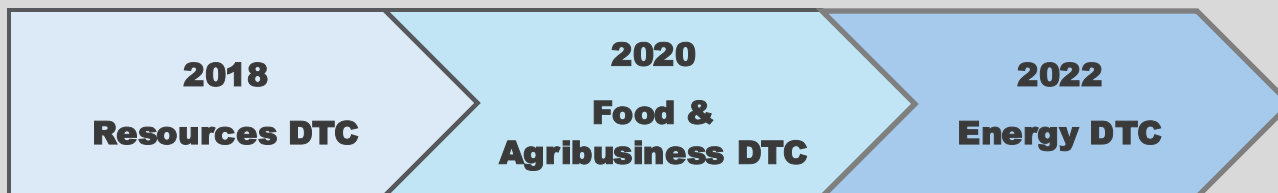




DOCTORAL TRAINING CENTRE

Inspiring the next generation of industry leaders with:

- transformative knowledge
- new ways of working
- academic solutions to industry challenges



Solar Panel Recycling and the Circular Solar Economy

Jackson Lee

Supervisors:

Dr Jessica Allen, UON

Dr Noel Duffy, CSIRO

Timothy Dawson, PV Industries



**DOCTORAL
TRAINING
CENTRE**



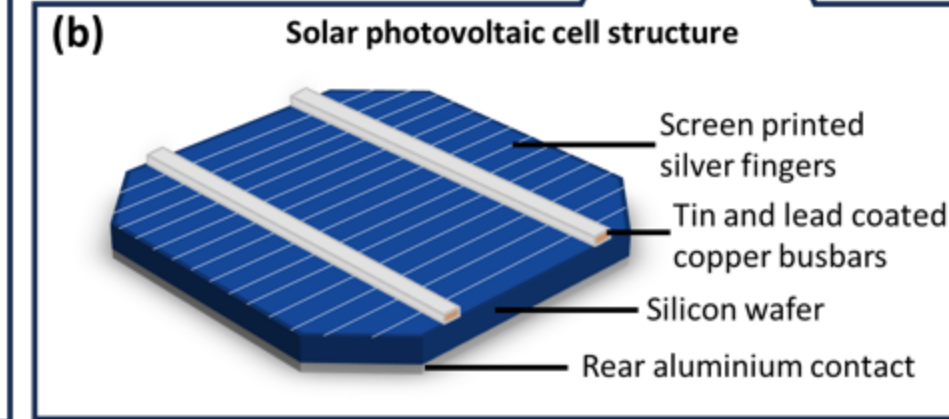
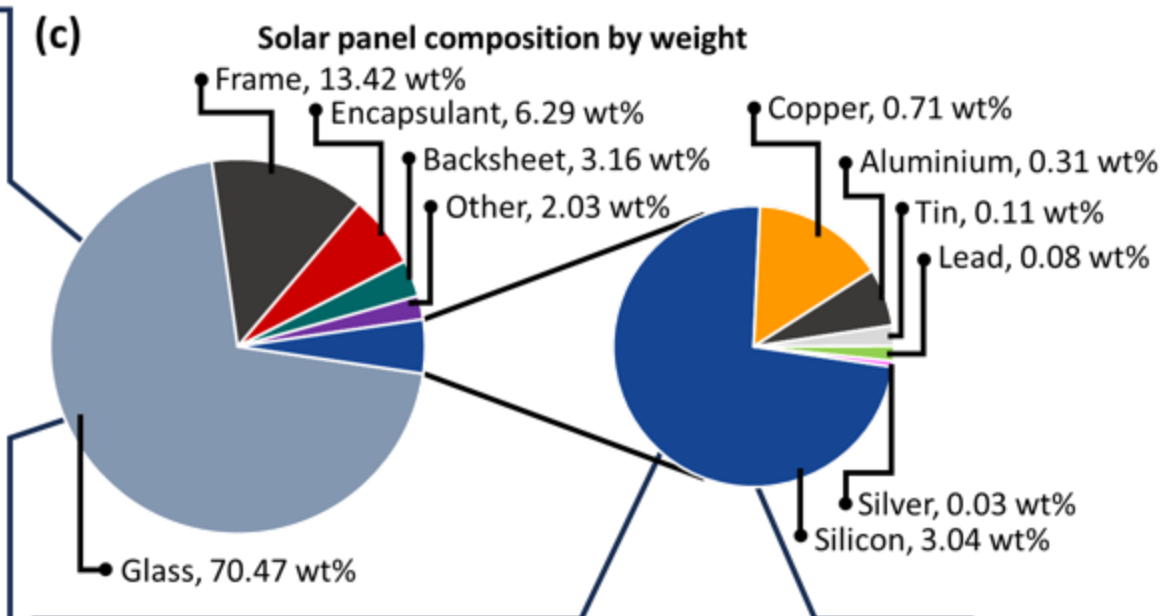
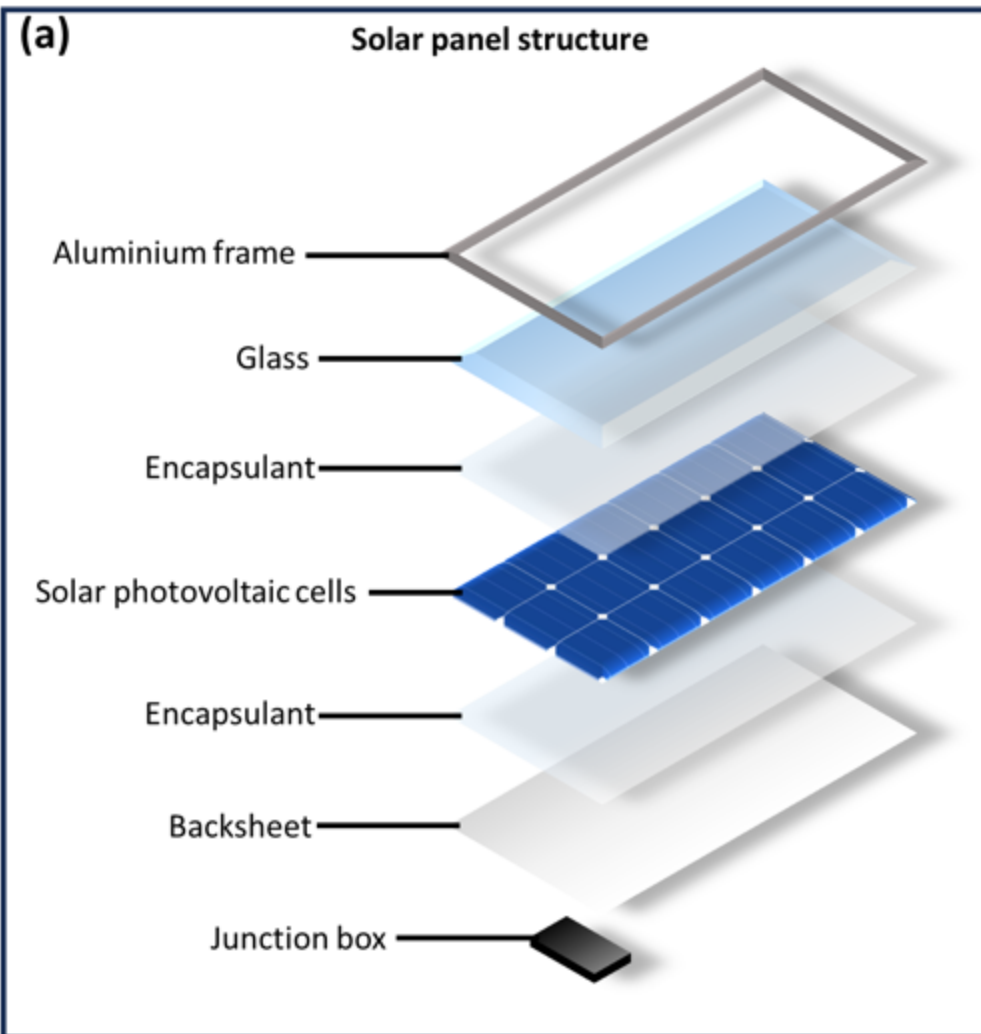
SOLUTIONS FOR GLOBAL CHALLENGES
ENERGY RESOURCES FOOD WATER



