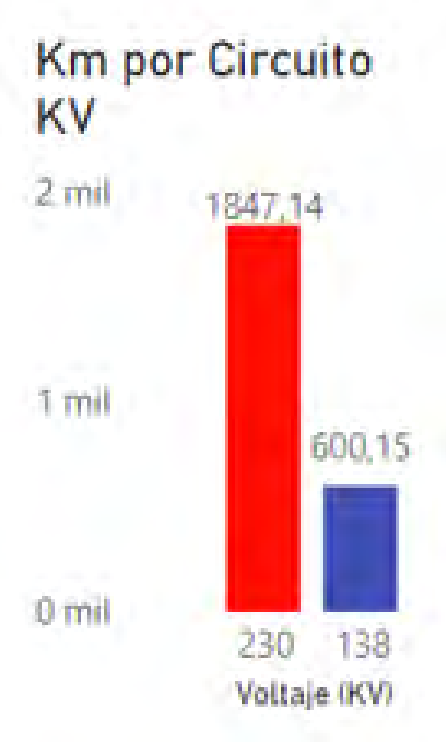

EDM
T&D SERVICES
ENVIRONMENTAL SERVICES
PRODUCTS
Overcoming utility infrastructure challenges by merging excellence in engineering, science and technology with a passion for client satisfaction.

Transmission Division

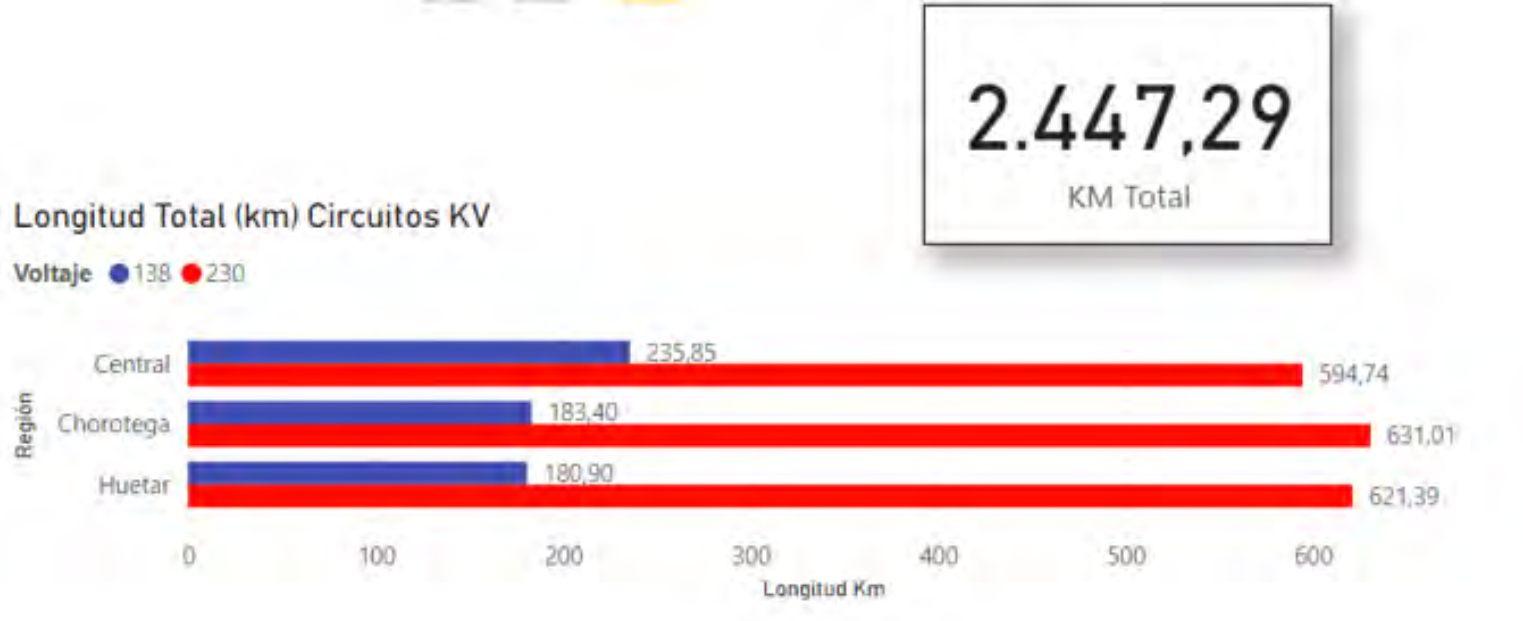
Method for repairing OPGW in proximity to energized conductors

COSTA RICA'S TRANSMISSION GRID OVERVIEW

COSTA RICA'S TRANSMISSION GRID OVERVIEW



Total km for 138 and 230 kV Power Lines



Total km of Transmission Power Lines

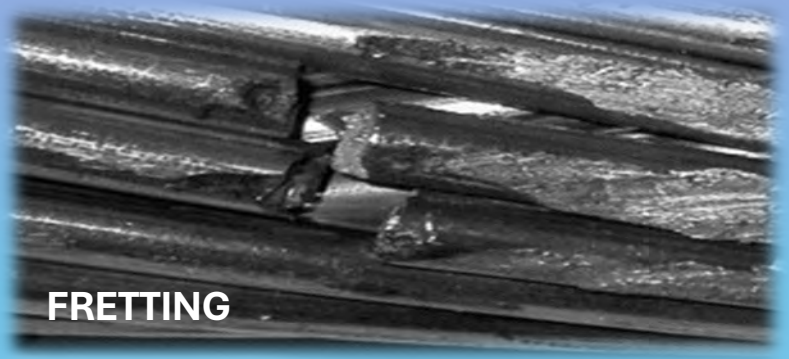
INTRODUCTION

The objective of this work is to present a procedure for the repair of a damaged OPGW conductor, in the proximity of energized transmission lines of 138 kV or higher.

This methodology is intended to be applied in a transmission line where is not posible to use heavy equipment, such as pullers or tensioners. In this specific case, it was not possible to use helicopters for the repair (there is no helicopter company certified in Costa Rica for this kind of activity).

This procedure was carried out by Costa Rican Institute of Electricity, Transmission Division, in a 230 kV power line, in October 2022, with the assesment of CACIER (Argentine Electrical Interconection Committee).

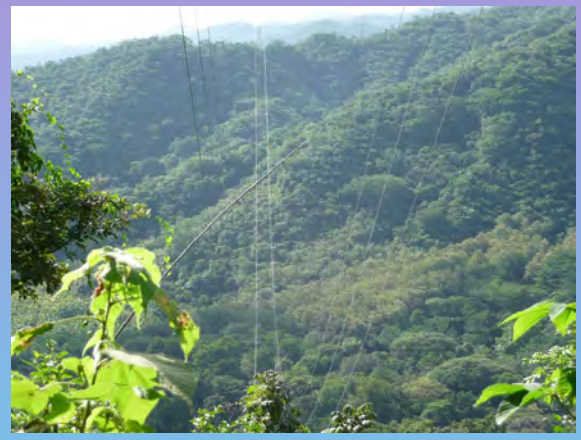
COMMON CAUSES OF DAMAGE IN OPGW IN COSTA RICA



REPAIRING OPGW IN COSTA RICA, SOME CONSIDERATIONS

Difficult access to work sites, for vehicles and heavy equipment, such as pullers or tensioners

Work sites inside mountains zone, some of them in National Parks



Work sites with access roads blocked due to natural phenomena, such as floods, earthquakes, etc.

The linemen are not allowed to use the OPGW cable to get to the point of failure

It is not advisable to use parallel lines directly fixed to the OPGW plate.

The OPGW is, in many cases, at a short distance from the conductors, the lineman would be in the zone of variable potential, where the risk of electric arc increases.

Although, the use of helicopter is a very useful tool in power line maintenance, actually there are not in Costa Rica helicopter companies certified for this kind of work.

The helicopter companies in Costa Rica are restricted from flying near transmission lines, mainly due to their insurance policies.

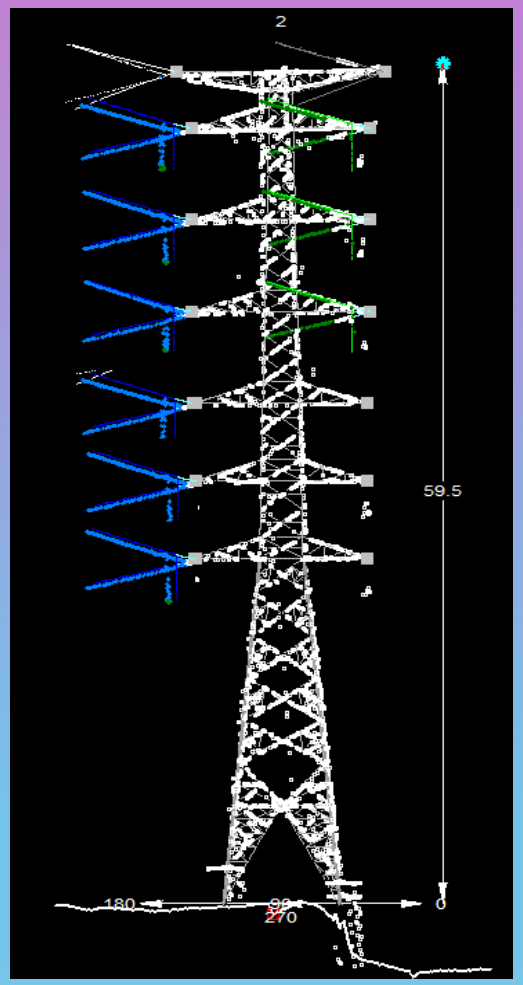
OPGW REPAIR, 31-32

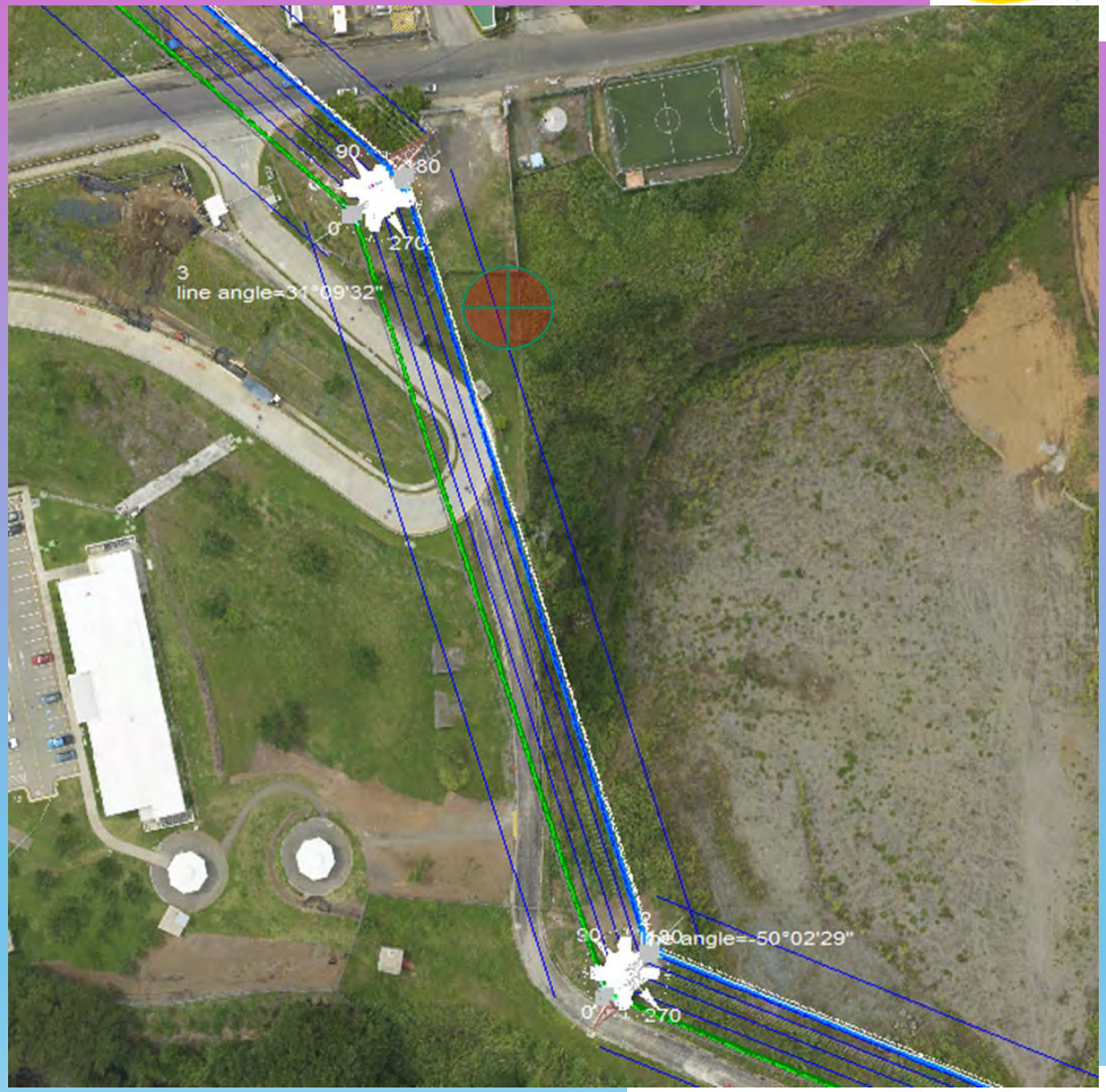
LT SAN MIGUEL-LINDORA
138 / 230KV

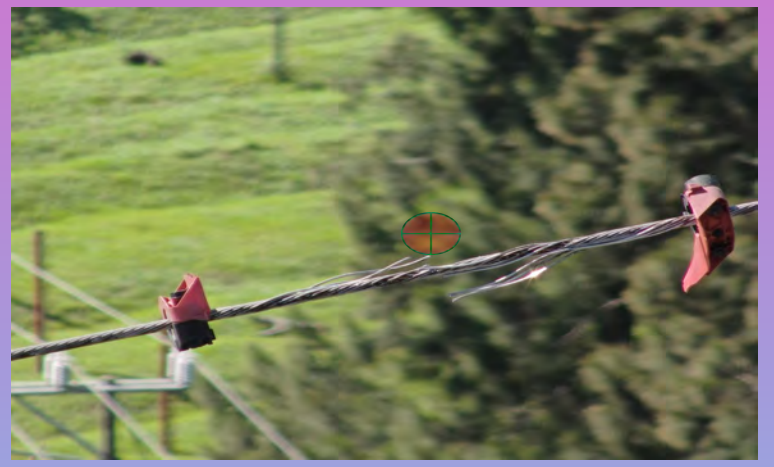
COSTA RICA

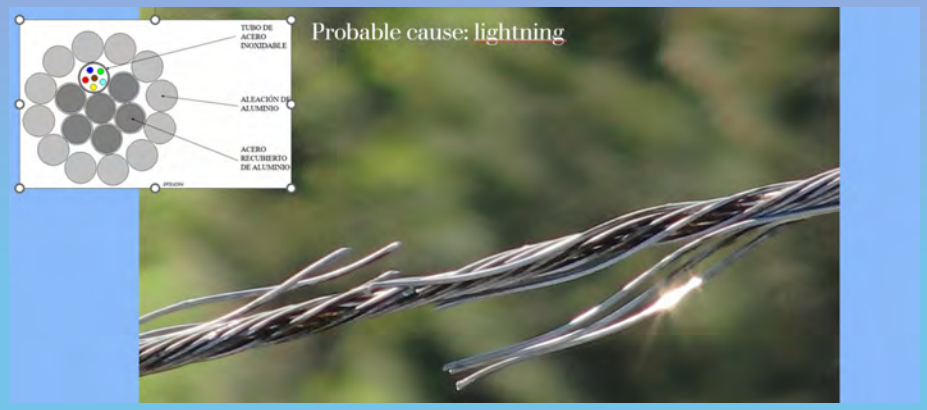
DETAILS:

