CONCRETE VS WOODEN POLES

EFFECTS OF THE SHIFT TO CONCRETE POLES ON TREE GROWERS

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INTRODUCTION

Preservative treated Eucalyptus poles have been used for power transmission for a long time in Kenya. The demand for treated poles has kept on increasing due to the Government efforts to connect more people with electricity and this has been matched with increased investment in growing of the species on both Kenya Forest Service (KFS) plantations and private farms. This has been well back-stopped by research initiatives, which have successfully developed a variety of hybrids of *E. grandis* and *E. camaldulensis* that are site-matched for different climatic regions including dry lands. Currently, wooden transmission poles are exclusively from Eucalyptus species, mainly consumed by Kenya Power and Lightning Company (KPLC) and the Rural Electrification and Renewable Energy Corporation (REREC) with an estimated annual demand of 400,000 – 500,000 poles per year. The domestic supply of poles has been enough to fulfil the demand but the consumers have been importing about 10% of the requirement.

With the increasing demand, attributed to increasing population and increased rural to urban migration among other factors, the government of Kenya has continued to support extensive growing of Eucalyptus species. This has been enhanced by the introduction of high-yielding, shorter-rotation varieties through biotechnology between 1997 and 2003. The recent past has therefore experienced unprecedented growth in farm forests in various configurations throughout the country (KFS, 2009). The readily

Concrete poles alongside Kibwezi-Kitui road (in 2015, before tarmacking). It is true that they look neat. Photo Jan Vandenabeele

available market for Eucalyptus poles has in the recent years motivated farmers to grow the species as a cash crop. A study assessing financial viability of growing *E. grandis* for power transmission poles and fuelwood in Kenya (*Langat et al.*, 2015) reported that, based on the market prices and prevailing economic conditions, growing of *E. grandis* was more profitable for medium power transmission poles than firewood.
In the recent years however, the pole consumers have been trying to shift from wooden to concrete poles, limiting wooden ones for distribution only.

Due to this shift, many farmers and forest-based organisations that had heavily invested in growing Eucalyptus trees face a market dilemma for their mature trees. For example, more than 12,000 members (small land holders) of the Kenya Forest Growers Association (KEFGA) have cumulatively established large eucalyptus plantations and woodlots. Through the Miti Mingi Mashambani project, over 1 million mature Eucalyptus trees were planted. Without ready market, they are likely to go to waste if not used for fuel wood. Eucalyptus trees grown for electricity poles take 10 -13 years to mature, depending on the climate and soil conditions of the area. Beyond this age, the trees can only be used for other purposes like sawn timber or fuel wood. This may not however provide the farmers with the same financial income as anticipated.

COST AND SERVICE LIFE OF WOODEN POLES

Treated wooden poles cost between KES 10,000 to KES 12,000 for a ten-meter pole. This is far lower than KES 18,000 and KES 20,000 for a same length concrete pole. Properly treated, wooden poles can provide an economical utility period of up to 40 years. While a concrete pole is expected to last in service for about 50 years, the difference in costs and lifespan does not make wooden poles more expensive and the benefits of using wooden poles go beyond just financial gains. In an era where every government is concerned about climate change and how to mitigate the potential impacts on the environment and human life, the sensible thing is to encourage a green economy. In the East African region, Tanzania restricts the use of concrete poles to areas where wooden poles cannot withstand prevailing conditions, like in areas prone to bush fires and those that are swampy. In Uganda, wooden poles are in use in all the projects but there are plans to use metallic poles for high voltage transmission only.

In Kenya, the government committed itself to promote a green economy, aimed at reducing environmental risks and ecological hazards, and one that ensures sustainable development without degrading the environment. This therefore calls for a policy to guide decisions based on circumstances and take advantage of both commercial tree growers and concrete pole producers during power infrastructural investments. Farmers have supported this initiative by growing trees on farms, enjoying the incentives provided by a good wooden pole market due to the continued expansion of electricity connectivity programmes.

ADVANTAGES OF WOODEN OVER CONCRETE POLES

The use of wooden poles has a number of advantages over the use of reinforced concrete poles. Some of the key advantages include:

Easy transportation and installation

Wood is a strong, elastic and lightweight material. The specific gravity of preservative impregnated wooden pole is in the range of 700Kgm-3. A ten-meter pole with a flexural strength of 8.2kN at the top, would weigh less than 300 kg. Accordingly, the loading rates of trucks increase several times, significantly reducing transportation and installation costs. It doesn't need heavy machinery to install the wooden poles.

Easy to climb on wooden poles

Wooden poles do not require careful handling. They are more flexible to dropping and abrasion than concrete ones.

Work well for bending

The use of wooden preservative impregnated poles on high-voltage lines meets the goals of increasing stability in the case of wind loads, due to their elastic property.