PV INDUSTRIES



Silicon Solar Technologies

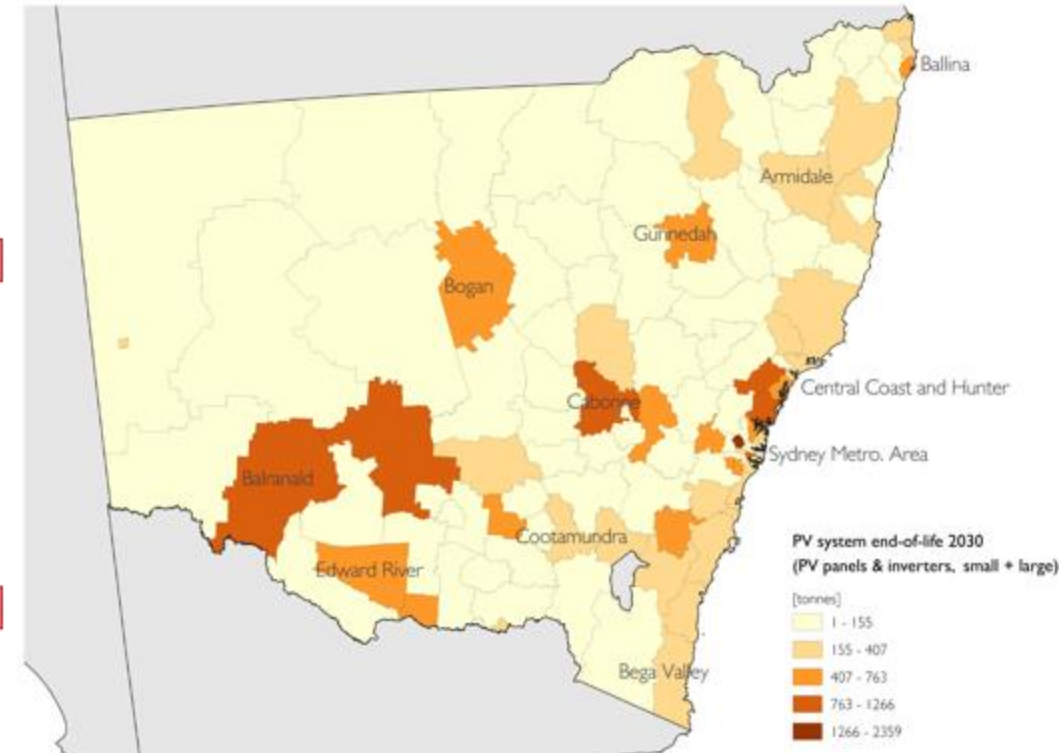
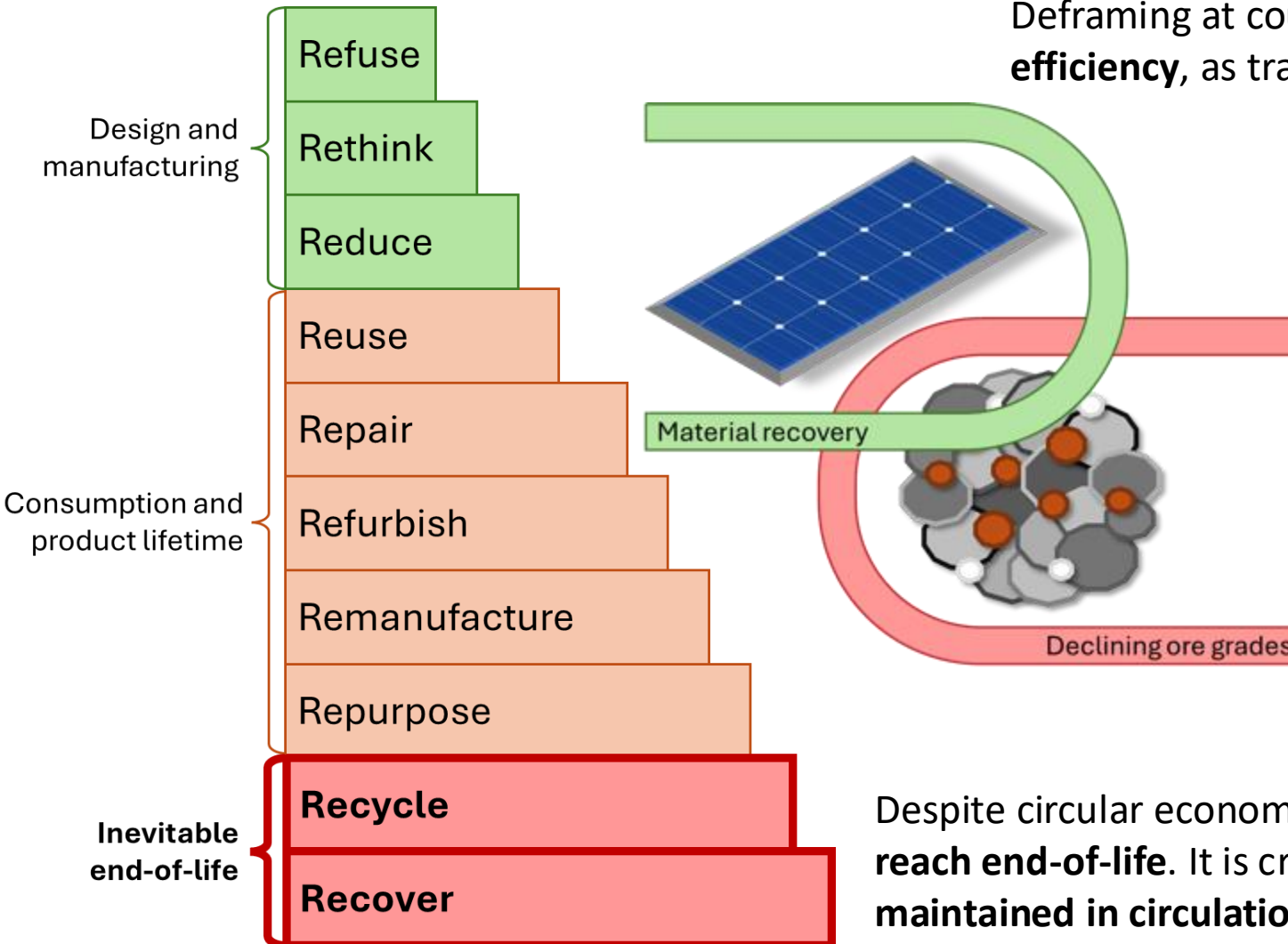


