AMCouncil Webinar

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Resilience at Scale: Transforming the Essential Energy Network through Composite Pole Transition

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Question Asked	Answer
How is the performance of composite poles with respect to wild life such as possums?	Possums cannot climb composite poles due to their smooher surface finish compared to timber poles. While we specify possum guards on timber poles, we do not specify them on composites. Where there is a Underground to Overhead (UGOH) cable on the pole that may allow possum to use it to climb, possum guard may be used
How does composite poles compare with traditional pole materials in terms of cost?	The material price is higher than timber but comparable with other manufactured material types. The price differential has reduced substantially in the last decade and is getting closer to timber. While hardwood timber supply is extremely constrained, softwood timber is a much higher cost than hardwood and would have a even lower differential compared to composite. However installation costs for poles (fleet, plant, transport, labour, equipment) etc can be almost 75% of the installed cost so when considering the installation efficiency, the overall installed cost can be comparable. For difficult access sites or national parks, composites provide a significantly lower cost due to no easy handling/access and no need to rehabilitate the site. The NPV costs beyond 40 years favour composites as the lowest lifecycle cost option for all sites and our modelling as part of our last regulatory submission showed majority of network poles were NPV positive with composites.
Is that cyclone proof?	We have seen microbusts in locations which took out around 17 timber poles with a composite pole standing. There is lots of proven evidence from cyclones in Mexico and USA including Hurricane Katrina where long spans of lines had poles fall over with composites being the only ones to remain standing. They can be designed to any given wind return period.
We are from cyclone region D.	—
Will Essential Energy continue proactive replacement under resilience?	No, all end of life pole replacements will use composites which is majority of our usage. Proactive program (circa 15%) will now be using alternate options like fire resistant wraps on at risk timber poles.
Post fire - how is the risk assessment of the composite pole performed - to determine if the structural strength is sufficient to support "no replacement"?	The poles are visually checked for damage or evidence of delamination (using a basic hammer tap test). If deemed necessaary a core sample can be drilled and tested for hardness and strength test. Unless it is a very intense long standing fire, most passing fires will not cause structural damage and may only need surface re-coating to reinstate the oute UV protection coating.
Have pole sleeves and temperature sensors been considered to determine exposure of pole post fire?	Our pole suppliers have done this review. You can contact Wagners for some good details here as their tests have replicated effects of some of the proven and well known tests done in Canada and USA.
Question: how many suppliers do you have for the composite poles you introduced?	Two suppliers in Australia. Others will be evaluated when they become available. There are overseas suppliers, however to transport poles from overseas is not cost effective.
Are the poles as generic to not get locked into one supplier?	Yes, our technical speciifcation and performance requirements/dimensions are generic and multiple local and overseas (eg US) suppliers are able to manufacture poles to those requirements. Theye are interchangeable with timber and other pole materials.