- Electric circuits:
  - 2 138 kV
  - 2 230 kV
- Tower total heights :
  - T32: 180 ft (60m)
  - T31: 120 ft (40m)
- Ground wires: 2 OPGW wires
- Span length: 960 ft (320 m)









Drone view of the failure in OPGW

STEP 1: Crane type aluminum derrick installation

COLOR CODES

- Polyester rope
- OPGW
- Conductor

STEP 1: Crane type aluminum derrick installation

COLOR CODES

- **Derrick suport cable**
- **Anti twisting Steel rope**
- **Derrick anchor cable**

STEP 2: Installation of guide cable and safety line

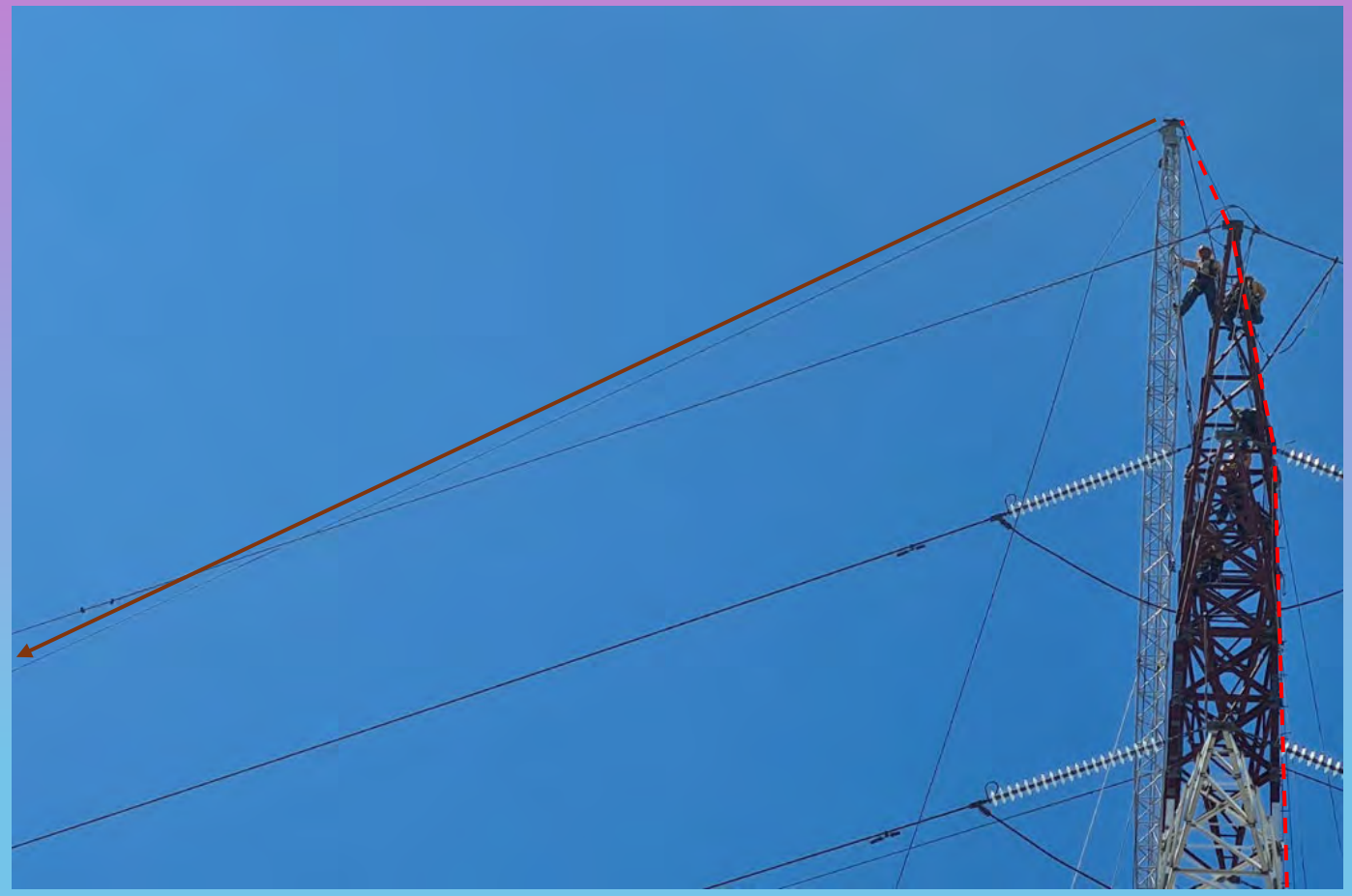
COLOR CODES

- Derrick suport cable
- Anti twisting Steel rope
- Derrick anchor cable
- Support rope
- OPGW

COLOR CODES

Support rope

Anti twisting Steel rope



STEP 3: Test with a 220 lb (100 kg) dead weight

COLOR CODES

- Derrick suport cable
- Anti twisting Steel rope
- Derrick anchor cable
- Support rope
- OPGW

COLOR CODES

Support rope

Anti twisting Steel rope

STEP 4: Lineman placed for OPGW repair

COLOR CODES

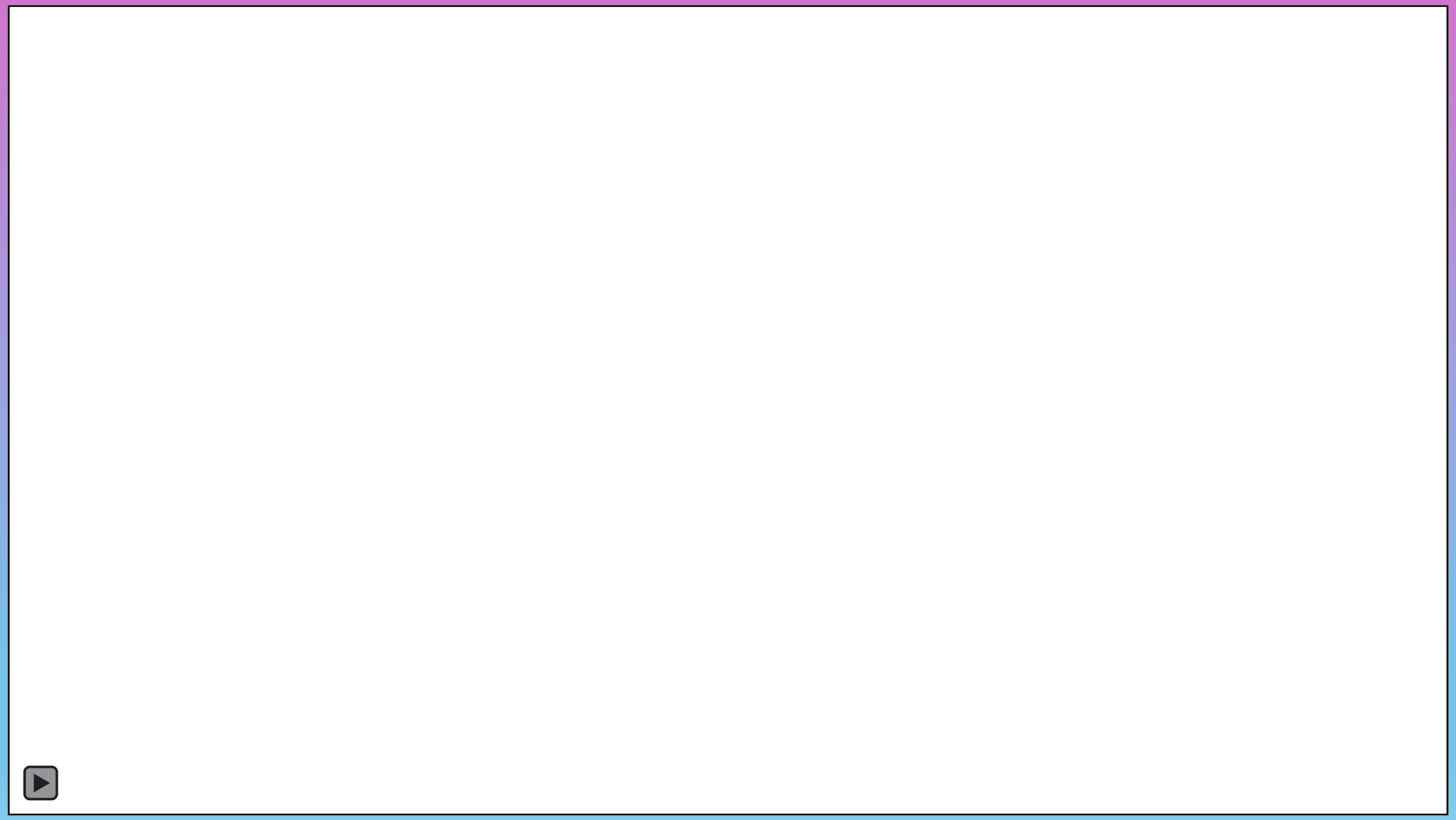
- Derrick suport cable
- Anti twisting Steel rope
- Derrick anchor cable
- Support rope
- OPGW

STEP 5: Lineman gets out of the line, repair finished

COLOR CODES

Support rope

Anti twisting Steel rope



FINAL NOTES

The repair of this OPGW was carried out without any inconvenience.

ICE is considering the use of helicopters for repairing this type of damages, among another maintenance works, but the main problem is that actually there are no helicopters companies in Costa Rica certified for power line works.

The damage of OPGW in Costa Rica by lightning is very common in Costa Rica, because the most of the lines have an OPGW with a low fault current, so they were installed before the newest technical requirements.

THANK YOU

EDM
reliability & innovation
International Conference on Overhead Lines
Design, Construction, Inspection & Maintenance
April 15-18, 2024 Fort Collins, Colorado USA
SANPEC

The Dulling Process is A Science!

Presented by:
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April 15, 2024

Shiny / Dull Structure

Shiny Structure

Why Dulling?

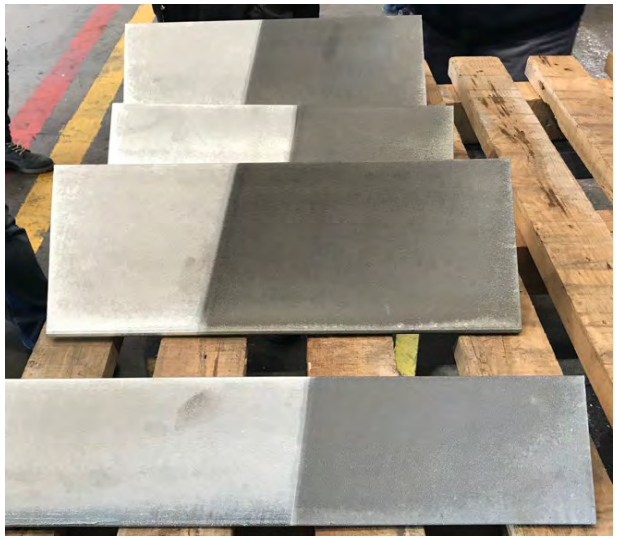
- Environmental and Permitting Restrictions
  - BLM Requirements
  - Reflectivity of Newly Galvanized steel
  - Poor Visibility and Driving Issues
  - Disturbance of Wildlife and surrounding nature

Note: Dulling is NOT a Painting Process. There is NO ASTM /NACE Standard available for Dulling Process.

Do we need to develop a Technical Report or Standard????

Dulling Method

- How to achieve less-reflective, and dull/matte finish
- Reflectivity:
  - Newly Galvanized: 75%-70%
  - Dulled Finish:
    - Light/Med/Dark
    - 33%/22%/10%
- Natural weathering
- Chemical treatments



Science behind Dulling?

- It is a Science Project. NO Guessing???
- Requires several Trials
- Challenges:
  - Steel Chemistry
  - Galvanizing Bath Composition
  - Time/Temp/Concertation of Dulling Bath
  - Dipping Time
  - Quenching and Rinsing Process
  - Passivation Process
  - Uniformity of appearance

Transmission Towers

Tower Components (Typical):

- Structural Angles (78%)
- Steel Plates (10%)
- Fasteners (7%)
- Zinc (5%)

ASTM Steel Grade (Common):

A36, A572 Gr. 50, Gr 60.

- Silicon % : < = 0.4% Max
- Phosphorous: 0.04% Max

A709 Gr. 50S

- Silicon % : < = 0.4% Max
- Phosphorous: 0.035% Max

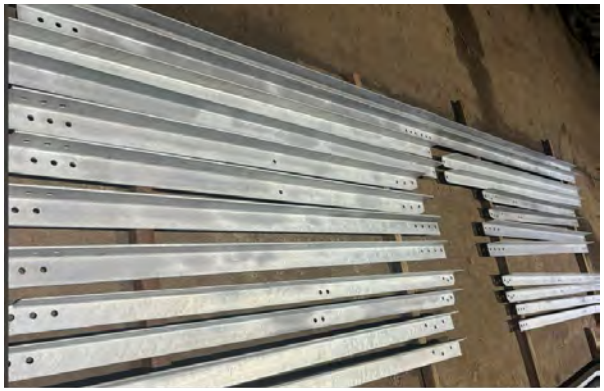
Modern Steel

- Scrap Based
- As-rolled Conditions
- Electric Arc Furnace
- Continuous Casting
- Silicon-Killed (Deoxidation)
- Al-Killed (Expensive method)
- Varying combinations of Micro-Alloyed (Manganese, Vanadium, Columbium, Prosperous etc.)
- Low Carbon and High Manganese
- Several Foreign stinger inclusions

It is very important to specify the right requirements of steel for appearance of galvanized and dulled finish.