End-of-life **solar waste** expected to cumulate to **80 million tonnes by 2050^[1]**. This has a potential material value of **\$15 billion USD^[1]**.

[1] IRENA and IEA-PVPS. (2016). *End-of-Life Management: Solar Photovoltaic Panel*.

Drivers of a Circular Solar Economy

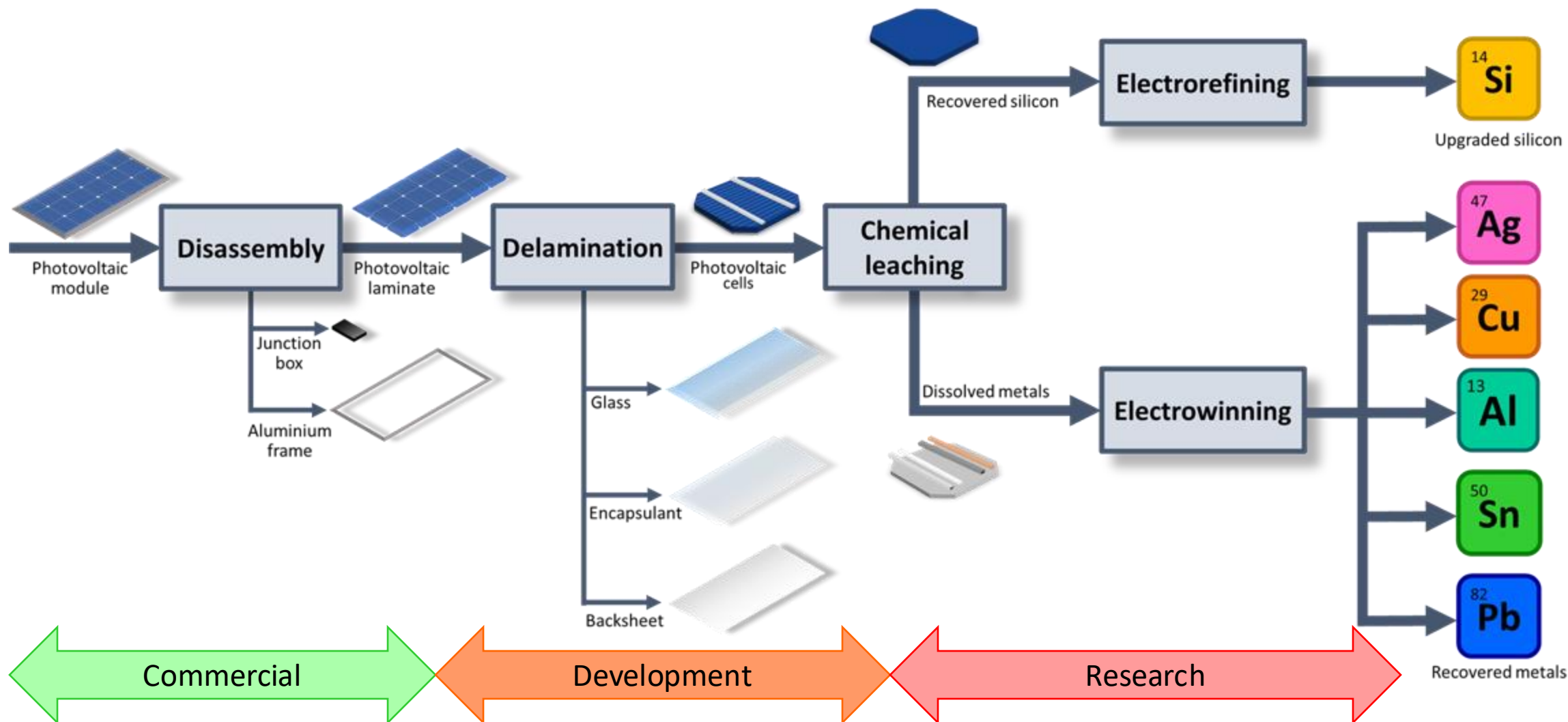
Deframing at council **aggregation points** to **increase efficiency**, as transport is limited by space not weight.



