

Deep Dive Workshop:

Key Insights of Renewable Energy Recycling Regulatory Framework in the Pacific

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MARINE PLASTIC SOLUTIONS
The Helping Hand in Waste Management



Oceania Recycling Solutions
Supporting the Circular Economy

- **Project Number:** TA-6810 REG
- Pacific: Development of the Pacific Energy Regulators Alliance - Utility-Scale Solar and Battery Energy Storage Disposal in the Pacific (49450-035)
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- TA – Mr Stewart Williams – Business Director Oceania Recycling Solutions/Director Oceania Recycling Solutions



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The Helping Hand in Waste Management

Pacific Waste Situation –Whats Happening Now

- Similar to Hawaii Situation
- No national/regional EOL plan for RE-waste (including EV batteries) - or other E-waste/ELV vehicles
- Recycling limited to high value materials, with little or no processing, and with known markets/shipping
- EOL lead batteries is the exception with established lead battery manufacturer in Fiji (Pacific Batteries)
- EOL PV + Li is effectively trapped in the Pacific (for now)

So What Waste Are We Talking About - PV



- Primary barrier for recycling solar panels in Australia is cost, which is approximately \$28 per panel (cost in Pacific unknown).
- This is six times the cost of sending EOL solar panels to landfills, which is estimated to cost \$4.50 per panel.
- But increasing landfill and export bans. Complete recycling requires subsidy/payment/EPR etc.
- Estimated 260,000 PV panels would cost over AUD \$7million to recycle atm

So What Waste Are We Talking About - PV

Weight and value composition of major materials in a typical crystalline silicon photovoltaic panel [21], [22].

| Component | Material | Weight | Price (\$/kg) |
|--------------|-----------|-------------|---------------|
| Solar cells | Silicon | 3-5% | 3.1 - 3.8 |
| | Silver | 0.03%-0.05% | 746 - 1084 |
| Ribbon | Copper | 0.8% | 7 - 10 |
| | Tin | 0.1% | 22 |
| | Lead | 0.01% | 3 |
| Frame | Aluminium | 16-20% | 2.1 - 2.8 |
| Glass | Glass | 67-70% | 0.06 - 0.13 |
| Junction box | Copper | 0.3% | 7 - 10 |
| Encapsulant | EVA | 6-7% | Negligible |
| Backsheet | PVF/PET | 3-4% | Negligible |

