likely to be particularly important for aluminium prices in the rest of 2017 and 2018. Smelter production in China is coal-powered, and smelters near major cities are a significant factor in air pollution. The government’s plans to reduce air pollution include shutting down smelters in some locations. These policies may affect investments in future smelter capacity as well as near-term smelter operations. The result could reduce China’s aluminium stocks and contribute to higher prices.

US trade policies and China’s exports
Another factor, possibly pushing prices in the opposite direction, is trade between the US and China. The Trump administration has expressed concerns about the quantity of goods that the US imports from China. Currently, China is the world’s largest net exporter of semi-finished and finished aluminium products. The US is a major trading-partner country; it accounted for 40% of the growth in China’s aluminium exports from 2012 to 2016.

Although there are no specific plans, the Trump administration has said it may consider raising tariffs on imports from China. This would reduce China’s total exports, affecting the country’s balance of aluminium supply and demand putting downward pressure on prices.

Smelter policies vs. demand factors
The aluminium market and prices appear to be at a tipping point. The smelter cuts in China may reduce supply and drive prices higher. On the other hand, the trend of higher exports from China to the US may be coming to an end. Changes in US trade policies could reduce the demand for Chinese aluminium products. Other factors will push global average prices into a rising trend. For example, stocks have fallen significantly outside China in recent years.

Aluminium price forecast
The net effect of the factors affecting China’s balance of supply and demand along with the factors in other countries will be a gradual rise in prices through
in growth rates is explained by the decrease in average prices, mainly due to conductor price decreases.

Conductor content and cable prices
The decreases in cable prices varied among cable types, depending on the amount of copper or aluminium and other cost factors. From 2011 to 2016, low-voltage energy cable prices dropped with a compound annual rate of (minus) -8.9%. The rate of decrease for other types of copper cables ranged from (minus) -8.1% to (minus) -6.1%. Aluminium power cable prices decreased with a compound annual rate of (minus) -3.8%. Winding wire prices decreased with a compound annual rate of (minus) -10.0%. Both aluminium and copper are used for winding wire, with copper accounting for 90.9% of the total conductor tonnes in 2016. The change in winding wire prices is almost entirely determined by the changes in commodity copper prices. Also, with winding wire, the enamel insulation is a very small part of the raw material costs.

Implications for the cable market
This means that the insulated wire and cable market value, expressed in US dollars, should show positive growth in the next five years, after five consecutive years of decreases from 2011 to 2016. As measured in conductor tonnes, the world’s consumption of insulated wire and metallic cable (excluding optical cable) increased with a CAGR of 2.6% from 2011 to 2016. During the same years, this market’s value in US dollars decreased with a compound annual rate of (minus) -5.6%. The difference in growth rates is explained by the decrease in average prices, mainly due to conductor price decreases.

Hollow prices show little movement
For cable makers, costs other than conductor materials have changed very little from 2011 to 2016. The hollow price is the average cable price per conductor tonne minus the average price of copper or aluminium per conductor tonne. The hollow prices for winding wire and metallic cable were basically flat from 2011 to 2016. Winding wire showed a 0.4% CAGR, and other cable types showed a slight decrease in hollow prices, ranging from (minus) -0.9% to (minus) -2.0%. These slight decreases may reflect many different factors, including currency exchange rates, improved efficiency in manufacturing, and lower energy costs.
COPPER PRICES DETERMINE THE PRICE OF COPPER CABLES
(Monthly prices indexed to 100 in January 2009 through March 2017)

ALUMINIUM CABLE PRICES DO NOT TRACK RAW MATERIAL PRICES AS CLOSELY AS COPPER CABLE PRICES
(Monthly prices indexed to 100 in Jan 2009 through Mar 2017)
ALUMINIUM VS. COPPER

The price difference has broadened
From 1970 to 2004, the LME price of copper ranged from US$1,044 to US$2,800 per tonne. For most of these years, aluminium was less expensive per tonne, but often by only a few percentage points. The ratio of copper to aluminium prices per tonne was less than 1.5 until 2004, when copper prices began increasing more rapidly than aluminium prices. The ratio of copper to aluminium prices, in terms of US dollars per tonne, increased to 2.0 in October of 2005, then 3.0 in August of 2006, and 4.0 in August of 2012. Since then, the price ratio has fluctuated between 3.0 and 4.0, and it has been near 3.0 in Q1 of 2017.