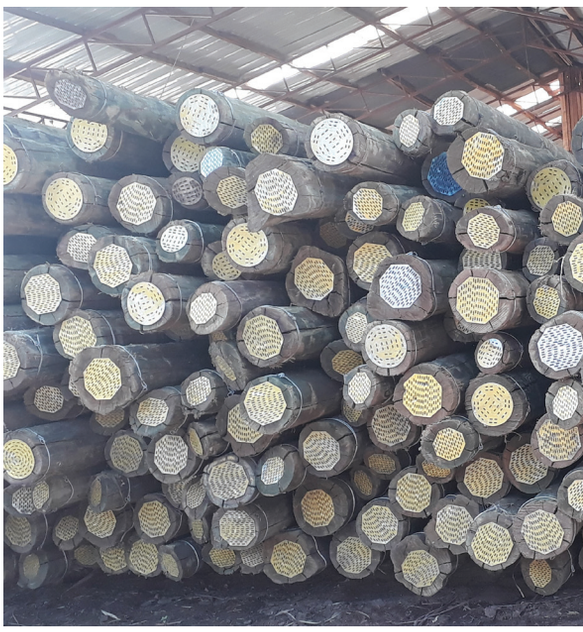
Absence of destruction of supports in watered soils

Reinforced concrete poles don't withstand operating conditions in particularly saline soils. Their service life is reduced to 3-7 years. Wooden poles, impregnated with antiseptic CAA are durable and extremely resistant to any weather conditions and environment.

Absence of a "domino effect"

A heavy reinforced concrete pole, falling, drags the next supports over the whole anchor span. A wooden pole will hold on wires strung, which reduces the number of outages on the lines.

Eucalyptus poles being debarked in the yard of a pole treatment plant. Photo G. Muthike



Concrete poles alongside Kibwezi-Kitui road (in 2015, before tarmacking). It is true that they look neat. Photo Jan Vandenabeele

Have a much higher level of isolation

Wood has exceptional dialect[1] properties due to the absence of leakage currents. The use of wooden poles provides significant energy saving when transferring electricity power over a long distance. Wooden poles provide a considerable isolation distance from the point of view of impulse over-voltages and can extinguish the power arc[2] overlap, providing high resistance of the earth fault circuit. These properties are used to reduce the number of lightning outages of transmission lines to increase safety.

Have better fire resistance

Effective impregnation of CCA not only prevents wood rotting, allowing extended service life of poles, but enables fire resistance. Moreover, in case of fire, wooden structures resist fracture longer than concrete and metal. Concrete poles are likely to yield within 15-30 minutes of intense fire, while wood may hold its integrity for more than an hour due to the charring of the surface, protecting the internal material.

Long service life and lower maintenance cost

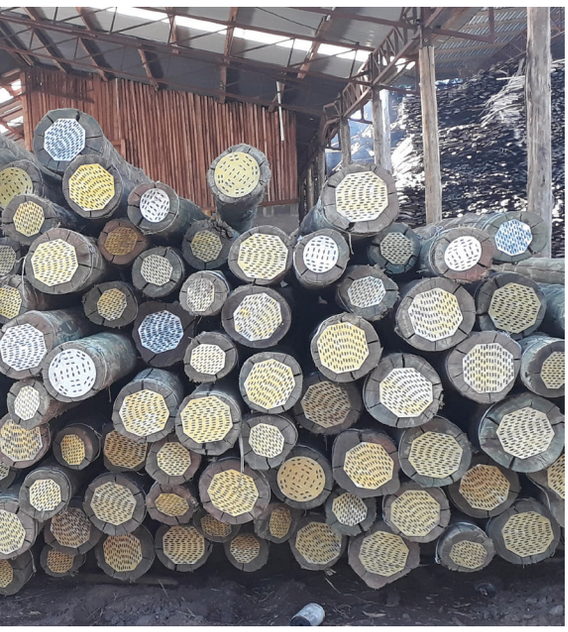
Wooden poles don't require maintenance during the service life of several decades. The service life of a high-quality wooden pole exceeds the standard lifetime of the power transmission line as a whole.