Steel Chemistry

- ASTM A 385 recommends limits and ranges for steel chemistry to ensure a high-quality galvanized coating
- Primary elements are silicon, phosphorus, Manganese, and carbon content in steel



- Elements affect galvanizing finish:
  - Carbon in excess of 0.25%
  - Phosphorous in excess of 0.04%
  - Manganese of about 1.3%
  - Silicon in the range of 0.04% to 0.15% or above 0.22%
- Where appearance is important:
  - For cold rolled steel:

    $Si < 0.03$ and $Si + 2.5 \times P < 0.04$ weight percent
  - For hot rolled steel:

    $Si < 0.02$ and $Si + 2.5 \times P < 0.09$ weight percent

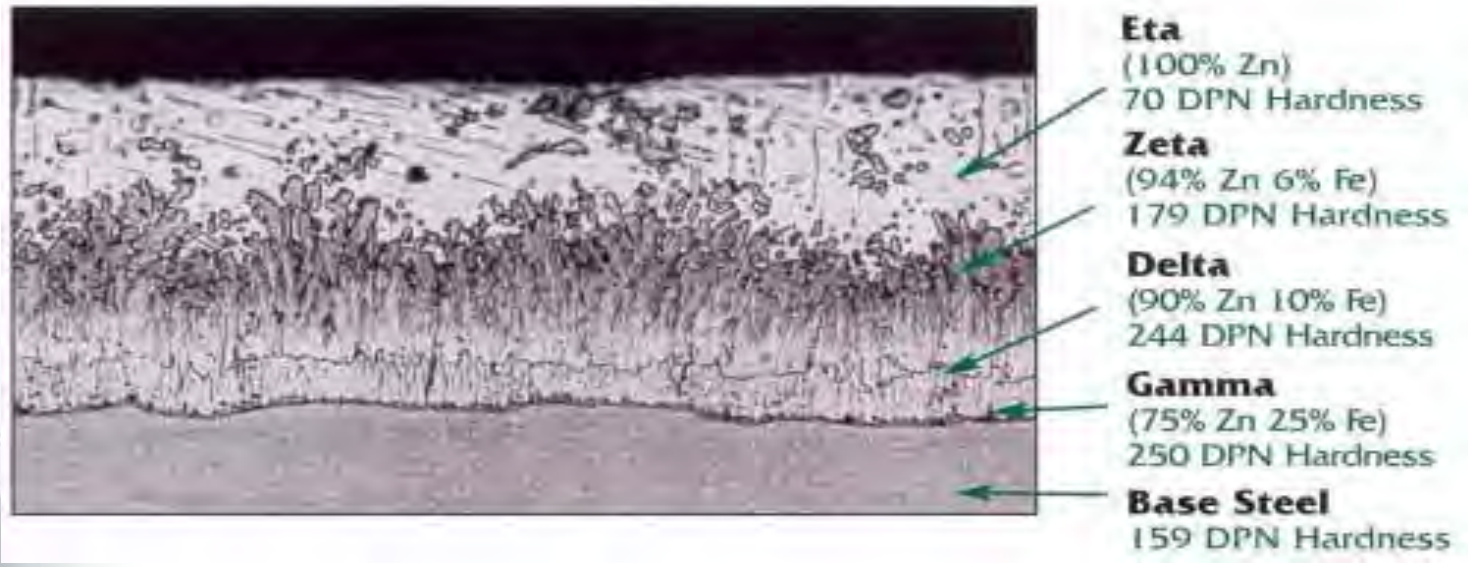
Galvanizing Bath

- Purity of Zinc (more than 98.5%)
- Remaining 1.5% consists of additives
  - Aluminum (AL): 0.16 to 0.20%
  - Iron (Fe): 0.015 to 0.03%
  - Nickel (Ni)
  - Bismuth
  - Lead (pb)/Antimony(sb): Free (pb/sb)

- Bath Temp:
  865-880 Deg F

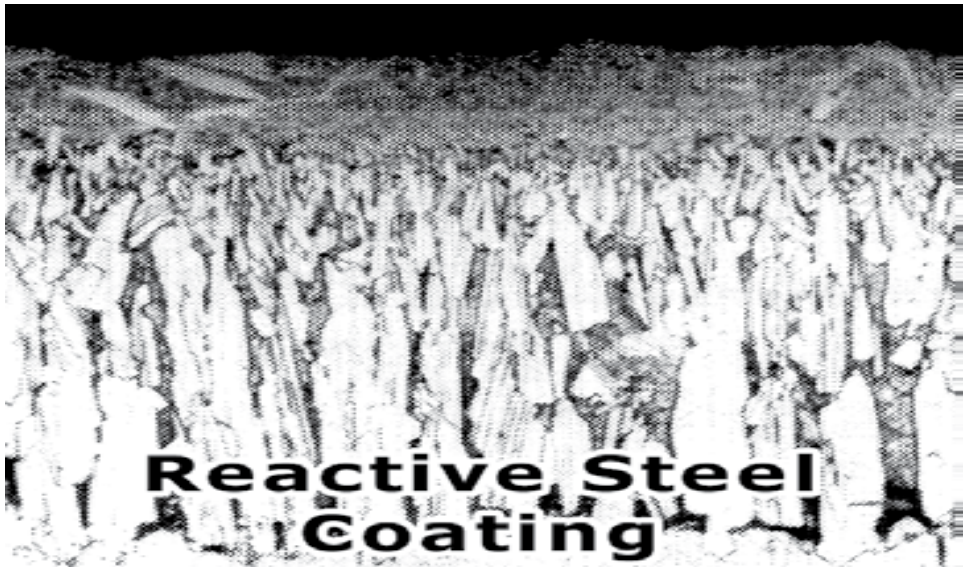
Galvanizing Coatings

- Steel surface should be perfectly cleaned
- Form metallurgical bond between the zinc and the underlying steel or iron
- Coating microstructures consist of three alloy layers and a layer of pure zinc:
  - The thin Gamma layer composed of an alloy that is 75% zinc and 25% iron
  - The Delta layer composed of an alloy that is 90% zinc and 10% iron,
  - The Zeta layer composed of an alloy that is 94% zinc and 6% iron
  - The outer Eta layer that is composed of pure zinc



Reactive Steel

- Steel chemistry outside recommended limits and ranges for galvanizing “Reactive Steel”
- Intermetallic Structure is NOT tightly compact and forms tall and vertical columns
- Allow free iron particles to migrate to the top of zinc coating

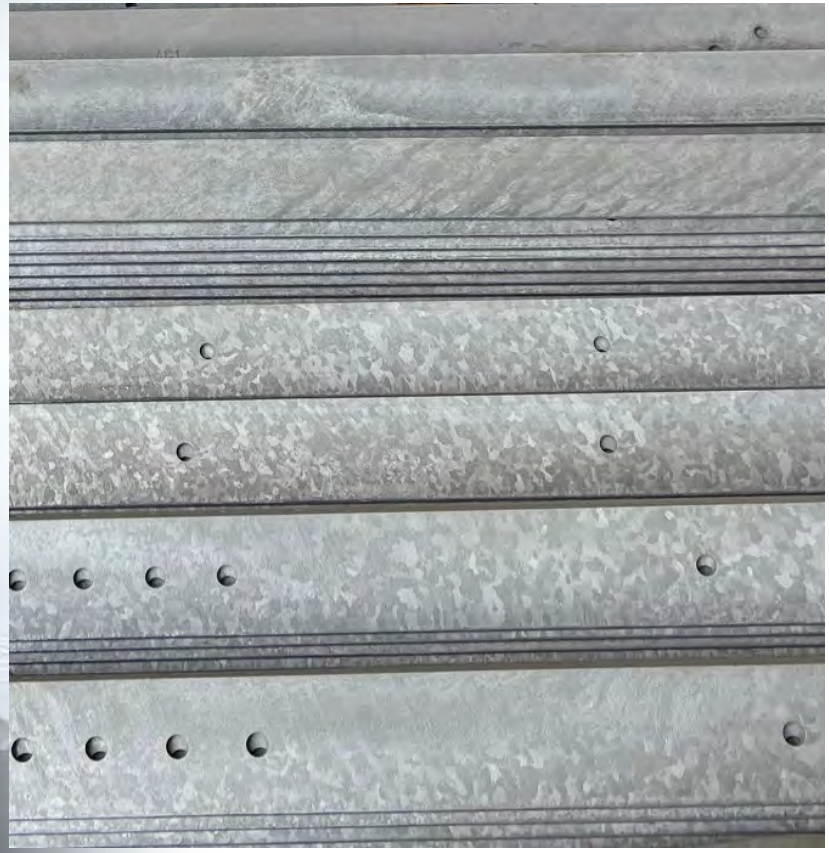


Dulling Bath

- Chemical Treatments such as acidic Zinc-Phosphate and other proprietary solutions.
- Deposit of fine grain zinc phosphate crystals
- Important Considerations:
  - Quenching after galvanizing
  - Concentration of chemical solions
  - Daily checking of concentration
  - Temp of dulling bath
  - Dipping Time
  - Vertical hanging vs Slant hanging of galvanized materials in the zig

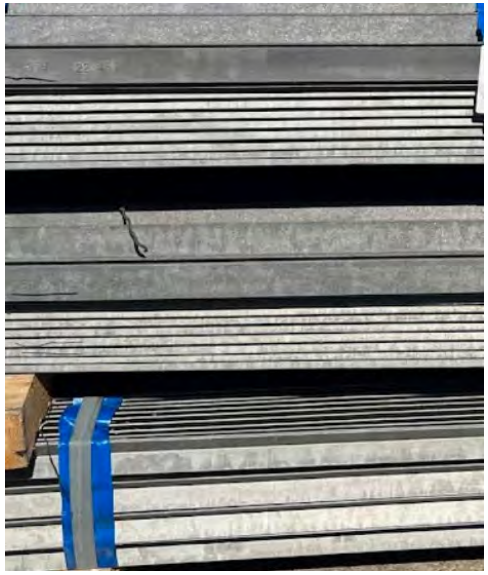
Dulling Challenges

- Challenges in achieving the uniformity because steel is NOT a homogeneous material
- No guarantee for dulling color to stay same due to influence of atmospheric conditions and self weathering process



Dulling Issues

- NOT following the proper Dulling Process
- White Residue/Deposits/White Rust
- Variations in Reflectivity



Discolored Steel

Discolored Steel

Wet Storage Stains

- Also Known as “White Residue/ Rust”
- Occur due to oxidation on a newly galvanized and dulled surface with presence of moisture and absence of free flowing oxygen
- Protective Zinc patina is not allowed to form by converting zinc oxides to zinc carbonates
- To avoid wet storage stains:
  - Proper method of transportation and storage
  - Adequate air flow
  - Prevent standing water
  - Proper method of passivation

Dulling in NOT a Passivation process.

Conclusions

- Dulling Process is a Science project requires serval trial and error methods to achieve desirable appearance
- Alloy elements in the steel such as silicon, phosphorus, manganese and carbon content, can affect the dulling appearance and thickness of the coating
- Study the steel chemistry before galvanizing and Dulling process
- Create recipes based on grade, thickness and size of steel members
- Avoid Silicon content in the range of 0.04% to 0.15% or above 0.22%
- Perform sample tests and add Bath Alloy (Al, Ni, Bi etc.) accordingly
- Avoid Lead (pb)/Antimony (sb) in galvanize bath
- Follow proper dulling process and Monitor each step very closely and keep the record
- No guarantee for dulling color to stay same due to influence of atmospheric conditions and self weathering process
- Perform Humidity and Salt Spray test on final finished product
- Establish a bundling, shipping and storage procedure to avoid wet storage stains or white rust

Do we need to develop a Technical Report or Standard????

Questions???

The Dulling Process is A Science!

Thank you!!!!

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Wood poles: environmentally positive until the end -Timber Circularity in Australia

Tripti Singh

Director, The National Centre for Timber Durability and Design Life

Forest & Wood Products Australia

UniSC

TIMBER POLES IN AUSTRALIA

- Wooden poles are commonly used particularly in rural and regional areas
  - Most cost-effective, practical
  - Sustainable forestry practice and responsible timber sourcing
  - Acknowledged for positive environmental impacts
    - Approximately 50% of replacement utility poles are made out of wood
- In the end, many poles end up in landfills

WOOD WASTE IN AUSTRALIA

Over 2.5million tonnes of timber waste annually*

** Maqsood et al, 2019*

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Timber Circularity project in Australia

Aim: A comprehensive programme aimed at assisting timber users in identifying suitable pathways for repurposing treated and EWPs

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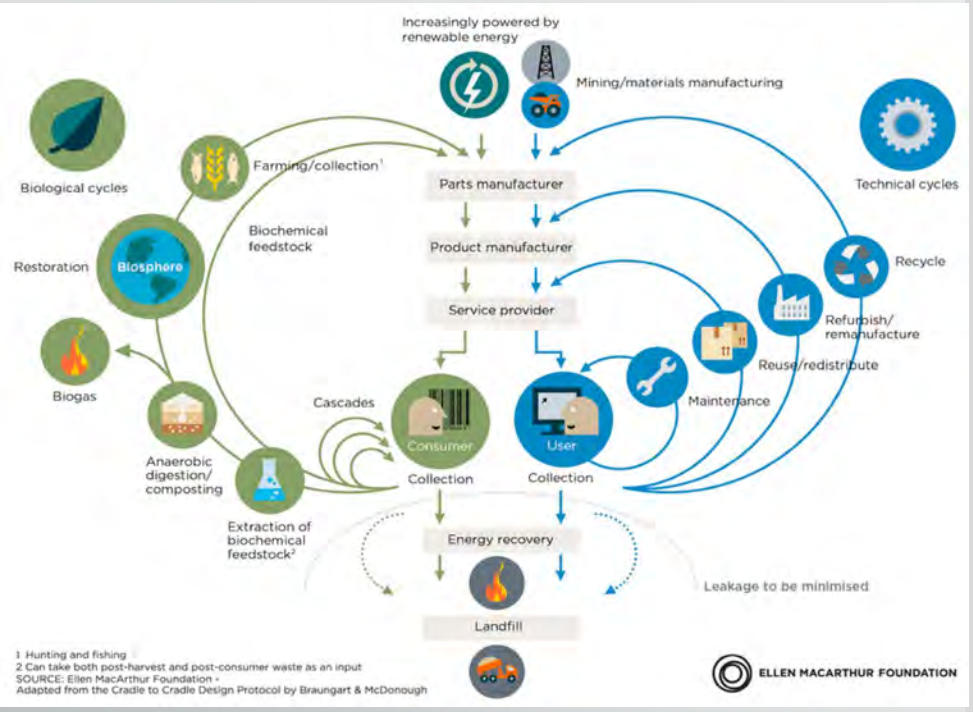
CIRCULAR ECONOMY

- In the circular economy, resources are utilized in a manner that minimises waste and maximises the reuse, recycling and regeneration of materials and products.
- This approach contrasts with the traditional linear economy model, where resources are extracted, used once and then disposed of as waste.

CIRCULAR ECONOMY



The Ellen MacArthur Foundation infographic on the flow of materials in CE

- Timber is the ultimate renewable resource
- We need to cascade it through multiple life cycles
- Currently, about 60% of the timber resource wasted is going to landfills - the rest is predominantly burnt for energy

AIM

80% average resource recovery rates from all waste streams

CURRENTLY
Biological resources are not used efficiently.