Cost is not the only criterion
The outlook is for both aluminium and copper prices to increase in the next few years. Copper prices are expected to increase at a faster rate than aluminium prices. This means that there could be more applications for which it may make sense to substitute aluminium for copper conductors. The business case for switching from copper to aluminium for cable conductors varies among applications and cable types. In some cases, copper remains preferable due to its advantages in size, corrosion properties, and termination or connector characteristics. In other cases, weight and cost are more critical, and aluminium may be preferred.

Preferences vary among cable users
Finally, experience shows that some companies – cable customers such as power companies – have proven more willing to switch, and other companies seem inclined to stay with copper. Sometimes the preferences are nationwide. In some cases, these national preferences may be due to local or national standards, specifications, government policies, or building codes. Or there can be concerns about compatibility with existing infrastructure, maintenance procedures, and other issues of user preferences, not just cable prices.

Substitution is progressing gradually
In 1996, the insulated wire and cable market was 9.7 million conductor tonnes, of which 0.9 million tonnes, or 9%, were aluminium. In 2016, the total market was 17.5 million tonnes, and aluminium’s share had increased to 15%, or 2.6 million tonnes. The CAGR for all conductor tonnes was 3.0%.
from 1996 to 2016. The CAGR for aluminium conductor tonnes was 5.7%, and the CAGR for copper tonnes was 2.7%.

Aluminium in power networks
As the cable industry adjusts to the end of the historically low-price environment, margins will remain under significant pressure and some increased substitution opportunities are forecast. For example, subsea power cables for offshore wind cables have been identified as a strong possibility for conductor material changeover, and some evidence of this has been observed already, even without the hike in differential pricing.

The percentage of aluminium in winding wire production has increased from 2.8% in 1996 to 9.1% in 2016. These percentages are based on conductor tonnes. Aluminium has achieved a greater penetration in power cables, rising from 10.4% in 1996 to 16.2% in 2016. Promising cable applications for aluminium include electric power networks and automotive wiring. In power networks, there are fewer concerns with corrosion, which has proven to be an issue for termination, connections, and splicing. These issues, along with concerns about fire safety, are obstacles preventing greater use of aluminium in building wiring and appliances.

Vehicular applications are increasing
In automotive applications, lower weight is a big issue for car makers. As a result, the auto companies are working to address the problems that oxidation can cause in cable terminations. So far, aluminium is still a small percentage of total vehicular wiring – less than 20%. But experience in the last 10 years indicates that aluminium will penetrate the various applications and wiring harnesses within a car over time, and it will gradually increase its overall vehicular market penetration model by model.

The first main application in cars and light trucks was battery cables, which have a comparatively large diameter for automotive wiring, plus a short length, and a large welded-on lug-type connector. In the 1970s, some car companies used copper-clad aluminium for battery cables, but by the 1990s, all-aluminium cables were in widespread use. For other vehicular applications, the car makers are developing approaches to overcome issues.
with aluminium’s strength, flexibility, oxidation, and thermal creep. These approaches include techniques for cable sealing, new connector interfaces, crimp-on terminations, and welding strands together.

The first car model with aluminium used in a wiring harness was the Toyota Yaris, introduced in 2009. Since then, other models have incorporated aluminium wiring. Japanese car makers initially led this trend, but US and European car makers are following. In 2016, aluminium accounted for less than 5% of wiring harnesses, by weight, but the trend will accelerate as US and European car makers also roll out models with aluminium harnesses.

Of course, there is an intermediate “semi-finished” product between aluminium and copper raw materials and wires for making cable: wire-rod. The world’s wire-rod capacity generally has not been a limiting factor in cable production, and it has not made a substantial contribution to changes in wire prices.

The suppliers of wire-rod include many of the world’s large wire-and-cable companies, copper suppliers, and other metal-supply companies. The manufacturers have invested in wire-rod production lines as demand has progressed, especially in higher-growth markets such as China, the GCC countries, and some countries in Eastern Europe.

Copper wire-rod facilities
According to CRU’s tally, the world had 180 copper wire-rod mills operating in 2015. This figure is up slightly from 175 in 2012. Capacity at these operations ranges from six tonnes per year to more than 400 tonnes per year. The total capacity of the world’s copper wire-rod mills was more than 25 million tonnes, putting the world average utilization rate at about 60% for 2015. Thus, there is ample wire-rod capacity in most geographic regions to have robust competition among the suppliers and to keep pressure on prices.

China’s copper wire-rod industry
China’s copper wire-rod capacity increased from 6.5 million tonnes in 2012 to 9.3 million tonnes in 2015. During that time, the number of copper wire-rod mills operating in China increased from 36 to 42. China’s total wire and cable output was 6.6 million conductor tonnes in 2015 and 6.8 million in 2016. Some of that total would have included aluminium conductor. Thus, the copper wire-rod mills in China on average have had a utilization rate of about 60% in the past two years. In other words, the investments in new wire-rod capacity for China have matched or exceeded the pace of growth in the Chinese wire and cable industry’s consumption of copper wire.

