Flotation & Dewatering

What does the future hold...

Processing of Ultra-Fines

- Coal is a commodity that South Africa will rely upon for years to come
- But untouched, high grade coal is becoming hard to come by
- Value must be extracted from every ton removed from the ground
  - Lot of focus on reworking old mineral deposits
- Typically, focus is placed on the coarse fractions of ore
  - DMS, Spirals, etc
  - And the ultra-fines are placed on MRDs and forgotten

- **An even more scarce South African commodity is water**

Ultra-Fine Coal

- **Where does Flotation fit into the picture?**

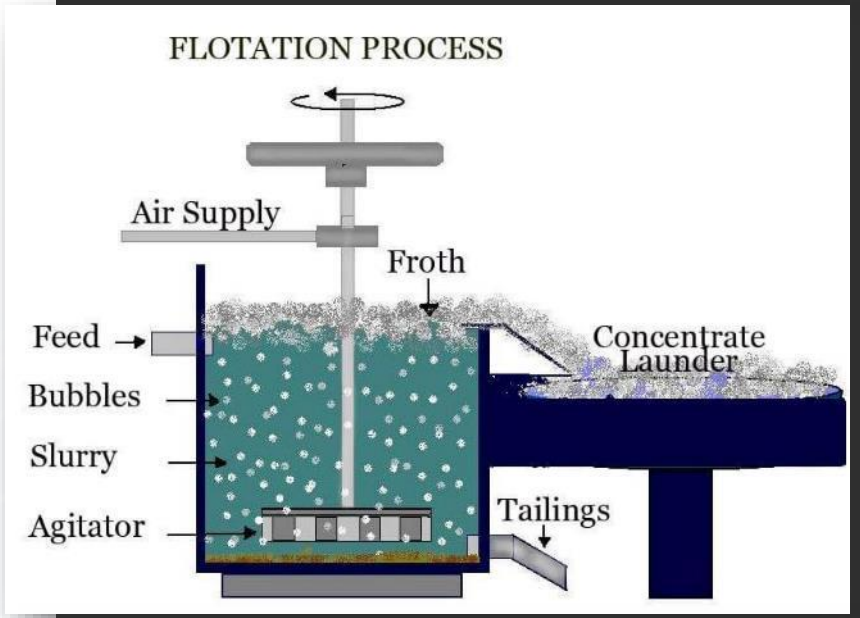
- Coarse coal to DMS (+0.65mm)
- Small coal to Spirals (-0.65 x +0.212mm)
  - Other technologies like TBS and Reflux Classifiers
- Ultra-fine coal to Thickeners (-0.212mm)

- Off to slimes dams?

- **There can be major value lying in material deposited into Mineral Residue Deposits and potential to recover precious water**

Froth Flotation

- **Ultra-fine coal can be a source of saleable product**
  - Fed from the DMS Thickener Underflow
  - It's surface physio-chemistry process
  - Requiring: ***Air, Energy and Reagents***
  - A fine balance between these inputs is required



Flotation Process

- **Governed by 3 phases**
  - Collision → Attachment → Collection
  - Critical to understand feed characteristics
    - Mineralogy
    - Feed Density
    - PSD
- Flotation Cell designs (and operation) based on lab test work