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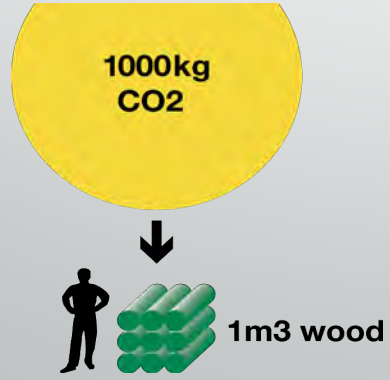
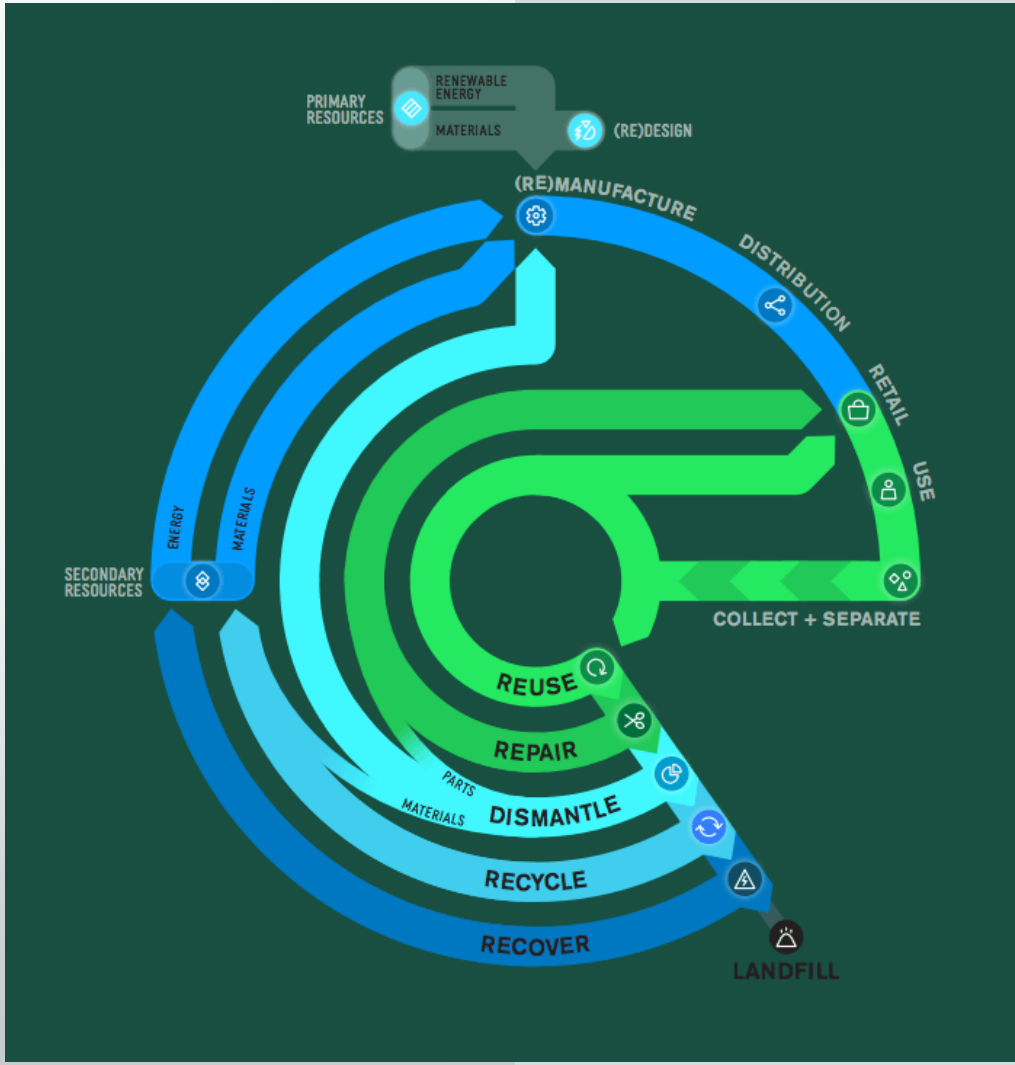
AUSTRALIAN CIRCULAR ECONOMY

- Circular Economy by 2030.
- Circular economy model for Australia could generate A$1,860 billion in direct economic benefits over 20 years*.
- Circular economy model could save 165 million tonnes of CO2 per year by 2040*.





Australian Circular Economy Hub Diagram

** PWC Gov. Commissioned Report*

CONSTRAINS AND DRIVERS FOR TIMBER CIRCULARITY

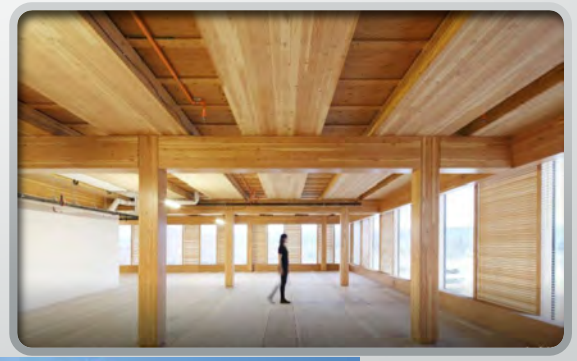
- Widely dispersed
- Perceived as low-value material
- Chemicals/resins
- Fasteners
- Inconsistence regulations

- Options – EWPs/Resawing
- Increasing land fill cost
- Limited landfill capacity
- Increased waste disposal levies
- Product stewardship
- CE mandate

TIMBER CIRCULARITY PROJECT

The NCTDDL-led project focuses on streams of wood products that are difficult in end-of-life situations

- Outdoor treated timbers including vineyard posts and utility poles, treated timber in buildings, and engineered wood products



COLLABORATORS

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Forest & Wood Products Australia

Australian Forest Products Association

TREATMENTS/ CHEMICALS

KOPPERS Performance Chemicals

azelis Innovation through formulation

HEXION

MANUFACTURERS

FTMA AUSTRALIA

ewpaa

USERS

Wine Australia

PROJECT TASKS

Volumes & Geographic Location

1

Condition & potential for reuse

2

Regulatory hurdles

3

Logistic models

4

Reuse & Recycling Opportunities

5

Mapping

6

PILOT

7

The volume of Removed Vineyard Posts in Australia By Location

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VINEYARD POSTS

	ATTRITION RATE	CCA POSTS REMOVED	CREOSOTE POSTS REMOVED	**TOTAL POSTS REMOVED**
NEW SOUTH WALES	2%	300040	155329	455369
QUEENSLAND	2%	5950	715	6665
SOUTH AUSTRALIA	2%	682061	185008	867069
TASMANIA	2%	20639	0	20639
VICTORIA	2%	230857	46377	277234
WESTERN AUSTRALIA	2%	96727	0	96727
NATIONAL	**2%**	**1336275**	**387430**	**1723705**

POST STOCKPILES

SOUTH AUSTRALIA	CCA POSTS REMOVED	CREOSOTE POST REMOVED	**TOTAL POSTS REMOVED**
All regions at 2%	682061	185008	867070
Langhorn Ck & Riverland 15%	2472607	736784	3209391

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Condition of stockpile posts

POST ANALYSIS

RELATIVE AMOUNTS OF CCA IN RADIATA PINE POSTS

REGION	VINEYARD	YEAR		Average Retention by Element (%)			
				Cu	Cr	As	Total
Langhorne	A	1997	%	0.17	0.25	0.21	0.64
			Balance	0.27	0.39	0.34	
	B	1997	%	0.14	0.20	0.18	0.51
			Balance	0.27	0.38	0.35	
	C	2002	%	0.16	0.23	0.21	0.61
			Balance	0.27	0.38	0.35	
Adelaide Hills	D	1997	%	0.19	0.30	0.23	0.72
			Balance	0.26	0.42	0.32	
	E	2003	%	0.24	0.35	0.12	0.70
			Balance	0.34	0.49	0.17	
	F	2007	%	0.19	0.26	0.25	0.71
			Balance	0.27	0.37	0.36	
AS/NZS 1604		Balance Standard		23-25	38-45	30-37	100

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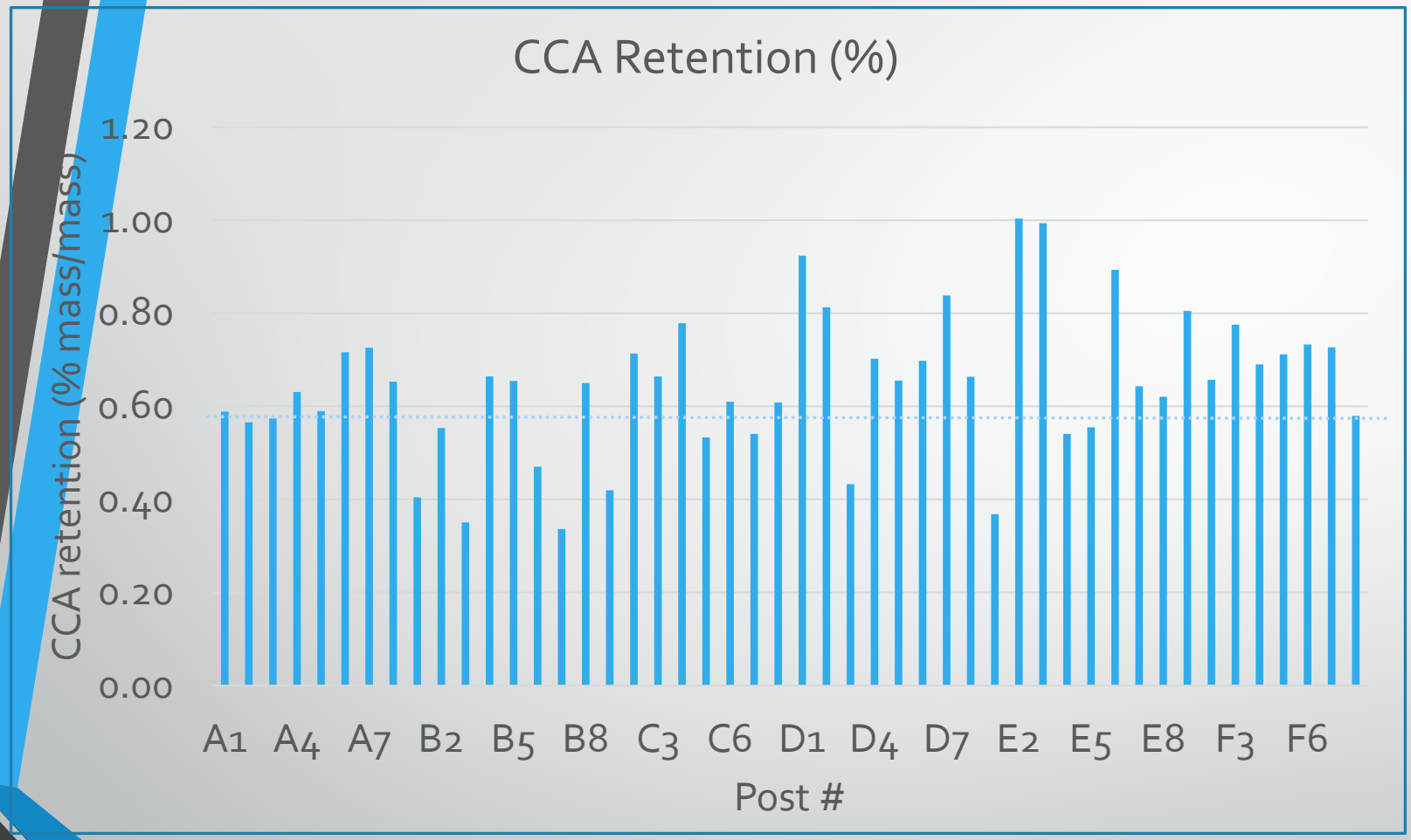
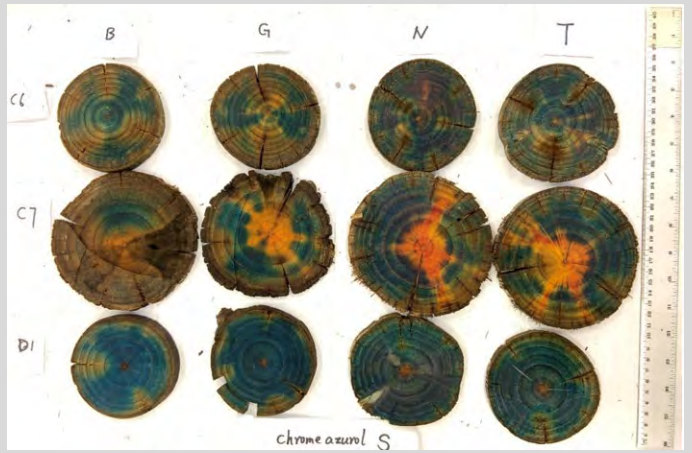
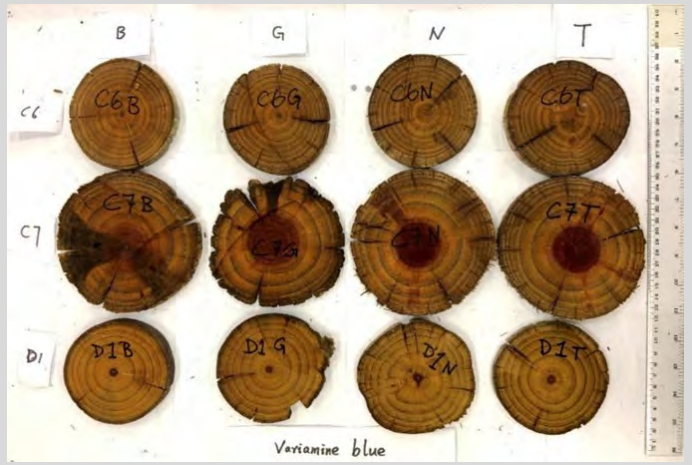
POST ANALYSIS



CCA RETENTION IN SAPWOOD ZONES OF CCA-TREATED VINEYARD POSTS





EXAMPLES OF CCA VINEYARD POSTS SPRAYED WITH VARIAMINE BLUE FOR DETECTING HEARTWOOD AND CHROME AZUROL S TO DETECT COPPER PENETRATION