Copper wire-rod in other regions
For both North America and Western Europe, the region’s copper wire-rod capacity did not change from 2012 to 2015. In North America, the average utilization rate has been about 60%. In Western Europe, the utilization rate has increased from 62% in 2013 to 67% in 2015. The capacity in other regions has been flat or up slightly. In most cases, new capacity has been added to achieve a local supply in order to minimize transportation costs, trade imbalances, or manufacturing costs. In all regions, the utilization rate is under 70%, and in some regions, it is under 50%. This means that copper wire-rod capacity will not cause any significant problems in the supply of cable raw materials for the foreseeable future.
OPTICAL FIBRE

The situation is quite different with the key material used to make optical cable – “bare fibre.” There is a global shortage. It has come about because the investment in fibre-making capacity did not match the growth in the amount of fibre needed. The shortage is not in silicon tetrachloride or other chemicals that may be considered the raw materials of fibre. Rather, the shortage is in the preforms – the cylindrical rods that are fabricated from the starting chemicals and then drawn into fibre.

Optical fibre preforms and wire-rods
The preform is the interim step between silicon chemicals and drawn fibre, somewhat similar to the way that wire-rod is the interim step between copper raw materials and copper wire for cable making. In the copper cable business, wire-rod capacity is not a limiting factor. In the optical cable business, preforms are the limiting factor. The other step in making fibre is the draw process. Currently, there is excess draw capacity, and this has been the case for many years.

The time to plan, build, and commission a new wire-rod facility may be 18 to 24 months. This also is about the time needed for a new preform factory. A new preform factory requires a minimum investment in the tens of millions of dollars – probably near US$100 million – to produce enough material to be cost effective. The investment in a new wire-rod facility may be slightly lower.

Fibre demand and capacity planning
The current shortfall in preform capacity, however, has resulted more from the time element than the amount of the investment. For more than 20 years, there have been many years when global fibre demand has jumped up more than 15% or 20% in one year. Recently, this has been due to the massive network construction projects of China’s telecom operators. With growth at these rates and the 18-24 months to bring up new capacity, the industry hasn’t really achieved a good long-term balance.

With metallic cable, demand in most places is growing at rates of 1.5 to 3.0% per year, and maybe 5 to 7% in higher-growth markets such as China. So there is more time to plan for wire-rod capacity requirements.

Preform tonnage: about 0.1% of copper
In 2016, production of communications grade fibre used about 14,250 tonnes of preforms. This figure is about 0.1% of the 14.9 million tonnes of copper conductor used in wire and cable in 2016. Note there are fibres made for non-communication applications, such as laser power delivery, illumination, imaging bundles, and sensors. Some of these non-communication fibres are based on different optical materials, not silica glasses. The communications fibre, however, represents the vast bulk of all fibres in terms of material tonnage, market value, and fibre kilometres.

From preform tonnes to fibre kilometres
The 14,250 tonnes of preforms made in 2016 were drawn in to 456 million kilometres of fibre. With most processes, one kg of preform can be converted to 32 km of fibre. There is a yield factor of about 94% in making cable. That is, some of the fibre is “lost” due to line start-up and shut-down processing, the handling of fibre reels and slight excesses on the reels, and other yield factors. The 2016 cable market therefore consumed 425 million km of optical fibre.

From centimetres to micrometres
Large-scale fibre operations are making and drawing preforms that are about 20 cm in diameter. The drawn glass fibre has an outside diameter of 125 micrometres (µm), less than one hundredth of the preform’s diameter. An acrylic coating on the glass fibre brings the “finished” fibre’s outside diameter up to 200 µm or 250 µm for most telecom applications. This acrylic coating is applied on the draw tower, before the
finished fibre is proof tested and reeled up at bottom of the draw tower.

In 2014, the Hengtong group of China published a paper describing its development of six-metre preforms, with a diameter 20 cm. This preform weighs more than 400 kg, takes the better part of a week to draw, and yields 14,000 km of fibre. Other factories are turning out preforms typically between 1.5 and 3.0 metres in length, with diameters of 15 to 20 cm.

**Preform process: achieving high purity**

There are several processes for making preforms, but most use a chemical vapour deposition process to achieve the high-purity needed in the fibre core. The starting material for this process in most cases is SiCl₄, which is sourced at grades of at least 99.99% purity. Some key suppliers offer six “nines” or 99.9999% purity. The material quality includes metal ion impurities characterized as on the order of one part per billion or less. The chemical vapour deposition process has some similarities to part of the process for making semiconductor “chips.” The chip process, however, has other similarities to printing – laying down chemicals in a pattern, rather than bulk deposition on a cylinder.