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How did you determine the asset life to be 80 years?	There are a wide range of tests from accelerated ageing (calibrated) that exposes the poles to intense UV-B throughout the test duration and cyclic salt, rain, temperature cycling (very hot to very cold) , mechanical, electrical and in service tests. Many of these have demonstrated longevity in excess of 80 years. There is also evidence from use of early composite poles in Hawai in the late 1950s/early 1960s that albeit with no UV barriers from technology of the time survived with no mechanical issues and just had UV blooming, As UV protection/coating and materials have ecolved since the 1960s, with the coating we use and the testing to replicate life life exposure, we have condidence in the poles lasting 100+ years (we quote 80 years as a conservative estimate). We also have 750,000 composite crossarms over 20 years use and they are as good as new.
New installation equipment - are these Essential Energy's inventions?	The composite pole web sling is just to support handling the poles given their smoother finish and allow installation with excavator jaws in difficult access sites at very low cost. These slings are sourced from USA. The pole steps are a standard bolt, the dust extraction clamp to contain dust when drilling is our internal invention. The vacuums are just a standard industry vacuum. The poles did not need any high cost equipment or changes. If at all due to light weight and easy installation, the installation is more efficient. More poles can be transported on trucks and jinkers as they are very light weight and this provides signficant savings for large rural network with long distances from the nearest depot like our footprint.
Globally, who came before Essential Energy to fully transition to composite poles. **(I was wondering why Essential decided to design installation equipment, compared to equipment available in the market).**	Globally, no utility has fully transitioned to composite poles for all end of life replacements. While composite poles are used in several continents incl North America and Europe, the extent of use has been quite limited. Therefore, a transition network wide of this magnitude is the biggest globally for a single utility.
Are there any transmission grid owners in Australia that also use composite poles?	Unsure about Australia but Hydro Quebec in Canada and a few other countries have for some transmission struture types. Composite poles have a better use case for distribution and subtransmission lengths and sizes (9.5m to 23m) and as our network is predominantly this, we have found them practical for most of our usage.
The poles are obviously a great improvement. Is any of the replacement proactive or completely reactive. If there is a component that is proactive how do you determine the basis for proactive investment?	The poles are used for end of life replacements of our network population of 1.4M poles of which 1.2M are timber. We replace about 8,000-9,000 timber poles as they reach end of life and those will now use composite poles.
Is there an increased cross-sectional area with composite poles when compared to hard wood and how are you managing this when replacing around existing underground infrastructure?	No, the diameters and lengths are similar and interchangeable with timbers and alternate pole materials. There are no special considerations when replacing and end of life timber pole with a new composite pole.
Any issue of physical damage of the coating at ground level e.g. whipper snipper. Does it have any impact on strength reduction if the coating is damaged and fibres are exposed?	This can theoeretically happen but not common. The poles are quite durable and will take a long time for a whipper snipper to cause any strength loss. If the outer coating is damaged, as part of our 4-5 year inspection cycles, inspectors will repair the outer surface with a spary on coating. Any significant impact due to heavy farm equipment, vehcicles etc can be assessed for loss of strength and either repaired using on site procedure I presented in the slides (majority of cases can be repiared unlike other material types). If the impact was so severe that the pole completely broke, it will be replaced.
As the poles are not tapered, can same clamp band used on concrete pole be used on composite pole?	Composite poles come pre-drilled. They can also be drilled on site. Attachments can be bolted but if bands are needed, poles can be banded as well.
Composite crossarm comes with insert at predrilled hole locations. Does composite pole use similar insert at the pre-drilled hole location?	As the wall thickess of the composite poles is much larger than the crossarms, the poles do not need inserts where they have holes drilled.