Regulatory hurdles

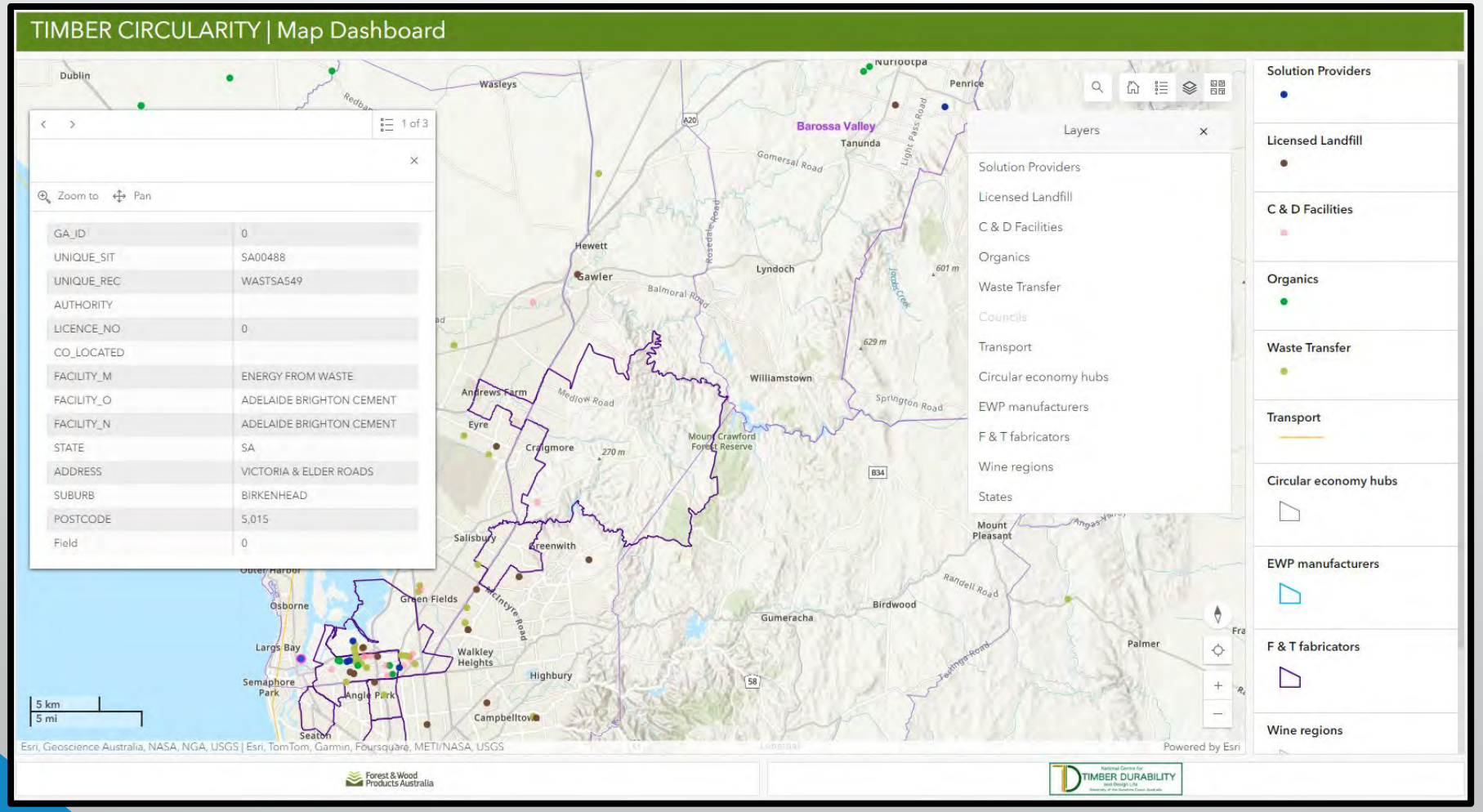
REGULATORY HURDLES

COMPARISON OF KEY ASPECTS BY JURISDICTION

KEY ASPECTS	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
PTTs classed as a controlled, special or priority waste subject to specific jurisdiction requirements.	√	√		√	√		√	√
Waste transport requirements apply for PTTs	√	√	√	√	√	√	√	√
Intra- and interstate waste tracking requirements apply, consistent with the agreed national reporting framework.	√	√	√	√	√	√	√	√
Recovered PTTs not allowed in land applications.	√	√		√	√		√	√
End of Waste (EOW) provisions currently in effect allowing classification other than as 'waste' if certain actions are taken.				√	√			
EOW provisions to be implemented or reformed.		√		√				√
Stated willingness to consult on specific proposals for alternatives to landfill for treated timber, including pyrolysis and gasification as well as potential regulatory approaches necessary to implement.		√			√		√	√

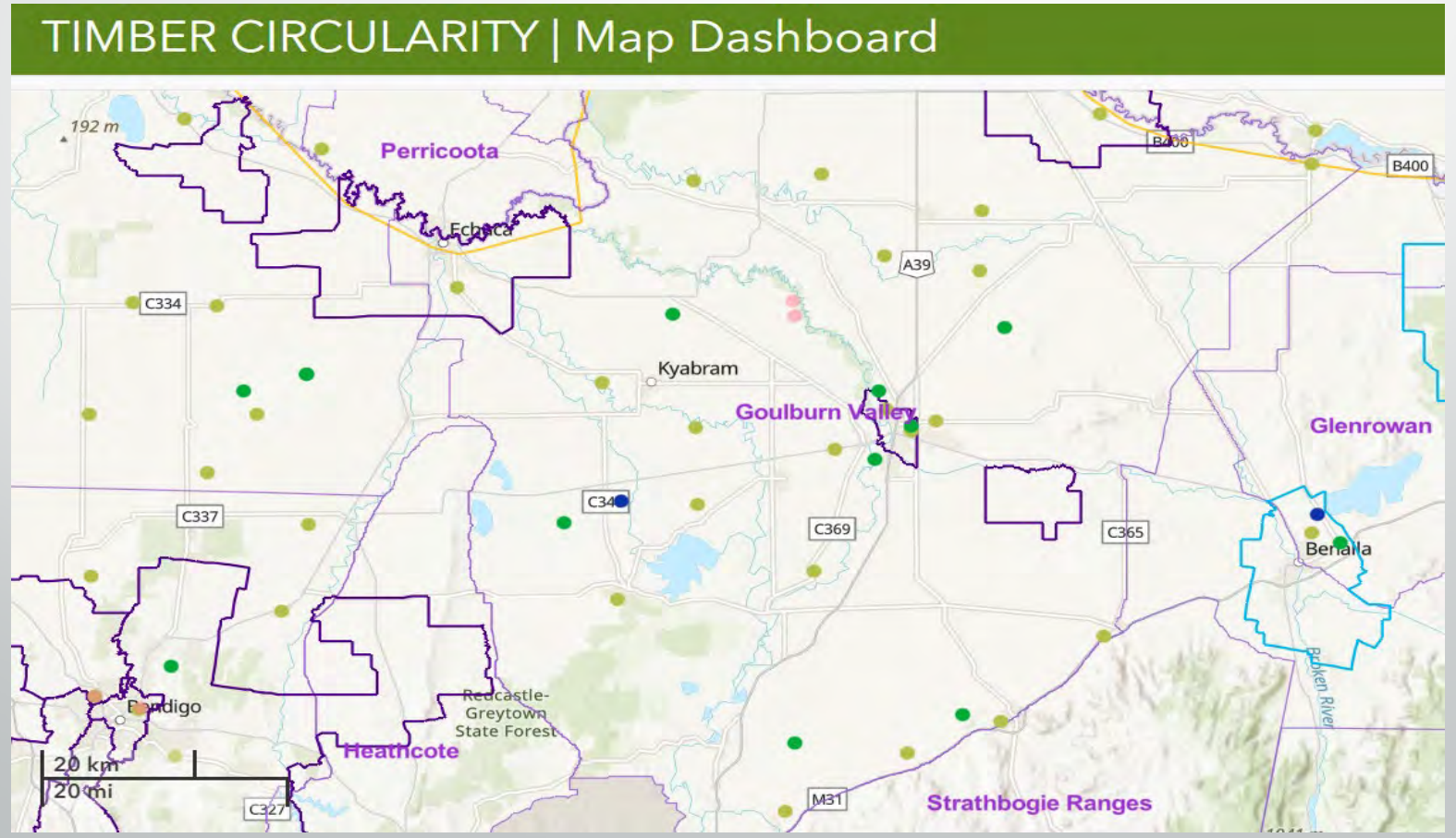
GEOSPATIAL MAPPING

The amount of timber resources is being geospatially mapped
Currently, the mapping includes all wine regions and the annual post-attrition numbers



GEOSPATIAL MAPPING

Frame and truss and EWPs facilities have also been mapped. EWP facilities are both a resource provider and potential users of timber waste. Councils with circular economy or zero waste strategies will be referenced as potential areas to support recycling infrastructure



PROJECT ACTIVITIES

1 VOLUMES

- Industry surveys
- Site visits
- Data collection & analysis

2 ANALYSIS

- Visual inspections
- Survey and discussion
- Retention analyses

3 REGULATIONS

- Regulator Interviews
- State-by-state analysis
- Material Info. sheets

4 LOGISTICS

- Cost com-parisons
- Waste charges
- Resource cost

5 SOLUTIONS

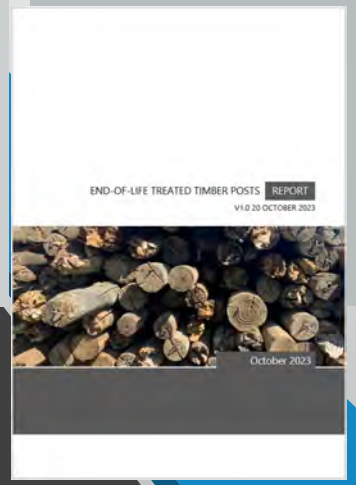
- Literature Review
- Industry Discussion
- Available tech.
- Events
- Workshops

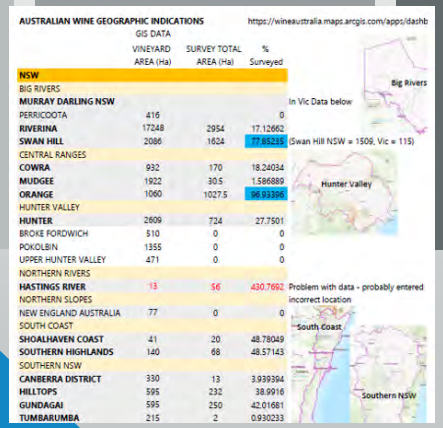
6 MAPPING

- Geospatial Mapping
- Info. Collation

7 PILOT

- Meetings with Industry
- Discussions with Product Stewardship groups/ Gov. etc.
- Workshops
- Testing





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MATRIX FOR SOLUTIONS

- Waste Hierarchy (Reuse opportunities first through the landfill last)

POTENTIAL SOLUTIONS	CURRENTLY AVAILABLE	ORGANISATION	LOCATION	DETAILS	TYPE OF TIMBER	ECONOMICS	ECOLOGICAL CONSIDERATIONS	TECHNICAL ISSUES	SCALE	REGULATIONS	CASE STUDY
Reuse as Fencing Posts	(Not available in Australia)			posts - processing at site to		Need to understand the feasibility in Australia.	processing	required. No technical or availability issues	MOBILE/ ONSITE	processed on-site?	
Finger-jointing CCA Posts	X	NA	NA	Have been made and tested but no-one doing this commercially.	CCA POSTS	May cost more than new post, depending on scale, but reduced disposal costs.	Highest use - least processing Requires glues Can double life of post	Specialised finger jointing technology required. Could be mobile. Joint not as strong as rest of post.	REGIONAL/ MOBILE/ ONSITE	Outside regulatory barriers if processed on-site?	NO
ENGINEERED WOOD PRODUCTS (RECYCLING)											
Glulam	√	Megabeam	Caloundra, QLD	Treated frame & truss offcuts greater than 300mm are finger jointed and glued.	Sawn timber offcuts. Treated F&T offcuts. Potentially CCA treated wood	Megabeam collect F&T offcuts as backload. Do not charge for collection.	Transport backload Reduced requirement for virgin timber More processing required - finger jointing and gluing	Working example. Require finger jointing technology (low cost).	GLULAM FACILITIES	QLD fits within EOW codes. May not be able to do this in other states. Could potentially use CCA treated timber if regulations supported use. Beams treated after made.	YES
Particleboard	√	Laminex	Gympie, QLD & Hazelmere, WA	Will accept clean timber chips for particleboard - EWP or PTT	Treated timber. EWP Potentially CCA treated wood.	Chipping and delivery required by third party. Currently, are not prepared to pay for this resource (although they do pay for recycled chips for burning, but considerably less than virgin chips)	Reducing requirements for virgin timber Transportation of chips - compared with virgin material?	Currently accepting specified sized wood chips from clean timber. Testing required to accept treated timber and EWP. Also require testing to accept CCA treated timber - ie adhesives may need adjusting.	PARTICLEBOARD FACILITIES	QLD fits within EOW codes. May not be able to do this in other states. Could potentially use CCA treated timber if regulations supported use.	YES
Particleboard	√	D&R Henderson	Benalla, Vic		Will accept H2F. Find out whether they accept CCA as well as other treatments						MAYBE
Particleboard	√	Borgs	Oberon, NSW	Obtains chips to specification from sister company Redirect Recycling	Treated timber. EWP Potentially CCA treated wood.	Chips supplied by Redirect Recycling - Borg's recycling arm.	Find out whether back loaded? Amount of recycled resource used compared with virgin.	Obtain details during site visit	PARTICLEBOARD FACILITIES	NSW - find out whether they need special licence.	YES
Chipping for Particleboard	√	Redirect Recycle	Sommersby, NSW	Collects timber including EWP and F&T for chipping and delivery to Borgs, Oberon.	Find out details during site visit	Find out details during site visit	Find out details during site visit	Find out details during site visit	TRANSFER AND PROCESSING FACILITY	NSW - find out whether they need special licence.	YES
Scrimber		NA	NA	Engineered wood-based structural	Potentially any wood resource	Requires further research	Could potential use scrap wood resources of	Developed in the 70s by CSIRO and now being further developed	Requires further research	Unsure	NO

CONCLUSIONS

- This matrix will aid in pinpointing solutions available and engage providers in a summit to identify the most appropriate reuse/recycling strategies based on global experiences but framed in an Australian context.
- Careful planning and consideration to minimise environmental impact and maximise resource efficiency are required

THANKS!

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ACKNOWLEDGMENTS:

Prof Jeff Morrell for starting this project!

All the industry partners for their support!

Research Team: Drs Penelope Mitchell, Martin Strandgard
Mohammad Reza Ghaffariyan, Sanjeev Srivastava, Ms Mel Harris

Russ Martin (MS2 Consulting) for providing the regulatory information

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FIVE UNUSUAL TREE DEFECTS WHICH HAVE CONTRIBUTED TO ELECTRIC UTILITY WILDFIRES

DAY & ASSOCIATES

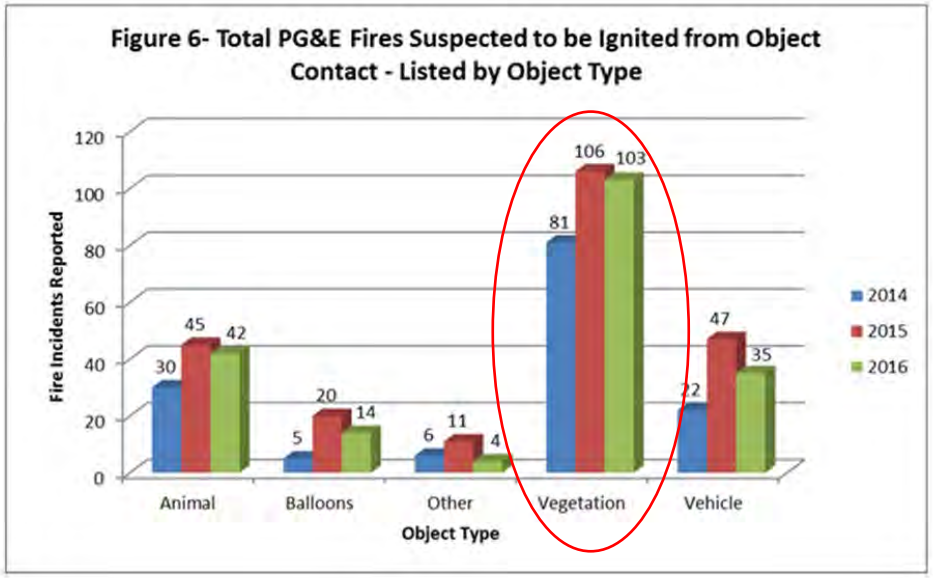
Consulting Arborist & Tree Pathologist

AGENDA

1. Defective Codominant Stems and Trunks
2. Hidden External Cavities and Old Fire Scars
3. Visible Indicators of Sapwood Decay
4. Obscure Root and Butt Rot
5. Artificially Supported and Weak Trees Released by Natural and Human Events

INTRODUCTION

Vegetation is typically the most frequent cause of utility-related wildfire ignition.