The SiCl₄, supplied to fibre makers in liquid form, is bubbled into the preform machine with O₂. A heat source, either a flame or an RF plasma, drives the reaction in which SiO₂ is deposited onto the substrate and Cl₂ is collected. The preform machine can be set up horizontally, like a lathe, to deposit the silica materials while the preform is spinning on the centre line of the cylinder, or in a vertical chamber, to “grow” the silica materials downwards at the bottom of the cylinder.

**Controlling material costs**

Over the years, fibre makers have pursued improvements in the fibre-making process in three main areas: deposition rate, preform size, and draw speed. Other enhancements that have been critical in recent years include the coating materials and processes, the fibre geometries, the mix of dopants, and the chemical processes in the reactor chamber. But the three areas of deposition rate, preform size, and draw speed have a big effect on the costs and profitability of making fibre.

**Effects of the fibre shortage**

With the worldwide fibre shortage that began in 2016, telecom fibre prices have gone up 10% to 20%, depending on the country. Delivery times have stretched from months into quarters. Some large “integrated” fibre and cable companies have enough internal fibre capacity to

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**PREFORM CAPACITY HAS CAUSED THE FIBRE SHORTAGE**

(Fibre demand (for cable production) shown with preform and draw capacity, in M f-km)

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Note: a buffer of about 10% excess capacity is needed for maintenance shutdowns, peak months, changes in product mix, and other reasons.
supply their cable-making operations. Other “independent” cable companies must buy fibre, and the shortage has caused some independent cable makers to find new sources.

**When the shortage will end**

As of early 2017, several companies have announced projects to build new preform factories or expand existing factories. There are projects underway in China, India, and the US. These projects will add 2,000 to 3,000 tonnes of preform capacity to the world’s total starting in 2017. Some of the new capacity may not be on-line until late 2018 or early 2019. In any case, the additional capacity could bring 60 million to 100 million km of new fibre capacity into the market.

Will this be enough to end the shortage? This depends on the trend in optical cable demand. Installations in 2016 consumed 425 million fibre-km. If this market continues to grow at 10% per year, then 90 million km of new capacity will be used up in two years. Currently China is more than half the world market. China’s demand in 2017 is not expected to grow 10% compared with 2016, and the extent of growth in 2018 is further in doubt. Thus, all eyes are watching China’s carriers to see what their demand trend will be.

If China’s market is flat after 2017, then there will be a good chance that the new preform capacity will push the world into an oversupply situation in 2018. This could result in lower prices and also more difficulty in achieving payback on some of the new preform capacity.

In the longer term, there are signs that 5G mobile network construction and fibre-to-the-home projects can keep the market at high levels – above 425 million fibre km well into the next decade. In some of the 5G mobile networks, fibre will be used to deliver the “traffic” or signals to the mobile base stations and the radio heads.

**OIL PRICES**

While copper and aluminium prices were falling sharply. The Brent crude oil price averaged US$99/bbl in 2014, but the price began to decline in mid-June of that year. This downward trend contin-
ued until the spot price dropped close to $26/bbl in January 2016. At the end of March, 2017, Brent crude was trading at $50.75/bbl and had averaged around $52/bbl for the month, down from about $55/bbl in February.

Oil prices to be more stable in 2017
The decrease in price from February to March may prove to be temporary. Going forward, there are two key factors in determining the trajectory of prices. Both point towards oversupply in the near term. The first concerns the November 2016 agreement in which OPEC members agreed to cut production. The agreement has held up well so far, but extending the deal beyond May 2017 will be difficult, particularly for Russia, if prices don’t firm up soon. And, if non-OPEC producers do not participate in the curtailment, it is unclear whether Saudi Arabia and the other Gulf states will want to shoulder the burden of the production cuts on their own.

Second, even with an extension of the OPEC deal, US shale production might continue to increase and partially, or even completely, replace any reductions achieved in OPEC output. Thus, there is less likelihood that the physical market will move into a meaningful deficit by 2018Q2, limiting the potential for the Brent crude price to recover to levels above US$60/bbl before late 2018. The price of Brent crude is expected to average $54/bbl in 2017, up from $44/bbl in 2016.