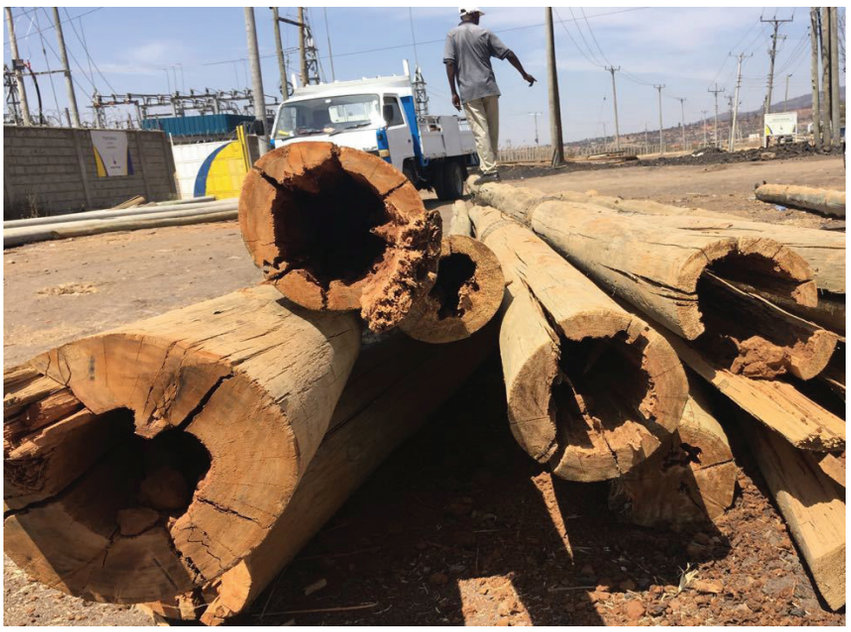
EFFECT OF SUBSTITUTION OF WOODEN WITH CONCRETE POWER TRANSMISSION POLES

Despite the advantages, wooden poles have continued to be replaced by concrete ones. Due to this shift, there has been a significant drop in uptake of wooden poles from over 500,000 in 2011, when the shift started, to 200,000 in 2019, according to the Kenya Wood Preservers Association (KWPA). This has had a devastating impact not only on commercial tree growers but also on manufacturers and suppliers of wooden poles. At least four wooden pole processing factories with about 200 employees closed down due to lack of market. In the recent years, power distribution in areas such as slums and swamps, which are prone to fire, water and termite damage, have been done with concrete poles.

Although the power company claims that the local supply of wooden poles does not satisfy the current demand, the move has caused silence among farmers and other sector players in a business which generates income to the tune of KES 3 billion annually. The power company takes up to 25,000 poles monthly, with about 13,000 coming from local farmers and the rest imported from South Africa, South America, Tanzania, and Zimbabwe. Kenya Power Company further argues that the shift to concrete poles makes economic sense, since concrete poles costing 33 per cent more than wooden ones have a life span of more

[1] Isolating
[2] Electrical breakdown giving rise to electrical discharges





The bane of Kenya Power: badly treated poles, the inside having been devoured by termites because of poor treatment. Photo G. Muthike

than 60 years. This is twice that of treated wooden poles, which in the recent years have been failing after shorter than 30 years. The shortening of service life of treated wooden poles is being blamed on malpractices during pre-treatment and treatment procedures.

In Kenya, pole treatment has undergone numerous changes since its introduction in the country about 30 years ago. The preservative would be supplied in powder form for mixing with water before the formulation was changed to a paste due to safety and health concerns. Both are salt formulations which were later modified to the current CCA oxide liquor. Major concerns have been raised regarding the efficacy of the new generation Copper-based non-Chrome & non-Arsenic wood preservatives like ACQ.

The industry has also been facing challenges in quality assurance due to lack of facilities for testing chemical retentions of treated wood and the chemical balance of the active ingredients. The main customer for poles - KPLC, has insisted that all CCA treatment plants install a spectrometric analyzer to serve this purpose. This has seen Oxford Instruments of Britain team up with British East African Technologies (BEAT EA) to install state of the art Spectrometric analyzers in a number of local pole treatment plants. Other challenges have been the long time poles take to reduce moisture content to the 25% MC level recommended by the standard (KS 516:2008). In fact, many of the poorly treated poles are highly associated with high moisture content.

CONCLUSIONS

While the preservation process and supply of poles to the main consumer is the preserve of the business fraternity, small-scale tree growers benefit from the business with earnings of up to KES 3,000 per standing tree of between 8 and 10 years. With improvement on quality to enhance their service life, it would be expected that the demand for wood poles would continue to increase in a sustainable manner and face off competition from concrete poles which are more expensive, bulky to handle but have a longer service life compared to wood poles. Sustained low service life would encourage the shift to concrete poles. While farmers and pole treatment industry players tend to believe that this shift may affect their long-term business prospects, if continued, it may reduce profitability in forestry business and affect the sector's growth in the long-term. Additionally, this is likely to discourage farmers from tree farming. This will have a ripple effect on the tree cover in the country, owing to the fact that much of the available land for tree growing is on the farms and can only be harnessed if tree farming is economically sustainable. There is need therefore to investigate and correct the cause of short service life of preservative treated wooden poles.

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