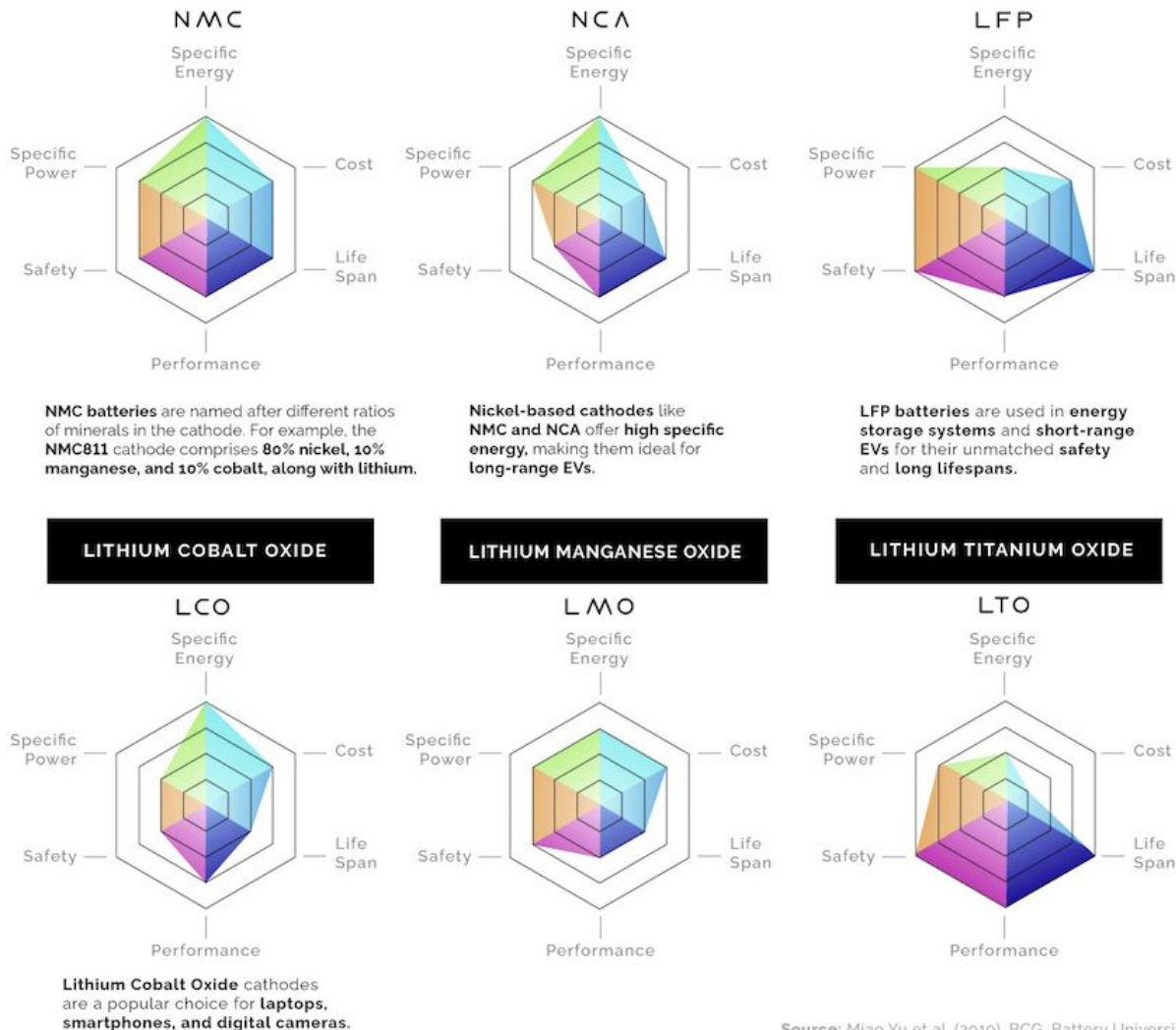
- In Australia 17% of solar panel components, (aluminium frame and junction box) are economic to recycle
- The “remaining’ 83% of a solar panel’s materials (glass, silicon, polymer back sheeting) are not economic recyclable and treated as waste.
- Whole PVs are increasingly unable to be exported or have costs associated that are unaffordable.
- Bans on landfill/export are forcing recycling to be the norm or storage. EoL PV are increasingly stuck in country

So What Waste Are We Talking About – BESS (Lead)



- 1st Generation BESS was Lead Acid Batteries –phasing out with Li BESS performance/price etc
- Well established global circularity – 99% of ULAB is recycled with well established commodity price
- Used lead Acid Batteries are easily exported (global market), without processing due to high value USD \$780 to USD \$800
- USD\$450 a tonne if exported regionally to Fiji under a Waigani Permit.
- Illegal export to Malaysia from Australia (KAS 2020), PNG and Solomon Islands is an issue

So What Waste Are We Talking About – BESS (Lithium)



- Li BESS is 2nd Generation with superior performance/ decrease weight and in price
- LFP and NMC are most preferred for BESS but have very different potential as recyclables.
- NMC is up to 3 times more valuable as a recyclable due to the value of cobalt (USD 30,000 a tonne) and copper (USD 9,000 a tonne) which LFP does not contain.
- Global recycling system however is not established. Market access, shipping and regulatory barriers. In Australia the result is only 10% is recycled