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According to AS3959 what is the bushfire performance for composite pole? What level of exposure (Bushfire Attack level) does composite crossarm meet e.g. BAL-40 or BAL-FZ?	Poles have been tested to BAL-40 however as this test is more appropriate for structures, we have used some other CSIRO tests that are more reflective of exposure conditions. Note that composite poles are not fire-proof just like concrete or steel poles are not fire-proof. A llong standing, very intense fire will cause strength loss in all these material types but unlike CCA timber poles they will survive and allow considerable time to assess and intervene as required. For most passing grassfires, the poles should not need replacement.
How the coating reacts at the section where the pole is buried below ground?	The coating is insert and does not react to acid-sulphate, alkaline, farm chemicals or other materials in the soil/site. There is no expected deteririation to the coating under site exposure conditions.
How does the manufacturing process compare to using timber poles in terms of meeting net zero and carbon emissions?	As the poles last 3 x timber, as they do not need any upfront CCA treatment and ongoing chemicals (eg Boron Polesaver rods used when drilling holes for inspections), as 4 x as many composites can be transported, as they can be repurposed at end of life unlike CCA timber which goes into landfill, we think ther overall carbon footprint is favourable compared to alternate material types. However, as users we will not claim that they are the lowest carbon footprint as that is better served by an independent study. A study done by University of QLD many years ago did review composite crossarms againist timber and steel and found them to be the lowest impact.
Some composite poles can fail relatively suddenly rather than gradually bending or deteriorating. what are the Brittle failure characteristics?	We have not seen brittle failures with composite crossarms and do not expect to see them with poles. Unless there are manufacturing/quality issues with certain manufacturing processes (eg mandrel not maintained in filament wound type process causing delamination when manufacturing, undetected during QA), the poles should perform well. I did share a picture in the slide on composite crossarm where an assisted event (large tree branch on the line) showed how they perform, We have seen in storm events when timber poles failed, composite pole remained standing without any cascade/brittle failure mode. The crossarms and poles use pultrusion technology for our current range and this is a very consistent and robust manufacturing process. Filament wound technology poles can aso perform well if manufactured with good QA practices.
Any recycling challenges?	Most of our crossarms and poles when removed from service due to customer/network upgrades can simply be reused. If they look fine, they are fine as their condition assessment unlike other materials which are not reused due to no confidence on impact during removal. if the pole is badly damaged due to heavy farm equipment or external factor, when there are enough volumes, you can repurpose them for other uses (irrigation pipes, farm posts) or crush them and use in cement/concrete mixes.
How do you manage the dust hazard from drilling?	The in-house designed fibre extraction clamps are a very low cost dust elimination option. There is no dust generated when drilling poles on site with these clamps. Most poles come pre-drilled from the suppliers.
What tools do you use to drill holes in the pole?	Composite pole drill bits easily available from common tooling providers. In-house designed dust extraction clamps connected to small common use vacuuum.
Have you tried the Dulhunty Titan poles? If not, do you have any plans to?	Our material selection is based on lowest ifecycle cost options that meet the performance and field user requirements.
Have you trialled clamp band systems in lieu of drilling?	Our current options allow for the lowest cost, faster installation and most practical outcomes.
what changes did you have to make to ensure the composites weren't impacted by UV, the likely degradation mechanism that you mentioned was an early challenge.	The overseas poles had UV stability issues but those suppliers have now understood Australian conditions and have made changes. The local suppliers have durable UV coating that meets our requirments. This has also been evidenced by our composite crossarm use for almost 20 years.
Is the fibre extraction clamp re-useable? If not whats the costs associated with these and the associated disposal process?	Yes, it is durable and would last a long time. It is 3-D printed in house at a very low cost for when an existing clamp fails after long term use.

Question Asked	Answer
Do you use them for pole transformers / reclosers / voltage regulators?	Yes, we can use them as equipment poles. The larger 500kVA transformer need a large washer at the attachment point but generally composite poles can do everything other pole types can.
Do you have any experience with or idea on composite pole photo oxidation degradation rate over its life span ?	We have reviewed the material type and do not foresee this issue to occur.
any weak locations on the pole due to tip loading ?	No, if the poles are built to the spec there are no limitations here.
What's your experience Deepak? deflection is >5% as nominated?	Yes, poles meet the specified limit. We require suppliers to provide actual test reports and actual defelection curves rather than desktop/FEA analysis alone.
we have heard all the pros of composite pole, what is cons of these poles? There should be something	Not much to share here other than they need to be modelled using actual test results rather than desktop analysis. No major negatives to note.
What is the cost difference %, how NPV stacks up ?	The material price is higher than timber but comparable with other manufactured material types. The price differential has reduced substantially in the last decade and is getting closer to timber. While hardwood timber supply is extremely constrained, softwood timber is a much higher cost than hardwood and would have a even lower differential compared to composite. However installation costs for poles (fleet, plant, transport, labour, equipment) etc can be almost 75% of the installed cost so when considering the installation efficiency, the overall installed cost can be comparable. For difficult access sites or national parks, composites provide a significantly lower cost due to no easy handling/access and no need to rehabilitate the site. The NPV costs beyond 40 years favour composites as the lowest lifecycle cost option for all sites and our modelling as part of our last regulatory submission showed majority of network poles were NPV positive with composites.
cost difference between composite and wood ?	—
in percentage	—
Can you install large transformers on all of your fibreglass poles - or do you have transformer specific poles (if so, why?)	Yes, we can use them as equipment poles. The larger 500kVA transformer need a large washer at the attachment point but generally composite poles can do everything other pole types can.
Did you consider timber sourced from plantations (e.g. softwoods)?	Softwood poles are much more expensive than hardwoods. They require CCA treatment almost across their whole diameter, they are larger in diameter, very heavy, have higher fire risk in rural networks like us and pose installation challenges across our large footprint.