CODOMINANT STEMS AND TRUNKS

Codominant stems: Two stems growing from the same point of attachment, and are of equal or similar size (diameter). Codominant stems, per se, are not inherently hazardous.

Shown: Codominant stems, requiring monitoring versus immediate removal.

CODOMINANT STEMS AND TRUNKS

Structurally sound codominant stems, with a strong wood-to-wood attachment and no splits or cracks at the stem union.

1. DEFECTIVE CODOMINANT STEMS AND TRUNKS

Defective, structurally unsound codominant stems. History of splits/cracks below the stem union. Cracks may appear to be open or closed, but either way, represent a potential hazard.

1. DEFECTIVE CODOMINANT STEMS AND TRUNKS

Structurally unsound codominant trunks. History of splits/cracks at and below the trunk union. Tree removal is the only option.

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1. DEFECTIVE CODOMINANT STEMS AND TRUNKS

Defective, structurally unsound codominant stems. Stems may be solid wood, but the attachment is weak and hazardous.

1. DEFECTIVE CODOMINANT STEMS AND TRUNKS

Defective, structurally unsound codominant stems. History of splits/cracks at and below the stem union. This was the area of failure which resulted in contact with a distribution line.

1. DEFECTIVE CODOMINANT STEMS AND TRUNKS

Defective, structurally unsound codominant stems. Embedded bark with no fused wood contact, indicating a weak attachment. Bark does not fuse together, as does wood.

1. DEFECTIVE CODOMINANT STEMS AND TRUNKS

Defective, structurally unsound codominant stems. Note development of woundwood ribs (excessive wood growth) as an indicator of a tree's natural response to defects.

2. HIDDEN EXTERNAL CAVITIES AND OLD FIRE SCARS

Gray pine with a lean toward conductors within strike distance. Suspect tree is outside of the utility easement/R.O.W., which is often the case.

2. HIDDEN EXTERNAL CAVITIES AND OLD FIRE SCARS

Base of the same gray pine after failure, showing old fire scar, trunk decay, and loss of major anchor roots—all of which were hidden from normal utility easement view angles.

2. HIDDEN EXTERNAL CAVITIES AND OLD FIRE SCARS

Base of pine with old fire scar and open cavity, exposing extent of remaining holding wood. All of these indicators were hidden from view along the utility corridor (road) in background.

2. HIDDEN EXTERNAL CAVITIES AND OLD FIRE SCARS

Same pine stump as viewed from the utility corridor (easement). Open cavity and old fire scar are not visible.

2. HIDDEN EXTERNAL CAVITIES AND OLD FIRE SCARS

Same pine: arrow indicates top of vertically attenuated old fire scar. Splintered wood represents lower end of failure fracture which occurred directly above the cavity and fire scar.

2. HIDDEN EXTERNAL CAVITIES AND OLD FIRE SCARS

Ponderosa pine leaning toward conductors, with no obvious defects as viewed from utility easement; however…

2. HIDDEN EXTERNAL CAVITIES AND OLD FIRE SCARS

The same pine with an old fire scar and open cavity with moderate to advanced wood decay. The anchor roots at grade are decayed.

2. HIDDEN EXTERNAL CAVITIES AND OLD FIRE SCARS

Douglas-fir with multiple fire scars, and only limited internal wood decay. Arrows indicate extensive woundwood response attempting to close the original open wound.

3. VISIBLE INDICATORS OF SAPWOOD DECAY

Mid-level trunk of a Douglas-fir broken out by strong wind as a direct cause, and sapwood decay as a proximate cause. Commonly, decayed trunks break out at 15'-35' above grade.

3. VISIBLE INDICATORS OF SAPWOOD DECAY

Same Douglas-fir showing signs of serious sapwood decay, with pouch-like fungal fruiting bodies protruding through the bark.

3. VISIBLE INDICATORS OF SAPWOOD DECAY

Punk knots extending from the inner wood to the outside of the bark. These are fruiting bodies of advanced sapwood decay fungi, and can mimic branch stubs.

3. VISIBLE INDICATORS OF SAPWOOD DECAY

Conks or shelf-like fruiting bodies of fungi causing serious decay of trunk wood.

3. VISIBLE INDICATORS OF SAPWOOD DECAY

Only present during autumn, these ‘honey-cap’ mushrooms indicate very serious decay of the lower trunk and root flare sapwood. These mushrooms do not grow on the trunk.

3. VISIBLE INDICATORS OF SAPWOOD DECAY

Yellowish-white nodules on the bark of many tree species represent the beginning stages of fungal fruiting bodies that indicate serious sapwood decay.

4. OBSCURE ROOT AND BUTT ROT

230’ tall Douglas-fir prior to its total and catastrophic failure onto an adjacent road. Cause: root and butt rot + gravity. Utilities are underground in this area.

4. OBSCURE ROOT AND BUTT ROT

Reddish-brown color of butt rot. This fungus most commonly affects Douglas-fir, and not most other conifer species. A basic knowledge of species-profiling is helpful.

4. OBSCURE ROOT AND BUTT ROT

Same tree, showing delamination effect of advanced root decay caused by laminated root rot. The wood is spongy and structurally unsound.

4. OBSCURE ROOT AND BUTT ROT

Swollen lower trunk of a deciduous tree with serious wood decay. Even in the absence of a fungal fruiting body, this symptom is diagnostic of internal wood decay and can cause failure.

4. OBSCURE ROOT AND BUTT ROT

In the absence of these ephemeral fruiting bodies, the obscure root and butt rot of affected trees often goes unnoticed to the untrained eye.

5. ARTIFICIALLY SUPPORTED AND WEAK TREES RELEASED BY NATURAL AND HUMAN EVENTS

The red dot represents a gray pine which slowly bent over and contacted a conductor after being released by the removal of adjacent trees which were artificially supporting it.

5. ARTIFICIALLY SUPPORTED AND WEAK TREES RELEASED BY NATURAL AND HUMAN EVENTS

Stump of the gray pine next to the logs of removed trees which artificially supported the gray pine for several years.

5. ARTIFICIALLY SUPPORTED AND WEAK TREES RELEASED BY NATURAL AND HUMAN EVENTS

A gray pine immediately adjacent to the failed pine in the prior slide is shown here being artificially supported by other trees.

Summary

1. Many unusual circumstances can contribute to tree failures, resulting in utility wildfires.
2. The power of observation during inspections is priceless.
3. A photo is worth 1,000 words!

THANK YOU!

DAY & ASSOCIATES

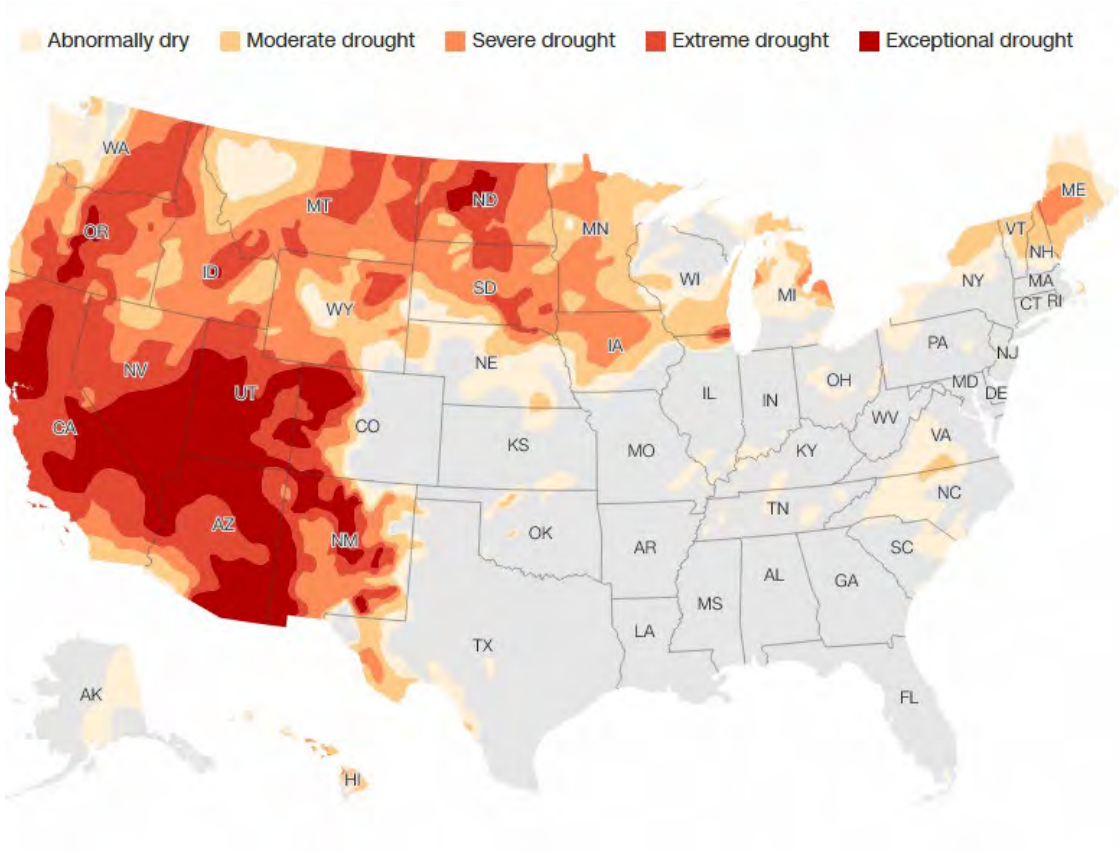
Consulting Arborist & Tree Pathologist

Small-Scale Performance Testing Methods for Fire Protection Systems for Wood Poles

Gerald Presley
And
Matthew Konkler
Department of Wood Science and Engineering

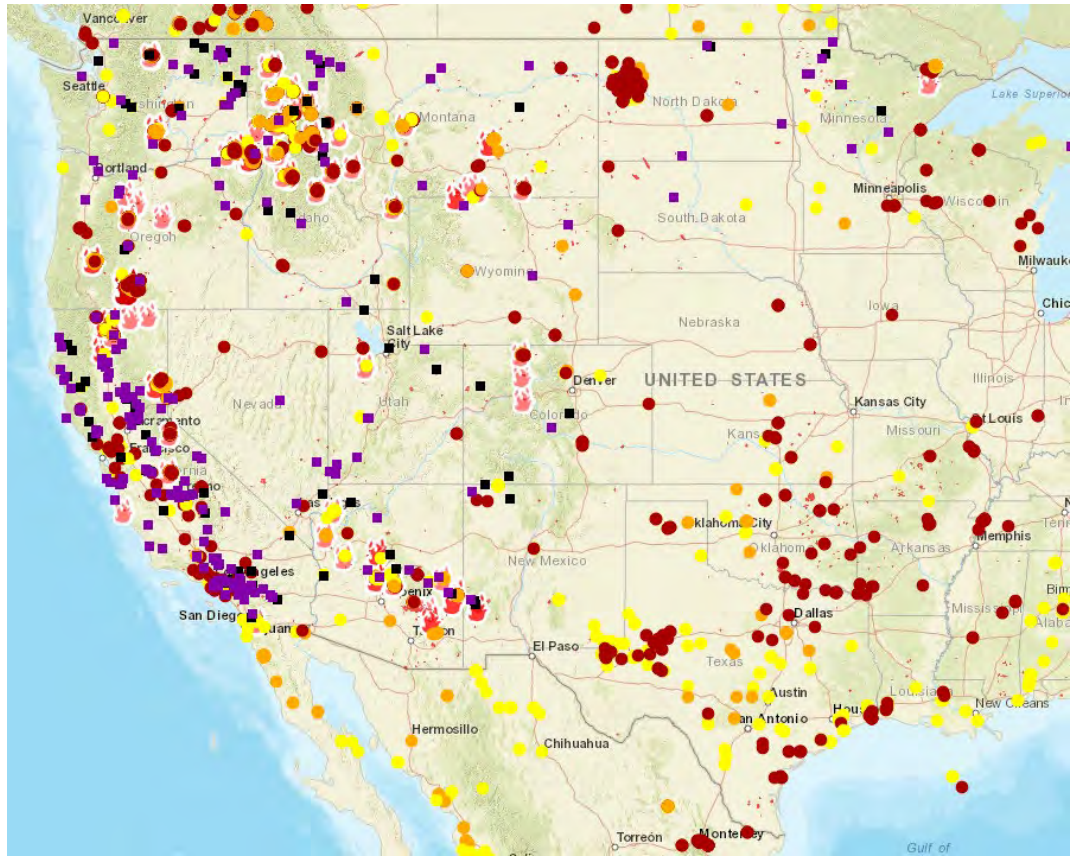
Fire is a Perennial Issue in the West

- Droughts are regular in the western USA
- Annual dry season



https://www.cnn.com/2021/06/17/weather/west-california-drought-maps/index.html

Ongoing fires as of 7/12/21



https://www.nifc.gov/fire-information/nfn

Wood Poles at Risk

- Utility assets in need of protection
- Resistance to low level fires
- Maintain structure until remediation is possible

https://live.staticflickr.com/5477/30121130813_caa7a2ed15_b.jpg

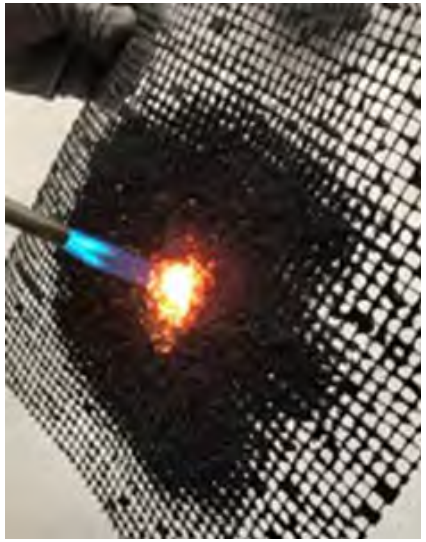
Wood Pole Fire Protection Systems

- Wraps/meshes
- Intumescent coatings
- Foams, spray on products

Coatings

Genics mesh wraps

Hexion Armorbuilt wraps



WoodPoles.org

Wood Pole Fire Testing

- All novel solutions require testing
- Testing centers are very expensive
- Single furnace tests for wood poles:
  - at least $5000 per burn
  - Minimum 2 replicate burns
  - Not suitable for screening