Despite circular economy strategies, **all modules eventually reach end-of-life**. It is critical that embodied **materials are maintained in circulation** and not lost to landfill^[2].

[2] Heath, G. A., et al. (2020). Research and development priorities for silicon photovoltaic module recycling to support a circular economy.

What Could Recycling Look Like?



Acknowledgements and Questions?

Supervisors:

Dr Jessica Allen (University of Newcastle)

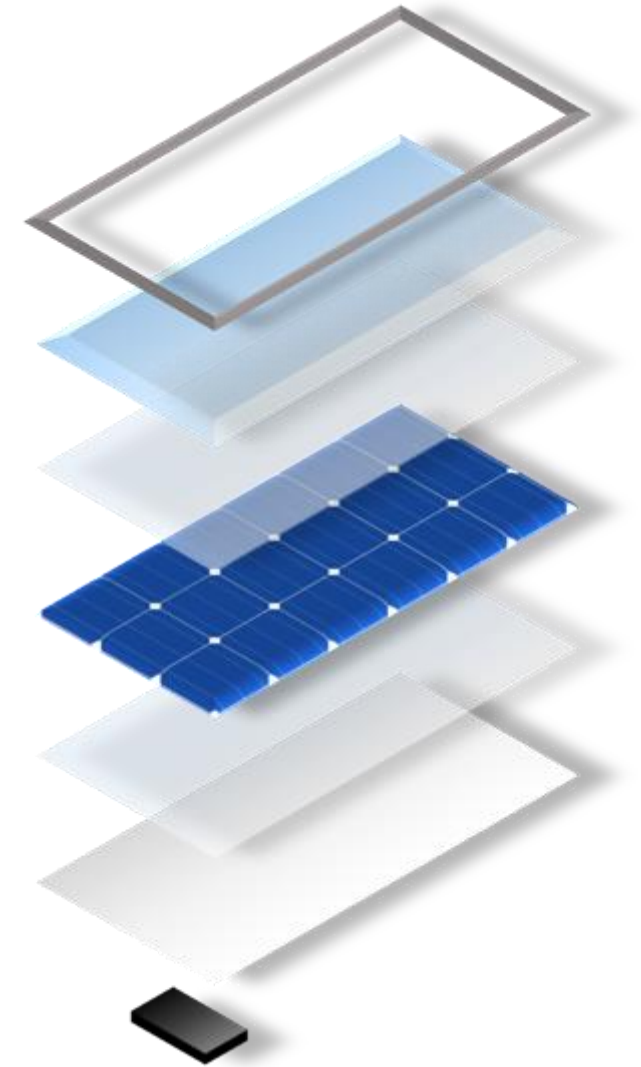
Dr Noel Duffy (CSIRO)

Tim Dawson (PV Industries)

James Petesic (PV Industries)

Tom Witheridge (PV Industries)

This work was made possible because of funding from the CSIRO Industry PhD program. The CSIRO Industry PhD Program is part of an Australian Government initiative to better translate university research into commercial outcomes.



