

Trends in Aluminium Consumption by Power Sector

Amongst all non-ferrous metals, fastest growth in consumption is that of Aluminium. Its availability, its superior properties, and its innumerable applications have paved way for its stupendous growth. Global production of Aluminium is touching 47 Million MT/A. Indian production is at around 1.6 Million MT and is likely to grow in next few years to 5.0 million MT.

Aluminium usage is expected to grow in future because of its high strength to weight ratio, its high resistance to corrosion, its excellent response to finishing, and the ease which it can be fabricated.

Major markets for Aluminium are Building and Construction, Transportation, Packaging, Consumer Goods, Machinery,



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Aluminium Metal in India

In India, for the last seven decades, Aluminium has made inroads and now it occupies a dominant position. Almost 6-7 lac MT/A is the consumption of Aluminium in electrical or power sector. As a percentage of total Aluminium produced in the country, close to 45% is used in this sector for over-head bare conductors, and other types of covered conductors. Aluminium has proved its superiority, through its longevity and cost effectiveness. Three basic inputs for Aluminium production namely Bauxite, Coal and skilled manpower are all available in abundance in India. Hence cost effective production of Aluminium has become a reality in India. During the 12, 13 and 14th five year plans, Aluminium usage in power sector expected to grow further.

Aluminium in Power Sector Applications

Overhead conductor is single largest use of Aluminium presently in India. Besides this it is used in underground cables, transformer winding wires, bus-bars, welding cables etc. It is expected to be used in the structures for T & D lines, substations, and outdoor control equipment bodies. Developmental work is on.

Overhead conductors using Aluminium are mainly of two types, one with steel as central reinforcement and the other without any reinforcement. Conductors with steel reinforcement are inherently more corrosion prone and they have higher T & D losses. Their overall life is short when compared to conductors without steel reinforcement. In India, about 80% conductors used are with steel reinforcement and it is one of the prime reasons for high T & D losses. Europe has been the leader in propagating usage of non-reinforced conductors and due to this reason their overall T & D losses are between 4-6%. In India T & D losses are between 30-40%. It is high time a careful evaluation is carried out to assess the same and go for better options.

Power sector mainly uses conducting alloys of Aluminum with conductivity varying between 52-62% IACS. Copper is considered to have

100% IACS as conductivity but still its high cost, poor availability, higher weight and prohibitive cost of lines have paved way for Aluminium conductors across the globe. In India we have stopped using copper conductors.

country, and with rapid industrialization coupled with urbanization, the current carrying capacities of lines have to be more than doubled. The old dwellings/ bungalows have now been replaced with multi

Table 1 : Types of Aluminium Conductors and their Merits

Particulars Type	ACSR	AAAC	AAHTC (TACSR/ACSS) etc.
Efficiency	Low	High	High
Application	T & D	T & D	T & D
Max.Continuous Operating Temp	75 °C	100 °C	200 °C
Sag	High	Optimal	Low
Corrosion	High	Low	Optimal
Weight/KM	High	Low	Optimal
Useful life in years	30	50	30
Present Usage	Bulk	Moderate	Selective
Future Usage Trend	Reducing	Increasing	Increasing
Power Losses	High	Low	High
Cost of Conductor	High	Low	Very High
Line Capital Cost	Moderate	Low	High

Conductors of Aluminium

Main application of overhead conductors is in overhead T & D lines. These lines vary in voltages starting with 220V at the lower end and progressively it goes to 440V, 11 KV, 33 KV, 132 KV, 220 KV, 400 KV, 800 KV and 1200 KV at the higher end. They are used in AC (Alternating current) lines as well as DC (Direct Current) lines. AC lines are with three phases single circuit type or double circuit type. The higher the AC Voltage, they use instead of one conductor per phase, up to eight conductors per phase. Whereas DC lines are with twin or Quad conductors in each section (pole) designated as positive and negative.

The theory is that longer the distance of transport of electricity, the higher is the voltage. For example a 11 KV line is expected to be not longer than 5-6 KM and a 400 KV line is expected to be not longer than 200-225 KM. Weight of Aluminium conductor in a 400 KV double circuit line /KM is between 25-50 MT depending on twin/Quad type of construction. 11 KV distribution line /Km may use Aluminium conductor weighing between 200 to 400 kg depending on the type of loading.

With the economic growth in the



storied mansions and the per capita power consumption has also grown, resulting in massive increase in consumption of Aluminium conductors. This directly reflects in increased consumption of Aluminium.

With underground cabling becoming the preferred option in urban areas, due to the reasons like safety, non availability of ROW(Right of Way) etc. bigger size underground cables are being preferred, again resulting in higher usage of Aluminium.

New Possibilities with Aluminium

With growing emphasis of R & D and possibility of new applications, Aluminium in alloyed form is expected to enter the structural applications of power sector. Products like Electric Poles, Towers, and Substation structures will be the next destination of Aluminium. Advantages like light weight, (almost half that of steel), with



can be assembled fast. This increased speed of transport will certainly weigh strongly in favour of Aluminium in power sector structurals during

Year	ACSR Lac MT	AAAC Lac MT	AAHTC Lac MT	Aluminium Lac MT
2012-13	3.96	1.15	0.15	5.28
2013-14	4.32	1.25	0.17	5.76
2014-15	4.80	1.40	0.19	6.40
2015-16	5.28	1.55	0.21	7.04
2016-17	5.64	1.70	0.23	7.52
Total	24.00	7.05	0.95	32.00

Year	Lac .M T
2012-13	NIL
2013-14	0.10
2014-15	0.30
2015-16	0.60
2017-18	1.00
Total	2.00

no requirement of coating or galvanizing because of rusting, with lighter weight (enabling cheaper transport), Aluminium in power sector structurals will become a reality. Added to this the rapid pace of electrification of the country, movement of structurals across the country by road is becoming a bottleneck. Aluminium structures offer a definite advantage because the structural parts could be transported across the country by helicopters and

coming decades.

Another emerging usage of Aluminium will be in packing drums of conductors and cables which also have to be transported over long distances. The reduced weight, the reusability, the realizable scrap price, and comparable mechanical strength will make Aluminium a material to be considered in this sector.

Projected Aluminium Usage Trends in Power Sector During 2012-17

For overhead conductors, cables, transformer winding, bus-bars etc, the consumption pattern is indicated in the table below.

For structural usage in power sector like poles, towers, substation structures, drums etc the usage pattern has to develop. My personal view is that as a country we should consider the possibility of using Aluminium structurals above the height of 3-4

meters from ground. The wooden drums for packing should be replaced with multiple use Aluminium drums. If this happens, a new market for Aluminium will open to an extent of 2 lac MT/A over a period of next 10 years.

In all about 35 - 40 Lac MT of Aluminium per five year plan is the emerging.

Conclusion

- Aluminium consumption in Indian power sector, which was below 50,000 MT/A a few decades has grown to 6-7 lac MT/A and its potential to grow can be around a million MT/A with newer structural applications included.

- With cost of steel, fuel, manpower, transport, growing at a rapid pace, the lighter and non-corrosive Aluminium will become a good option.

- In Indian context, there is a special relevance on usage of Aluminium. Our country is rich in bauxite, coal and technical manpower which are prime inputs for Aluminium.

- Last but not the least, Aluminium being the green metal, (the most easily and economically recyclable metal) offers great advantage in power sector.

- It is time that India concentrates on R&D to use more Aluminium in all applications, including power sector, to economise and to ensure cost effectiveness and longevity of equipment.

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