Full-Scale Vertical Furnace

http://www.westernfire.com/Complete.pdf

Inexpensive Small-Scale Testing Solutions

- OSU Utility Pole Research Cooperative developed testing methods over two decades

Straw bale in wire mesh

Weed Burner

Straw bag for fuel

UPRC 1999 Annual Report

UPRC 2006 Annual Report

UPRC 2014 Annual Report

Heat Panel-Based Fire Testing Apparatus

- Small scale fire test- Built by Milo Clausen
- Relatively uniform heat application
- Reproducible conditions vs. open flame

UPRC 2016 Annual Report

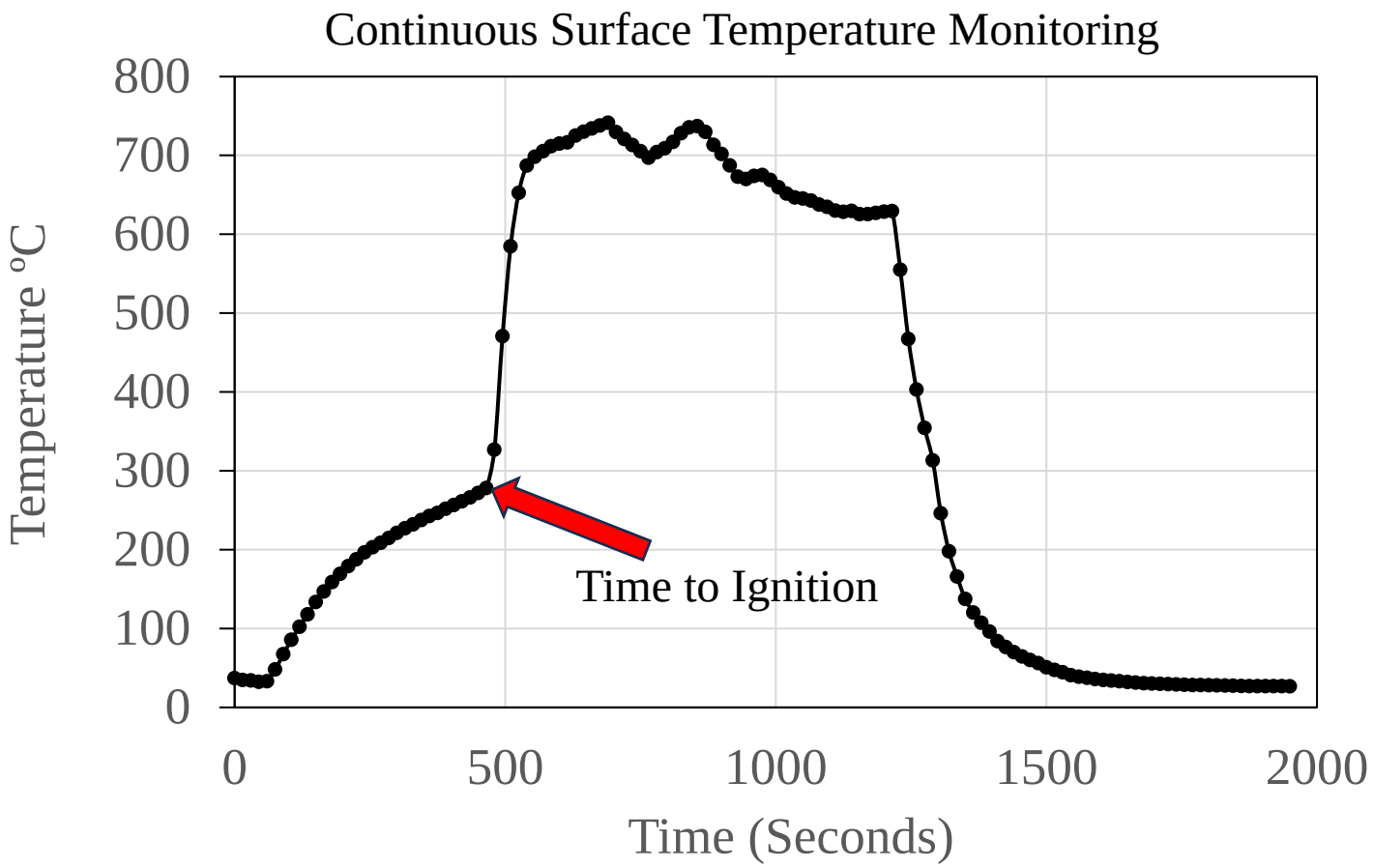
Recent Test Modifications

Remote operation on Generators

- Generators now used as power source
- Surface temps up to ~700ºC in 6 minutes for untreated wood

Measuring Performance

- Several performance parameters can compare treatment performance



Check Widening

Circumference Loss and Char Depth

Rapid Testing of New Commercial Products

- Previous work by Konkler and Morrell compared barriers and coatings

Brooks Polyurea Barriers

FireGuard Coating

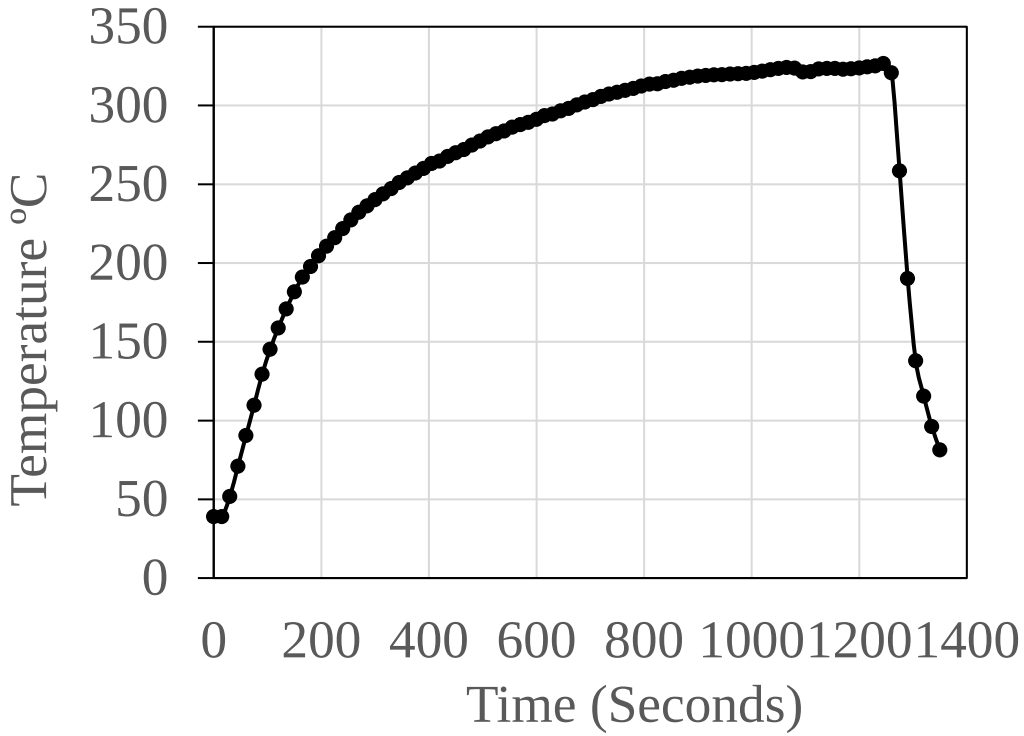
Sun Seeker Coating

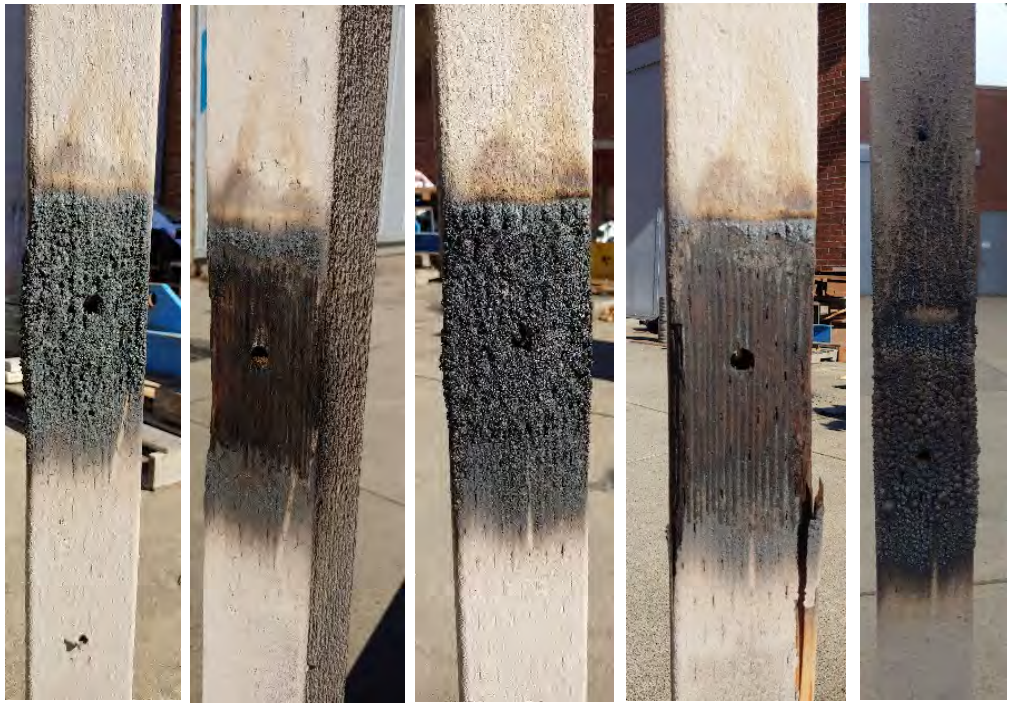
Copper Care Barrier

Genics Fire Mesh

Adaptation for Crossarm Testing

- Fire retardant-treated crossarms: Fire Protection Coating
- Titanium Dioxide coating



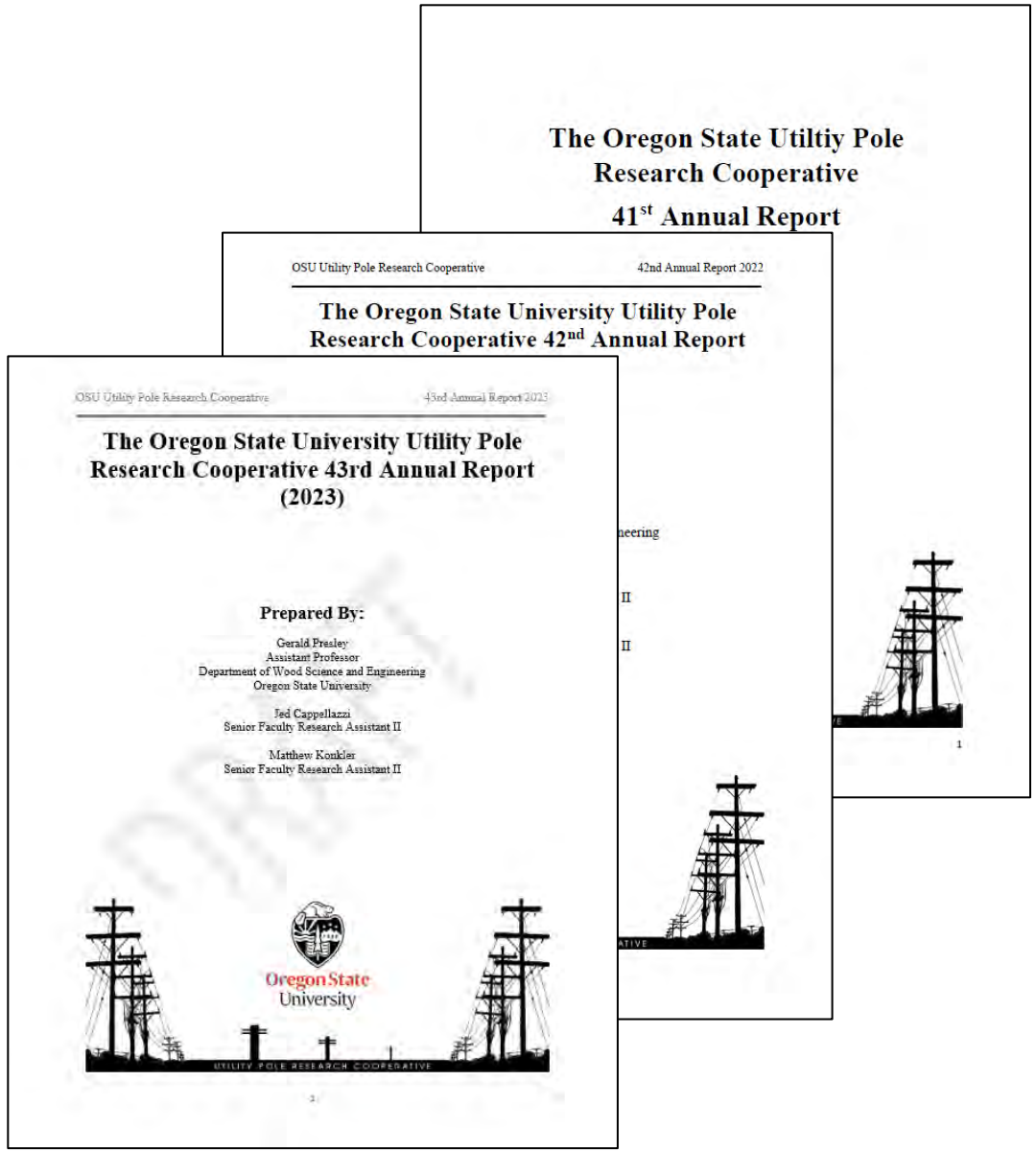


Improvements for Apparatus Durability

- Insulation, spacing, and wiring improved system durability
- Proven performance in over 40+ consecutive burns in one week
- Plans for write up into standard protocol

The Utility Pole Research Cooperative

- You can participate in Utility Pole Cooperative Research
- Annual report and annual meeting
- Utility partnerships on research projects



https://utilpole.forestry.oregonstate.edu/

ACKNOWLEDGEMENTS

Oregon State University
Matthew Konkler
Jed Cappellazzi
Jeff Morrell

Utility Members
Clark Public Utilities
Fortis Alberta Inc.
Idaho Power
Pacific Gas & Electric
PacifiCorp
Portland General Electric
Puget Sound Energy
Salt River Project
Snohomish Public Utility District
Xcel Energy

Associate members
Arxada
Brooks Manufacturing Co.
Copper Care Inc.
Genics Inc.
Hexion Inc.
Intec Services Inc.
Koppers
Osmose Utilities Services, Inc.
Poles Inc.
RioTinto Minerals
SmartFume Co.
Stella Jones
Wood Care Systems
Viance LLC

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Reducing Wildfire risks using technology and AI

PIKSO

FIELD OPS AI

Welcome to Epik Solutions' presentation on revolutionizing wildfire mitigation through cutting-edge technology and artificial intelligence. At Epik Solutions, we're at the forefront of integrating advanced technology and AI to empower wildfire mitigation programs. Our approach centers around leveraging the ESRI technology stack to develop innovative tools specifically tailored to support the Wildfire Mitigation Plan (WMP).