**DOCTORAL
TRAINING
CENTRE**

nier

SOLUTIONS FOR GLOBAL CHALLENGES
ENERGY RESOURCES FOOD WATER

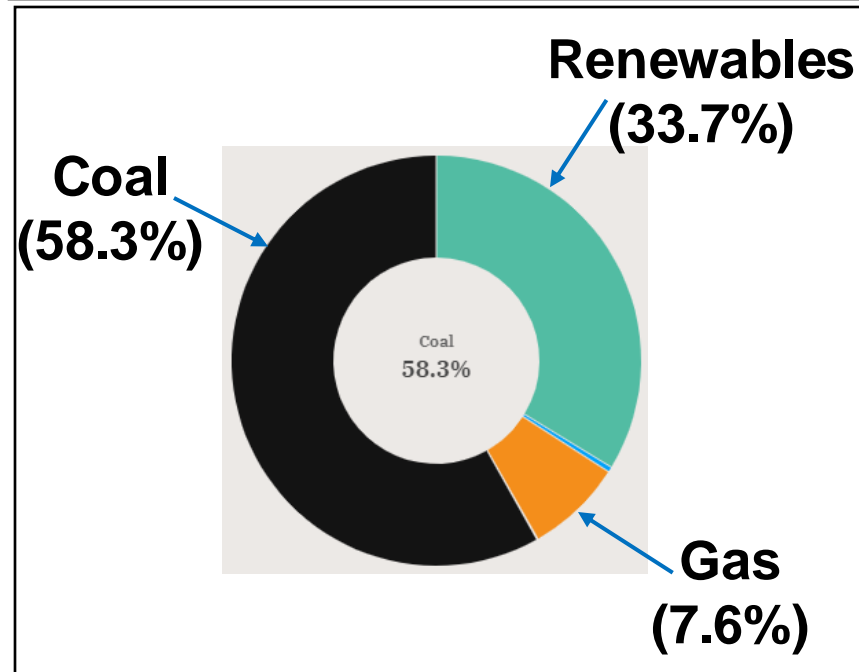
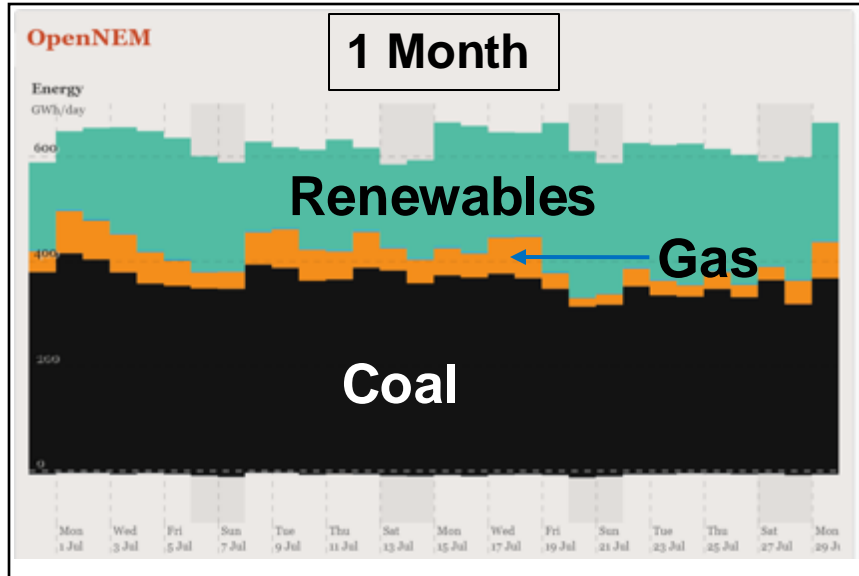


Gamsavi Kanagasundaram

The University of Newcastle

PhD in Geotechnical Engineering

Sources of Energy Generation in New South Wales¹



Coal Extraction²



Final Voids



If Final Voids are STABLE



Source:

1. <https://opennem.org.au/>
2. <https://www.shutterstock.com/video/search/coal-mining-isometric>
3. <https://www.vecteezy.com/vector-art/173011-hydroelectric-power-station-illustration>
4. <https://www.pinterest.com.au/pin/229261437264168806/>
5. <https://ontarionature.org/campaigns/wetlands/wetlands-are-carbon-storage-superstars/>

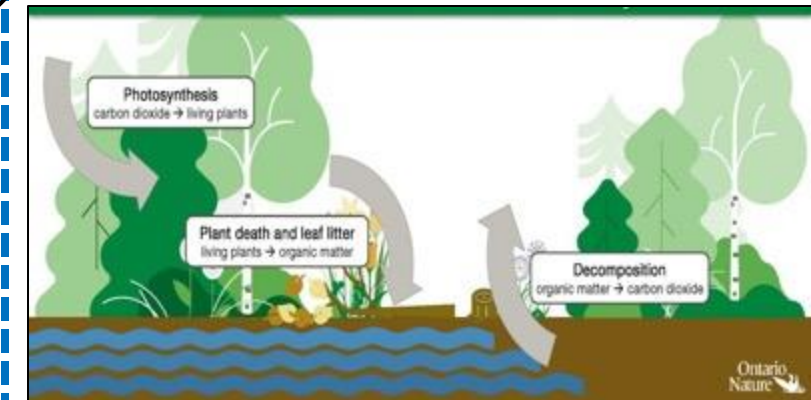
Hydropower Generation³



Wetland⁴



Carbon Sequestration⁵



Thank you!

Any questions?