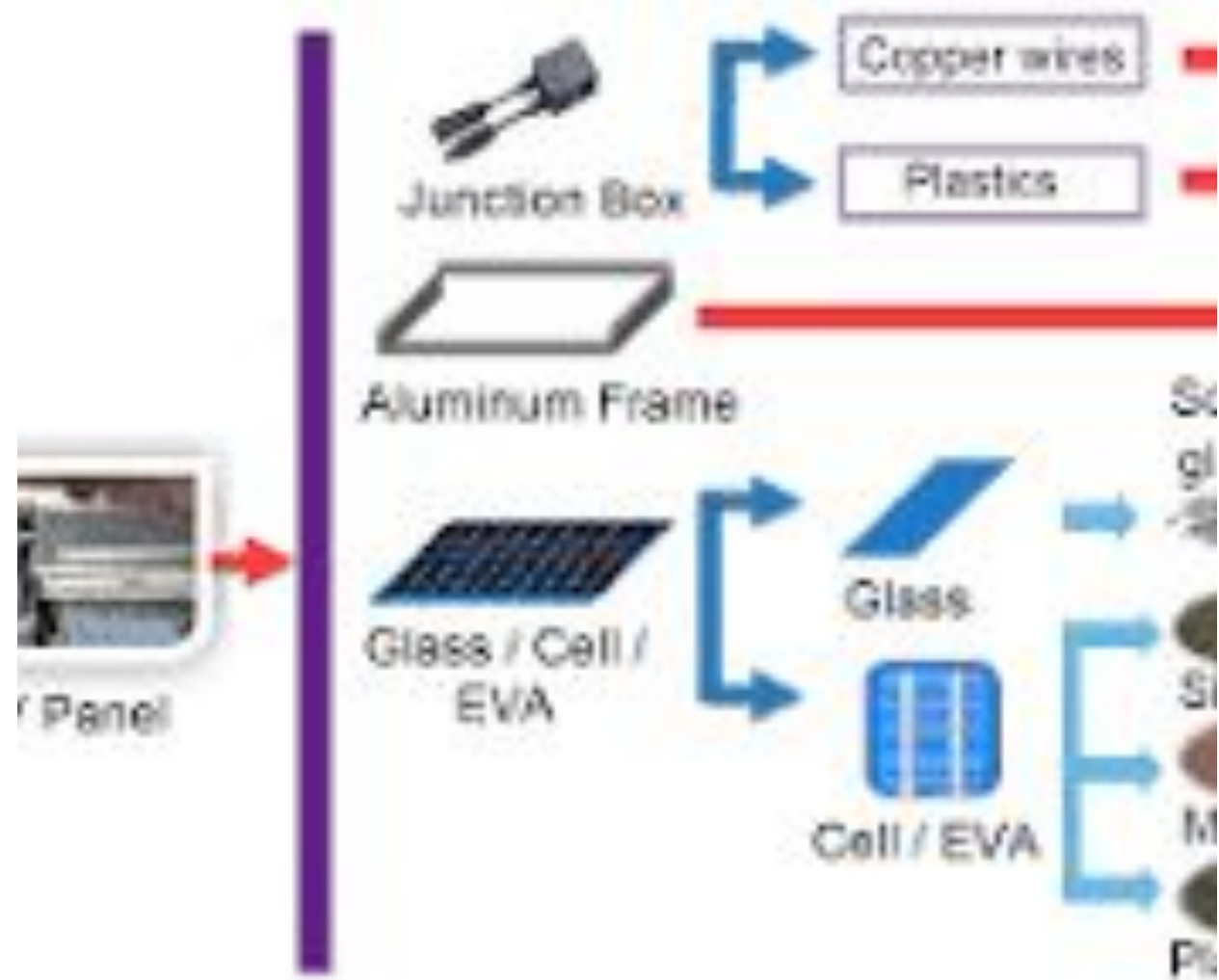
So What Waste Are We Talking About – BESS (Lithium)