These tools facilitate both field and desktop inspections with unparalleled precision and efficiency. By merging real-time data analysis with AI-driven insights, our solutions enable rapid and accurate assessment of wildfire risks and mitigation potential.

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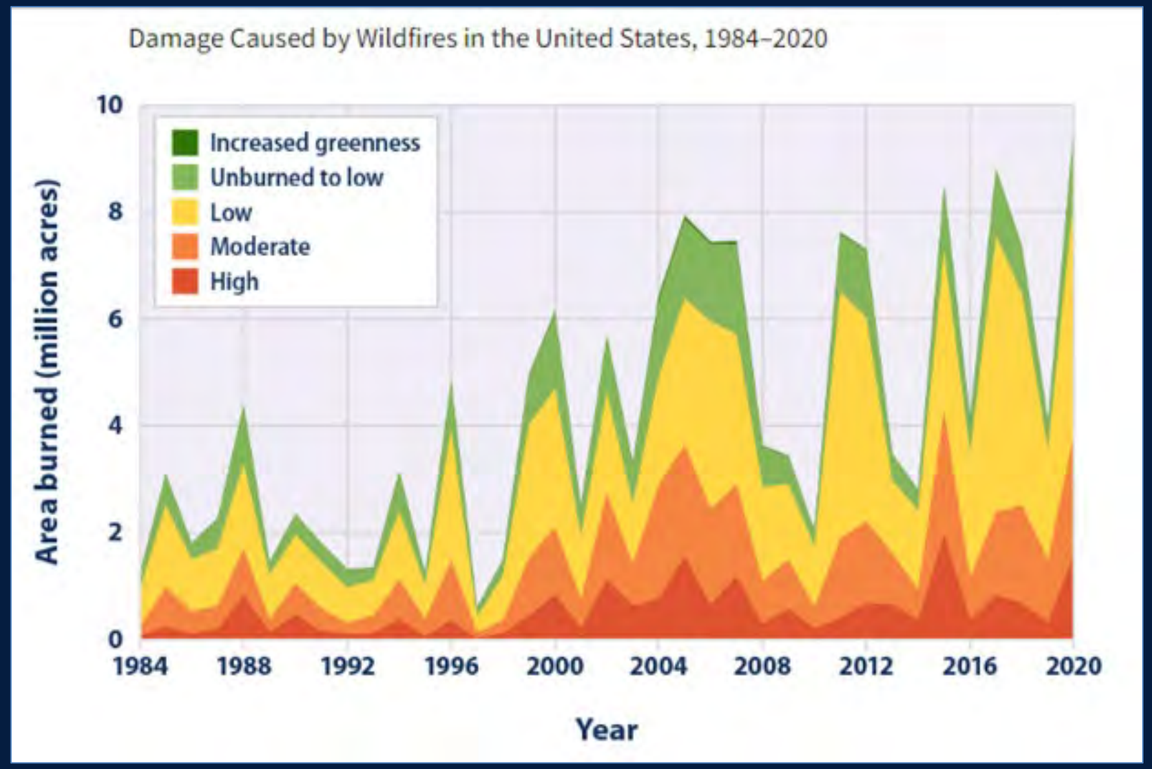
WHY



Since 1983, the National Interagency Fire Center has documented an average of ~70,000 wildfires per year

Coordination center	Acres	Hectares	Suppression costs	Structures destroyed
Alaska Interagency	171,045.7	69,219.7	$14,837,241.00	8
Northwest Area	1,925,434.2	779,195.6	$334,672,820.78	4,473
Northern California Area	3,961,089.6	1,602,996.1	$1,369,875,556.25	7,410
Southern California Area	1,241,246.5	502,314.6	$751,084,644.00	1,824
Northern Rockies	359,948.6	145,666.0	$71,770,047.00	222
Great Basin	891,689.5	360,853.9	$236,649,112.00	172
Southwest Area	1,036,287.6	419,370.7	$192,069,000.96	63
Rocky Mountain Area	818,608.6	331,279.1	$276,080,314.34	212
Eastern Area	10,508.4	4,252.6	$522,398.58	19
Southern Area	2,678,366.3	1,083,896.4	$14,692,891.11	313
Totals[a]	13,094,224.9	5,299,044.8	$3,262,254,026.02	14,716

a. ^ Year-to-date totals as of October 21, 2020

Comparison of burn size, fire suppression cost, and razed structure count across 10 sub-regions

Sources: https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires
https://gacc.nifc.gov/sacc/predictive/intelligence/NationalLargeIncidentYTDReport.pdf

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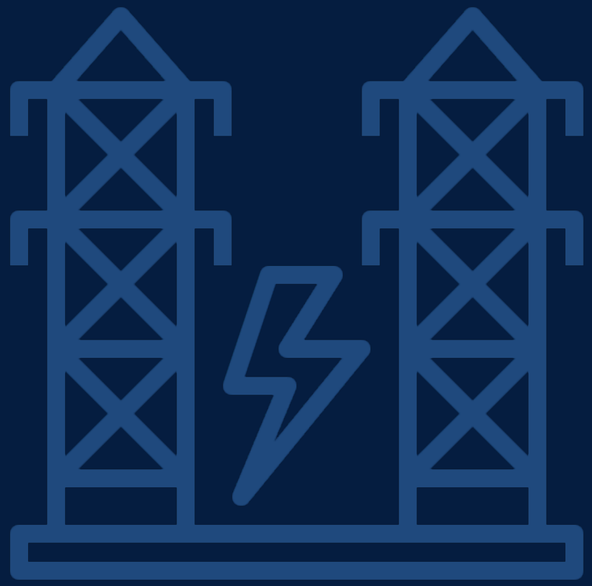
FOCUS AREA

- **Electric**
  - System Inspection (SI) contains electric system components like transformers, transmission lines, power grids
  - Vegetation Management (VM) contains mainly like trees, wooden poles etc



OPPORTUNITIES AND PAIN POINTS

Admin SMEs

"We do not have real-time information about the status of review tasks done by our team"

"We are unable to track changes or reasons for changes in survey records"

Field Specialist / Desktop Specialist

"Current Excel-based tools are resource intensive and slow down the laptop. It takes 5-10 minutes to even get things to barely work"

"If a specialist has to delete a discrepancy, they have to manually edit all discrepancies or lose all the information"

"I have to carry additional monitor screens when I go for field work because it is difficult to work with so many (12) apps simultaneously on one screen"

"Some apps are restricted to iPad only. Hence, we have to put things in SharePoint or emails for transferring data between devices. Furthermore, emails have a limitation on attachments"

Dispatcher

"It is stressful to get the Dispatch out within three days, and we work long hours to make it happen"

"There is a lot of manual repetitive work in the dispatching process. This makes the output vulnerable to human error. So we have to put a lot of effort into verifying everything multiple times to reduce errors"

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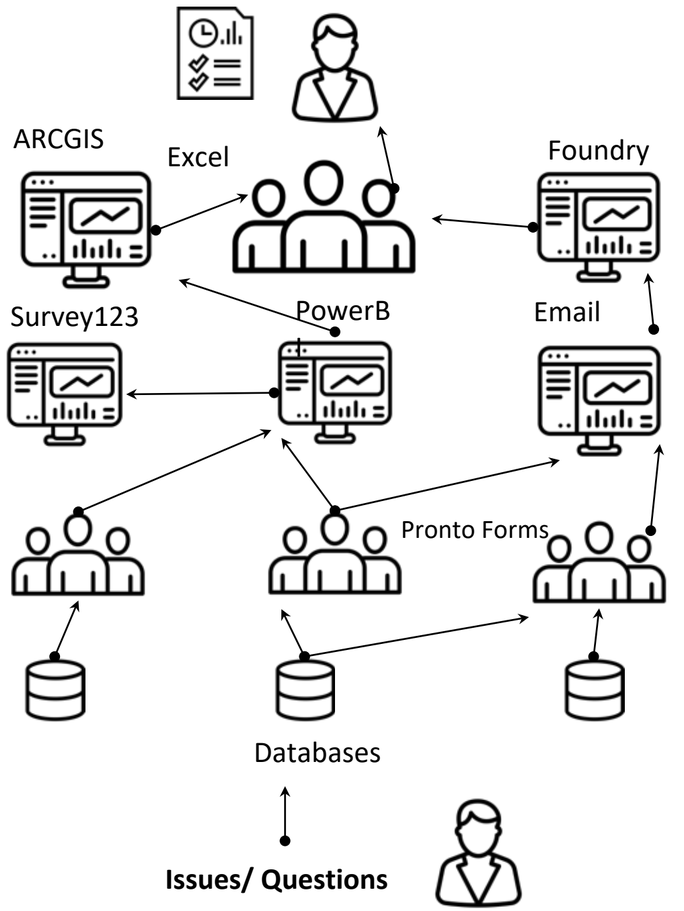
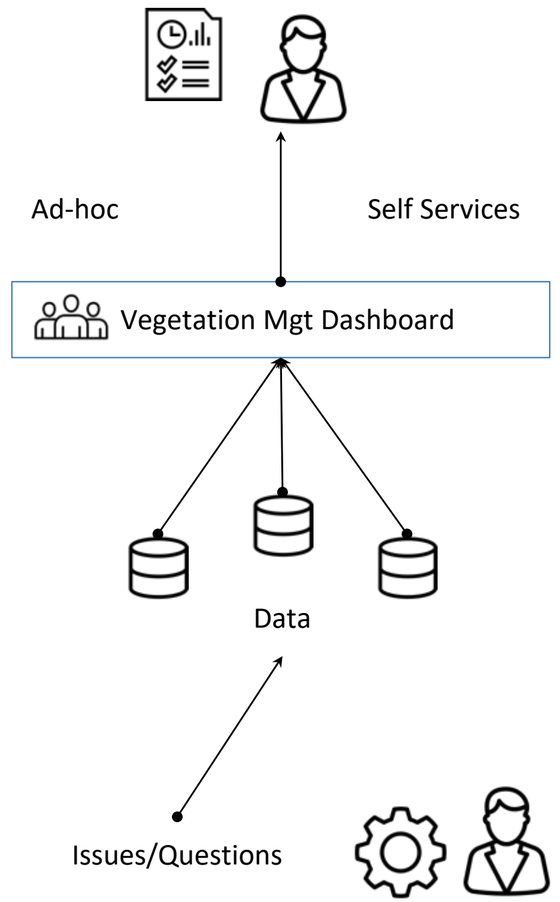
SIMPLIFICATION



Current State TAT > 5 - 12 days



Future State TAT On Demand

CRAWL, WALK AND RUN

Overall

- Partner to improve processes and built tools for efficiency, accuracy, and reliability

Phase 0

- Shadow, understand business process and technology
- Leveraging our expert manpower, assist in running processes, identify improvements, frame roadmap

Phase I

- Roll out APP to all programs through multiple releases
- Collaborate with teams to ensure seamless transition
- Create a roadmap for continuous improvements

Phase II

- Build Data Warehouse which house all data to enable data driven insights and act as source of truth for all reporting
- Deeper business engagement to further identify areas of improvement
- Customized reporting

Phase III

- Intelligent inspection capabilities using AI/ML
- Predictive analytics to detect and rectify issues before they snowball
- Comprehensive tracking of assets
- Real time data access

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IMPACTS

Comprehensive Tracking

- System Health tracking based on real time data, historic data and inspection records for equipment
- Trend analysis based on similar equipments
- Proactive Prescriptive Maintenance over Descriptive Maintenance

Risk Scoring

- Risk scoring of all equipment based on equipment health, similar equipments, weather and other local parameters
- Field auditors can focus on high risk equipment rather than spray & pray (random sampling)

Intelligent Inspection

- Built-in error detection for missing or incorrect data in field study
- AI based detection of system anomalies using of photos, videos and survey data
- Automated corroboration of field findings with historic and current inspections

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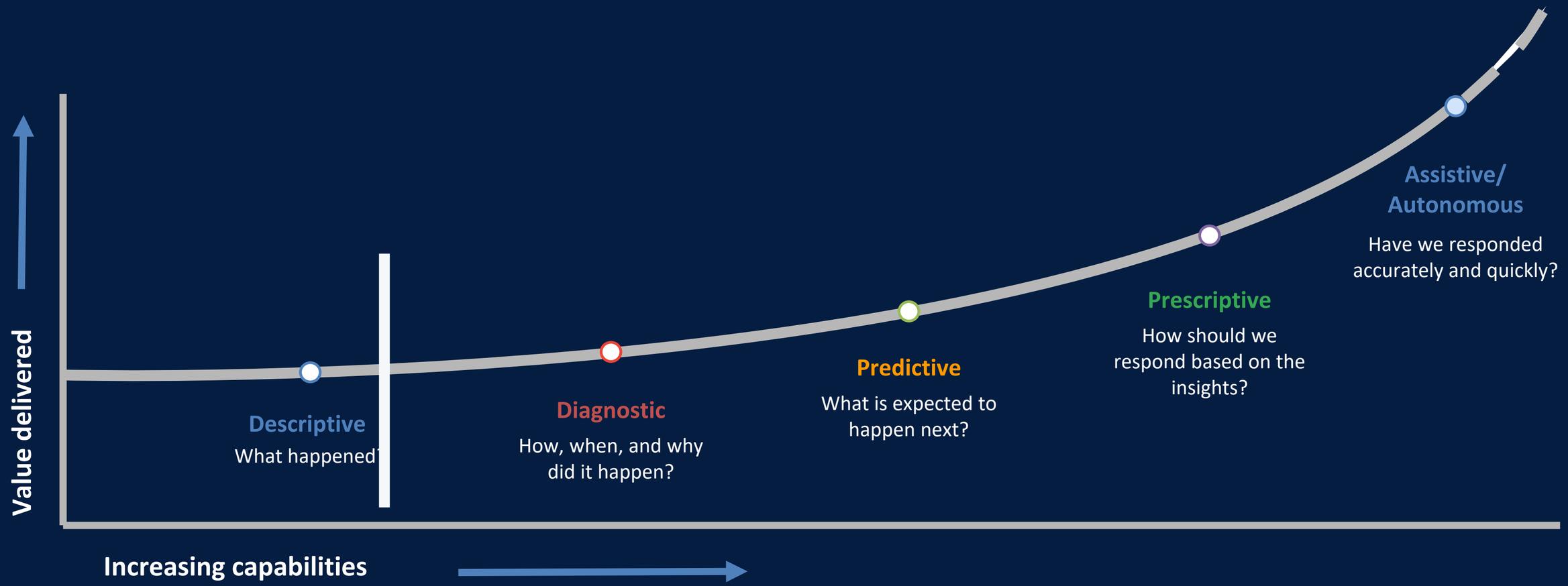
VALUE CREATION



Thank You

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EDM
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ENVIRONMENTAL SERVICES
PRODUCTS
Overcoming utility infrastructure challenges by merging excellence in engineering, science and technology with a passion for client satisfaction.