**DOCTORAL
TRAINING
CENTRE**

CGSE 
Geotechnical Science & Engineering

GLENCORE

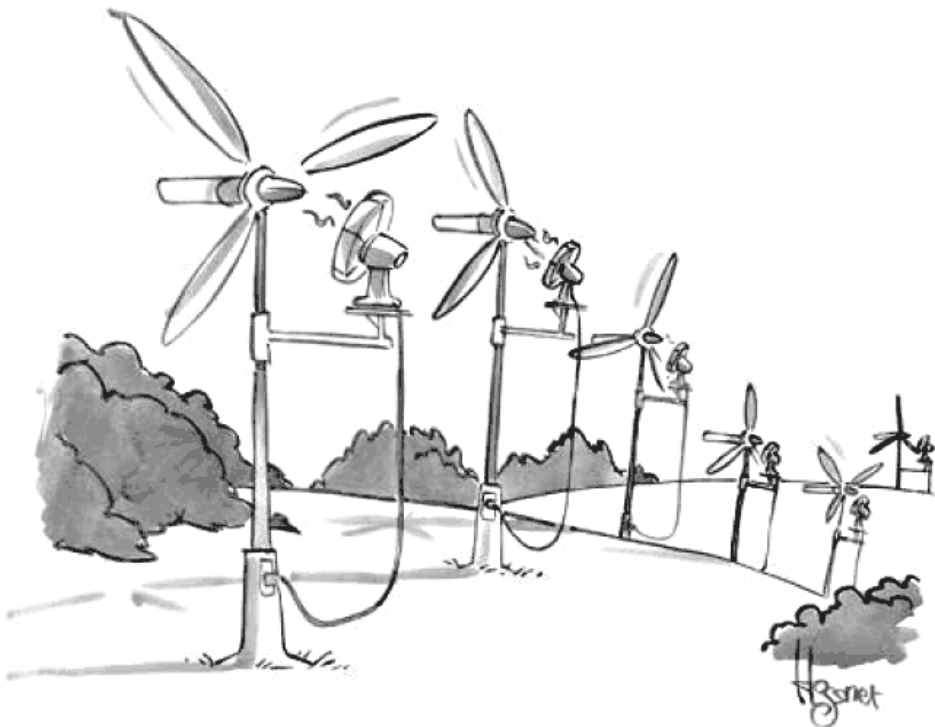
Amanda P Cameron

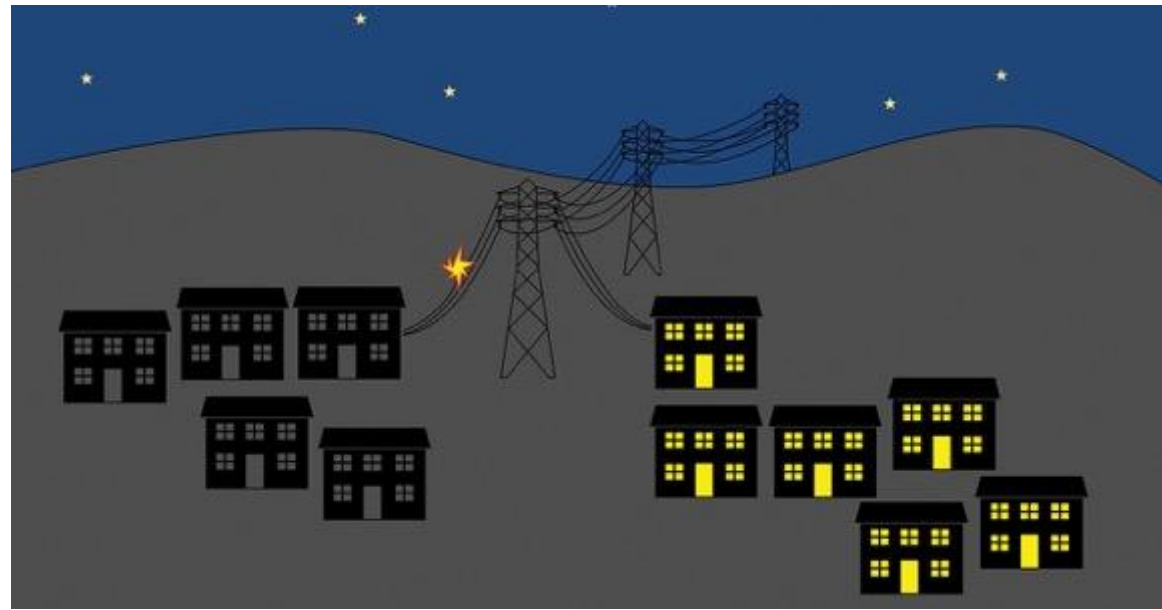
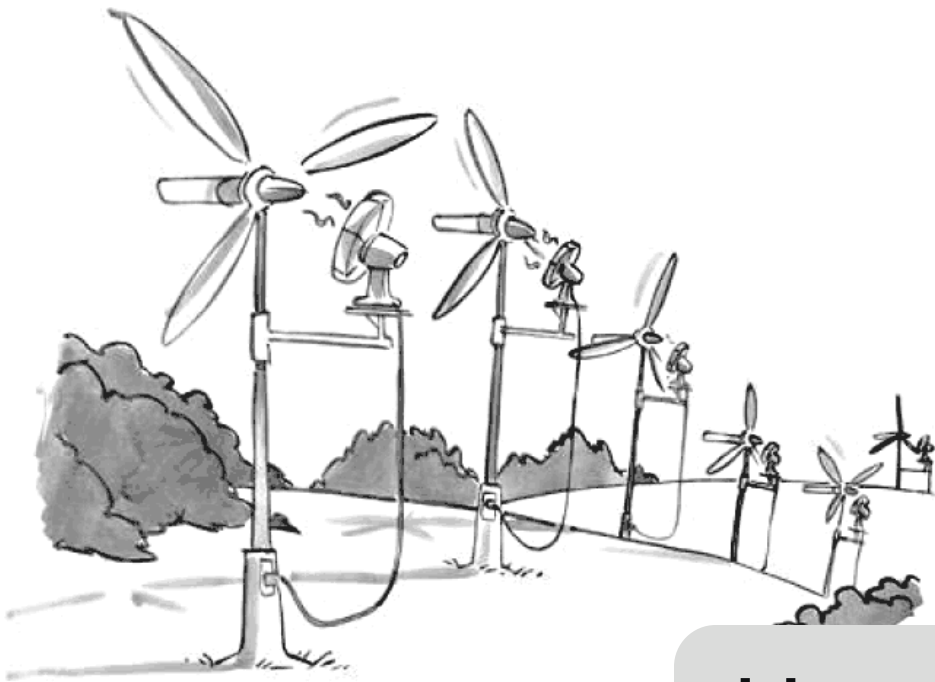