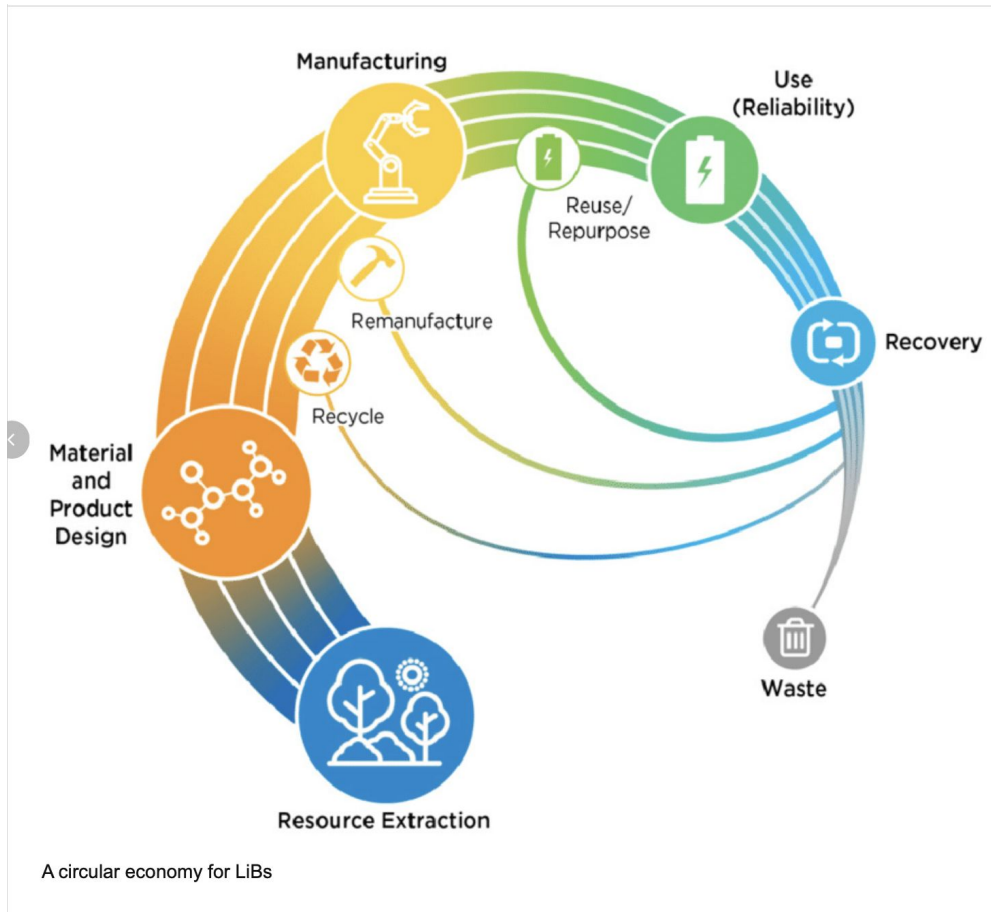


- Li BESS require reprocessing as 'black mass' as whole batteries probably will not be shipped
- But China has banned import and Europe only just permitted the first import (from UK)
- For the Pacific the best options appear to be Korea, but market links need to be built
- Shipping is a great unknown. ULAB is shipped for USD \$3500 from Solomons per 20 FCL

The Role of Government

- The Pacific does not yet have a need for LI BESS management, but EoL EV Lithium batteries are currently already stranded in Fiji (potential for 2nd hand BESS) as is EoL PV
- The Pacific needs a capability to at least produce 'black mass' the simplest level of processing/producing an exportable product that can be shipped
- National recyclers to equip them for more advanced recycling of RE wastes, probably via a national or regional EPR
- Without this EoL PV and LI batteries will pile up





- The Pacific EoL PV and Li BESS needs frameworks established to allow RE wastes to be returned to the Circular Economy
- Korea and the EU have, so far, the best-established PV and Lithium BESS recycling rates with approximately 50% recycled (ULAB is 90%).
- For the Pacific EPR from these countries will be useful to examine while also looking at other regulatory frameworks that can help build a sustained system

Thank You!

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Questions or Comments?

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