WINDAC AFRICA

BREAK THE GRIDLOCK! WIRE FOR GROWTH!

SAWEA
South African Wind Energy Association

21 - 23 OCTOBER 2025
8:00 am – 5:00 pm

CAPE TOWN, SA
CTICC 2

2025 PRESENTATION

Circular Innovation For Wind Energy Waste: Chemical recycling of the Decommissioned Turbine Blade fiberglass for waterproofing South Africa Toilets Pits, Eliminating ground water pollution and Blade disposal pollution

NKWELE AARON TLADI

22 OCTOBER 2025

SPEAKER **OVERVIEW**

NKWELE AARON TLADI

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Graduate Metallurgist

PRESENTATION **OVERVIEW**

SLIDE **ABSTRACT**

- South Africa faces dual challenges: turbine blade waste and sanitation gaps.
- Project explores chemical recycling of decommissioned fiberglass blades.
- Recovered resin repurposed for pit-latrine waterproofing and methane capture.
- Promotes circular economy and renewable integration.
- Contributes to environmental protection and sustainable energy goals.

SLIDE **INTRODUCTION**

Context

- South Africa's wind energy capacity is expanding rapidly.
- Decommissioned turbine blades are composite fibreglass which are durable but non-biodegradable.
- Current disposal: landfill → environmental risk (soil and groundwater contamination).

Problem

- Blade waste: heavy, chemically resistant, and difficult to recycle.
- Rural communities face sanitation challenges and energy insecurity.
- Opportunity to link waste management with energy and sanitation.

Project Goal

- Transform decommissioned wind turbine blades into pit-latrine linings.
- Capture methane from sanitation pits to generate biogas energy.
- Promote a circular economy: renewable energy waste → community health → energy resilience.

SLIDE MATERIALS AND METHODS

Sample Collection and Preparation

- Industrial diamond saw
- Jaw crusher or cutting mill

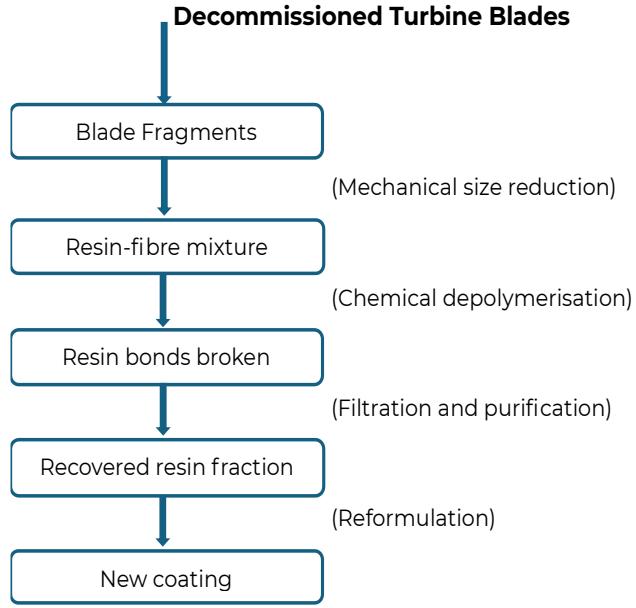
Stainless steel autoclave

Decommissioned turbine blades

Chemical reaction (Glycolysis)

- Acetone or ethanol
- Ethelyne glycol
- Sodium hydroxide
- Sulfuric acid
- Water

Process Flow



SLIDE **RESULTS AND DISCUSSION**

Pit dimensions

- Length: 1.2 m
- Width: 0.9 m
- Depth: 2.3 to 3.0 m
- Volume: 2.7 to 3.2 m^2

Using lining thickness of 5mm and composite density of 1800 kg/m^3 the total area (A_t) equals 13.62 m^2. Then mass per unit square (m_A) is equals 9.0 kg/m^2. Mass of lining per pit (M_{pit}) equals 123.1 kg.

Known spec of wind turbine from Klipheuwel wind energy

- Model: Sinovel SL3000/113
- Blade length: 55m
- Rotor diameter: 113m
- Rotor mass (which includes hub + blades): 12.5 tons

With 80% recovery efficiency and 10% fabrication waste. Net efficiency: 0.72 and number of toilets pits linings to be produced is 58 from one wind turbine.

Methane production and energy yield

	CH4 (m3/day)	Energy (kWh/day
Baseline	0.135	1.34
2 kg cow dung	0.375	3.73
5 kg cow dung	0.735	7.30

- Each toilet pit alone can generate 1.3–13 kWh/day, depending on dung input.
- With 5 kg of cow dung/day per pit, each pit produces enough biogas to cover one rural household's total daily energy needs.
- At turbine scale (58 pits), this supports approximately 70 households daily, showing real energy offset potential.
- The biogas could replace LPG, firewood, or part of grid electricity, reducing emissions and pressure on Eskom supply.

SLIDE **CONCLUSION**

Main Outcomes

- 80% fibreglass recovery from decommissioned turbine blades.
- One Klipheuwel turbine (12.5 t rotor) 7.2 t is recovered composite, forming approximately 58 sanitation units.
- Each lined pit yields 1.3–13 kWh/day, depending on cow dung input.
- At 5 kg dung/day: each pit provides approximately 7.3 kWh/day, powering one rural household.
- One turbine can power up to 70 –130 households energized through biogas integration.

Policy Relevance

- Supports National Waste Management Strategy (2020) by diverting composite waste from landfill.
- Advances Just Energy Transition (JET) goals by coupling renewable waste recycling with rural electrification.
- Contributes to SDG 6 (Clean Water & Sanitation), SDG 7 (Affordable & Clean Energy), and SDG 12 (Responsible Consumption & Production).
- Encourages cross-sector policy integration: energy, sanitation, and environment.

Future Potential

- Scale-up composite recycling hubs near wind farms and sanitation programs.
- Standardize co-digestion systems using human waste and livestock dung for rural biogas generation.
- Develop certification and reuse frameworks for recycled fibreglass sanitation products.
- Promote industry research collaboration to optimize depolymerization and biogas yield.
- Integrate circular infrastructure planning into national renewable energy policies.

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THANK YOU FOR LISTENING!

CONTACT DETAILS

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