**DOCTORAL
TRAINING
CENTRE**

Thesis:
Analysis of the Electrified Interface

Supervisor:
Professor Scott Donne



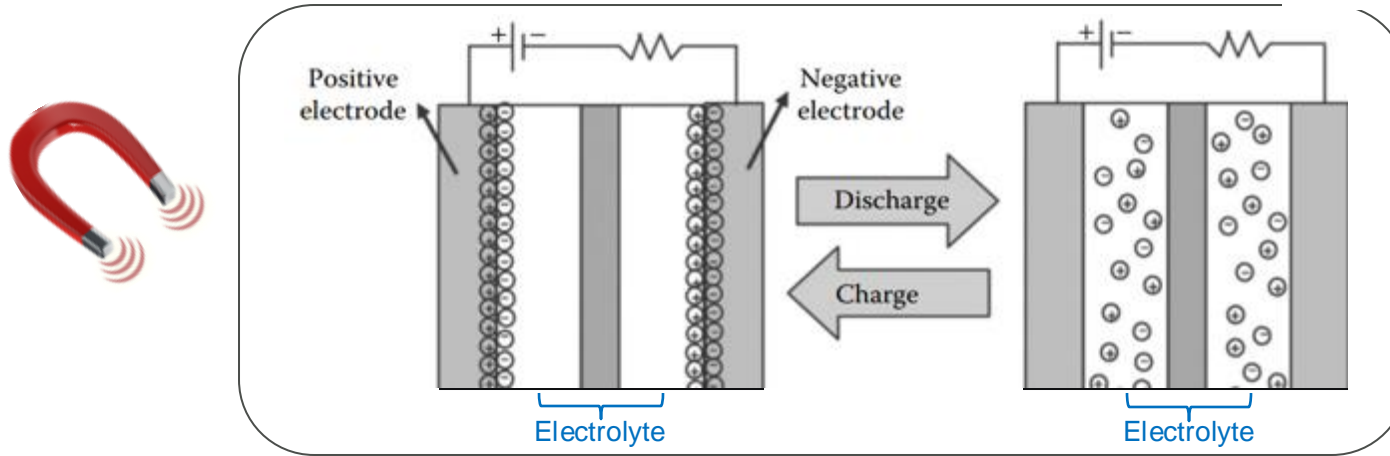


Heard of Capacitors?

(Sadly, no, a flux capacitor doesn't exist...)



Capacitors



Capacitors vs Batteries

Capacitors: > 99.9% efficient

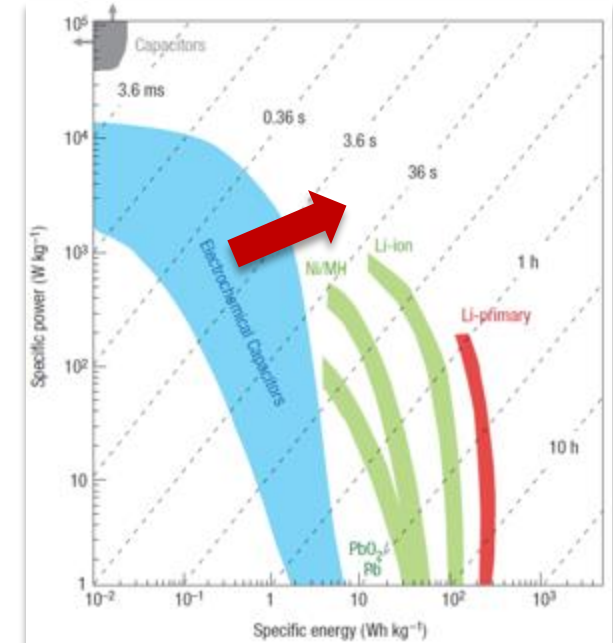
Pros: High efficiency, long cycle life, fast charging

Cons: Low energy density, fast discharge limits large scale applications

Batteries: 80 – 90% efficient

Pros: High energy density and slow discharge

Cons: susceptible to degradation from incomplete or unwanted reactions occurring

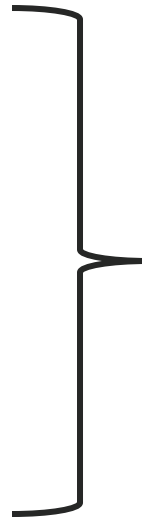
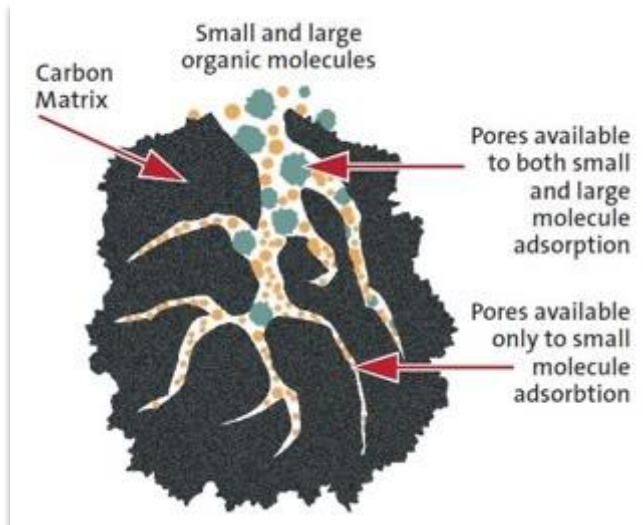


[1] C. Schutter, S. Pohlmann, A. Balducci, Advanced Energy Materials, 1900334 (2019)

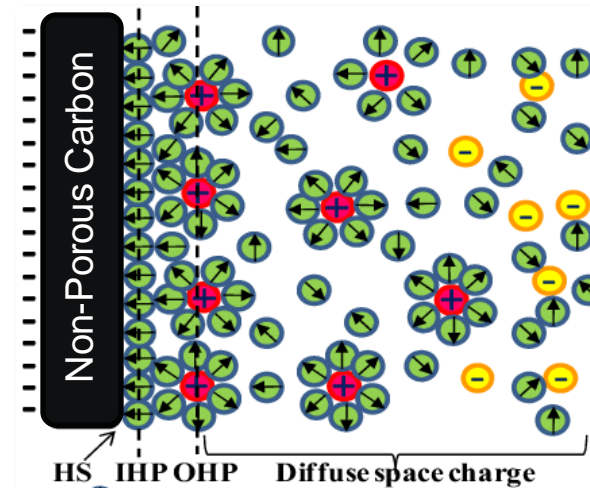
[2] Mechanism of charge/discharge process for electric double-layer capacitor. (Reproduced with permission from Manaf, N.S.A. et al., ECS J. Solid State Sci. Technol., 2, M3101–M3119, Copyright 2013, The Electrochemical Society.)