POLYMER PRICES

What do oil prices mean for cable makers? Changes in crude oil prices have very little direct effect on cable-making costs. Unlike copper, aluminium, and fibre, oil is not used as a material in making cable. Oil prices can have two indirect effects on cable costs. One is the cost of energy. The other is the cost of polymers compounds and gels that are derived from oil products and used inside cables or as the outer jackets of cable.

PVC and PE prices don’t vary with oil
CRU has monitored data from the polymer industry on polyvinyl chloride (PVC) and linear low-density polyethylene (LLDPE) prices going back to 2009. From January 2009 to March 2012, crude oil prices increased nearly 400%. Then from March 2012 to 2016, oil prices dropped below the 2009 level, falling by nearly 70% in three years.

PVC and LLDPE prices, on the other hand, did not show this sharp rise and fall. From 2009 to 2012, PVC and LLDPE prices rose about 50%. From 2012 through 2016, PVC and LLDPE prices rose steadily and unevenly. In March of 2017, PVC prices were 46% above the 2009 level, and LLDPE prices were 86% above the 2009 level. The reason that these basic polymer prices do not track with oil prices is the extent of processing involved in their production.

Cable compounds have many materials
Further, the prices of polymer compounds used in making cable do not track directly with PVC and PE prices. The reason is that there are many other materials in cable compounds – flame retardants, smoke suppressants, plasticizers, etc. These other compounds may have their own price swings, often due to their use in other industries. The prices of metal oxides used as flame retardants, for example, may be affected by demand in other industries that use the metal materials.

The compounding process
For outer jackets and some internal tubes and coatings, the polymer materials are extruded at higher temperatures and cooled on the cable-making lines. These compounds are fed into the extruders as pellets, with each pellet having the correct mixture of the necessary materials. The compounding process brings together these materials and makes the pellets. In some cases, there are companies that specialize in compounding and supplying the cable makers. In other cases, the cable makers do the compounding themselves. The decision on whether to use an in-house or external compounding depends on the complexity of the recipe, the quantity needed, and the number of cable products that use a specific compound. Compound-making companies often buy bulk chemicals such as PVC or LLDPE
with contracts that may incorporate terms providing for price adjustments based on indexes of material prices. Of course, a compound may be only partially based on PVC, say less than half, so only that fraction is adjusted according to a commodity polymer price index.

**Sustainability and green requirements**
The cable industry is heavily regulated. In most countries, there can be multiple independent standards bodies and government agencies that make rules affecting cable materials and cable performance. There are building and fire-safety codes. There are standards for cable materials, testing procedures, and labelling or marking. And the regulations are changing. In recent years, new regulations are being formulated to facilitate recycling, or to reduce the environmental impact of cable making. Such regulations may affect the types and amounts of halogen-based chemicals or other materials in cable compounds. As the regulations change, the compounds can become more complex. Such additional complexity generally tends to increase the compound costs, not decrease them. Or cable makers may find that they have to work with a larger number of compounds for different products, which complicates the purchasing, storage, and processing functions for cable makers. And all of these increased costs mean that the prices of crude oil or bulk commodity polymers have less effect on the overall costs of making cable.

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**CONCLUSIONS**

In the past five years prices for copper, and to a lesser extent for aluminium, showed more volatility than previous periods, excluding the global financial crisis of 2008 and 2009. Factors contributing to this volatility included:

- **the strength and timing of the recovery from the recession;**
- **rapid upswings and downturns in China’s construction industry;**
- **the addition of night trading and higher trading volumes on the Shanghai Futures Exchange (SHFE);**
- **the increased volume of commodity-metal hedge funds being traded in China;**
- **disruptions to mining operations and uncertainties in smelter volumes.**

During the last five years, the net effect of these factors has been a downward trend in copper and aluminium prices. The decreases in conductor prices have caused the cable market value, expressed in US dollars, to decrease over the last five years.

This trend is likely to be reversed in 2017 with higher copper and aluminium prices being the main factor.

Fibre prices shifted up in 2016, due to the fibre shortage. This shortage will likely last through 2017.

Starting in 2017, new preform capacity is coming on-line. Preform capacity is likely to increase through 2019. The growth in fibre demand also may slow down. The result will be an end to the fibre shortage, probably occurring sometime in 2018.

Finally, we haven’t seen that raw materials have had a noticeable effect on operating margins, based on the financial reports of the publicly traded cable companies. For one thing, the larger listed companies often make a number of different types of cable, with varying material requirements and varying profitability. This means that market factors could affect the mix of products sold, making it difficult to see the effect of raw-material price changes in operating margins.

Plus, cable makers often have contracts with metal suppliers that allow for adjustments in the prices in accordance with published price indexes. This means that fluctuations in conductor prices are passed through to the customer and do not directly affect operating margins.