My Work

Industrial Carbon Capacitors



Porous carbon capacitors with tetraethylammonium tetrafluoroborate (TEABF₄) electrolyte dissolved in acetonitrile (ACN) or propylene carbonate solvent



**DOCTORAL
TRAINING
CENTRE**

[3] Knight, Chris & Davidson, Josh & Behrens, Sam. (2008). Energy Options for Wireless Sensor Nodes. Sensors. 8. 10.3390/s8128037.

[4] G. Figueroa Miranda, L. Feng, S.C.-C. Shiu, R. Dirkwager, Y.-W. Cheung, J. Tanner, M. Schönring, A. Offenhäuser, D. Meyer, Aptamer-Based Electrochemical Biosensor for Highly Sensitive and Selective Malaria Detection with Adjustable Dynamic Response Range and Reusability, Sensors and Actuators B: Chemical 255 (2017).

Sophie Nichols




**DOCTORAL
TRAINING
CENTRE**

Thesis:

**Legacy, Stewardship and Place
Attachment: Elder Land and Landscape
Protection at the Mine Frontier**

Supervisor:

Associate Professor Hedda Askland



Legacy, stewardship and place
attachment:
elder land and landscape protection
at the mine frontier

Sophie Nichols



**DOCTORAL
TRAINING
CENTRE**

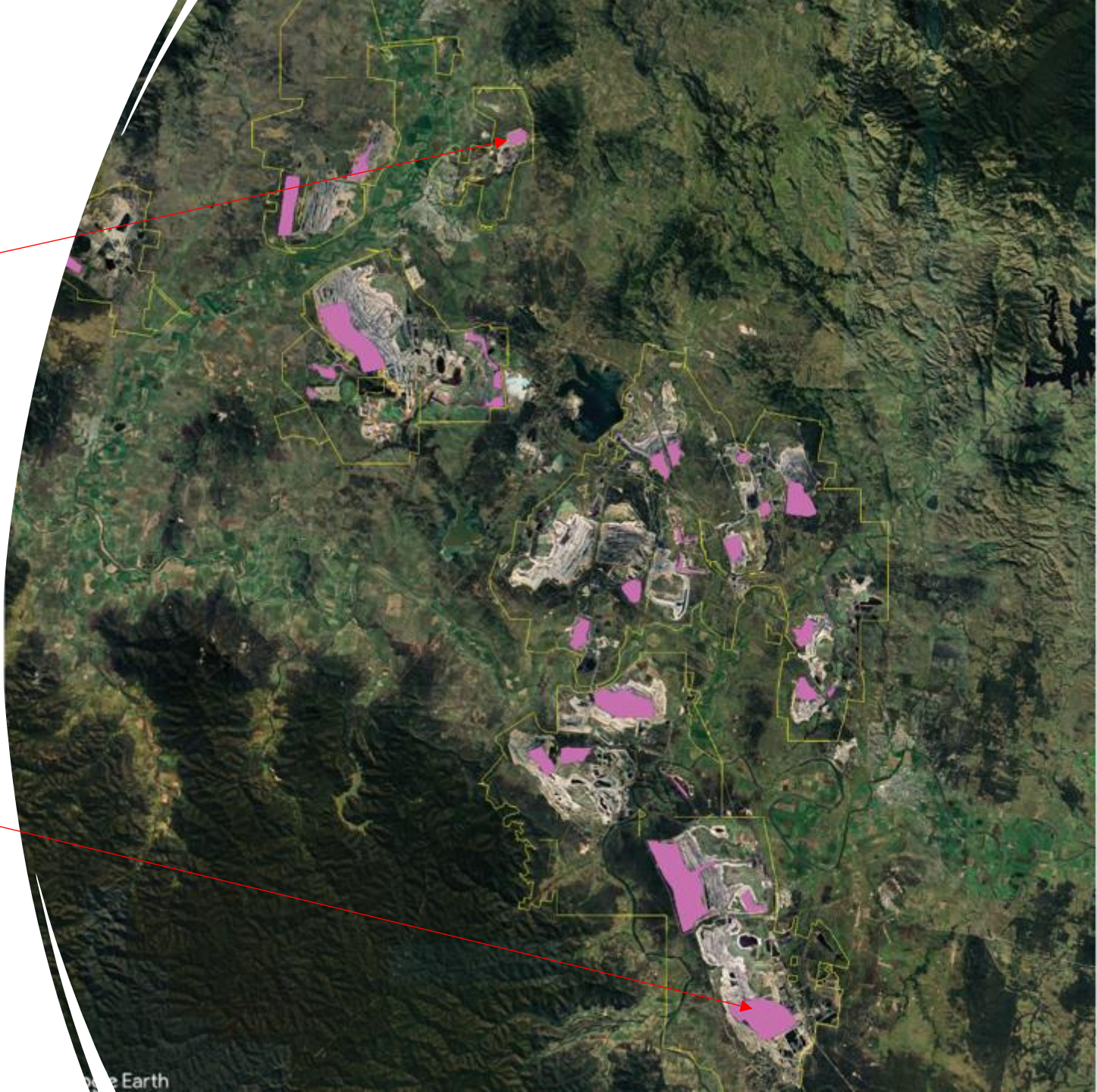


Muswellbrook Coal Open Cut - final void

Muswellbrook Coal:

One final
Size 62 hectares

Bulga
One final void
Size 550
hectares





Research Design

Decolonial Research
Eldership methodology
Ethnography
Participant Observation
Qualitative Interviewing
PhotoVoice

PhotoVoice

My research participants will be given the option to exhibit up to three photographs of their mining community and landscape, going back in time and/or current.