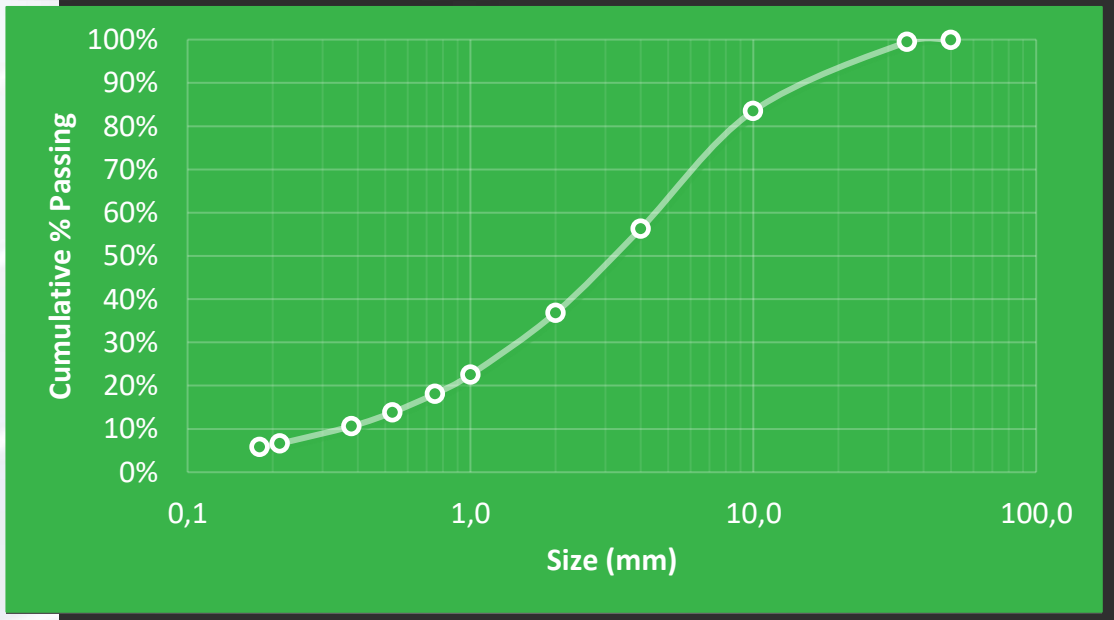
Flotation Lab Work

- **A Denver Flotation Cell provides valuable data**
  - Test work on new ores to determine kinetics
  - Used to design flotation plants
    - NB! – Remember scale-up factors
  - Identify Air and Energy inputs
  - Test multiple reagent suites

Flotation Process Control

- **Useful tool for plant Metallurgist**
  - A working recipe today might not work tomorrow
  - Mineralogy changes as mining progresses
  - Regular benchtop float test with a Denver provides baseline flotation performance

- **Significant portion of ROM can be upgraded and recovered through Froth Flotation**



Water and Our Environment

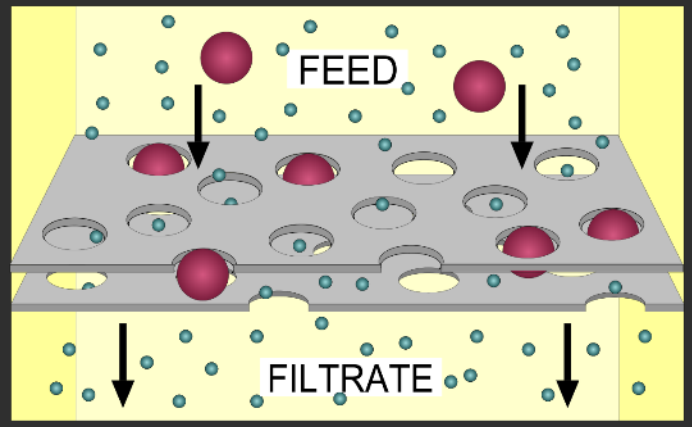
- **South Africa is classified as a Water Scarce country**
  - Processing plants in dry regions are impacted by lack of water
    - No water means no production
- **Pollution is a real problem in the mining industry**
  - Uncontrolled run-off of polluted water reaches the environment around us

- **Tailings dam failures claim lives**
  - **Jagersfontein – Freestate 2022!!!**

- **The future of mining relies on the responsible use of water and the care of our environment and our communities**

Liquid / Solid Separation

- **A simple process of *Filtration***
  - Can be applied to arising tails or after flotation
  - By removing solids from a slurry, water can be returned to the plant
  - A dry tailings can be placed safely on a storage facility
    - No seepage means no polluted ground water
    - Dry , properly compacted fines are unlikely to fail
  - ~80% reduction in water leaving in the tailings



Illustrative Mass Balance

	Thickener Underflow	Filter Cake	Water Reduction
Tailings tons (tph)	50	50	
%Solids (w/w)	35%	75%*	82.1%
Water (m3/h)	92.9	16.7	

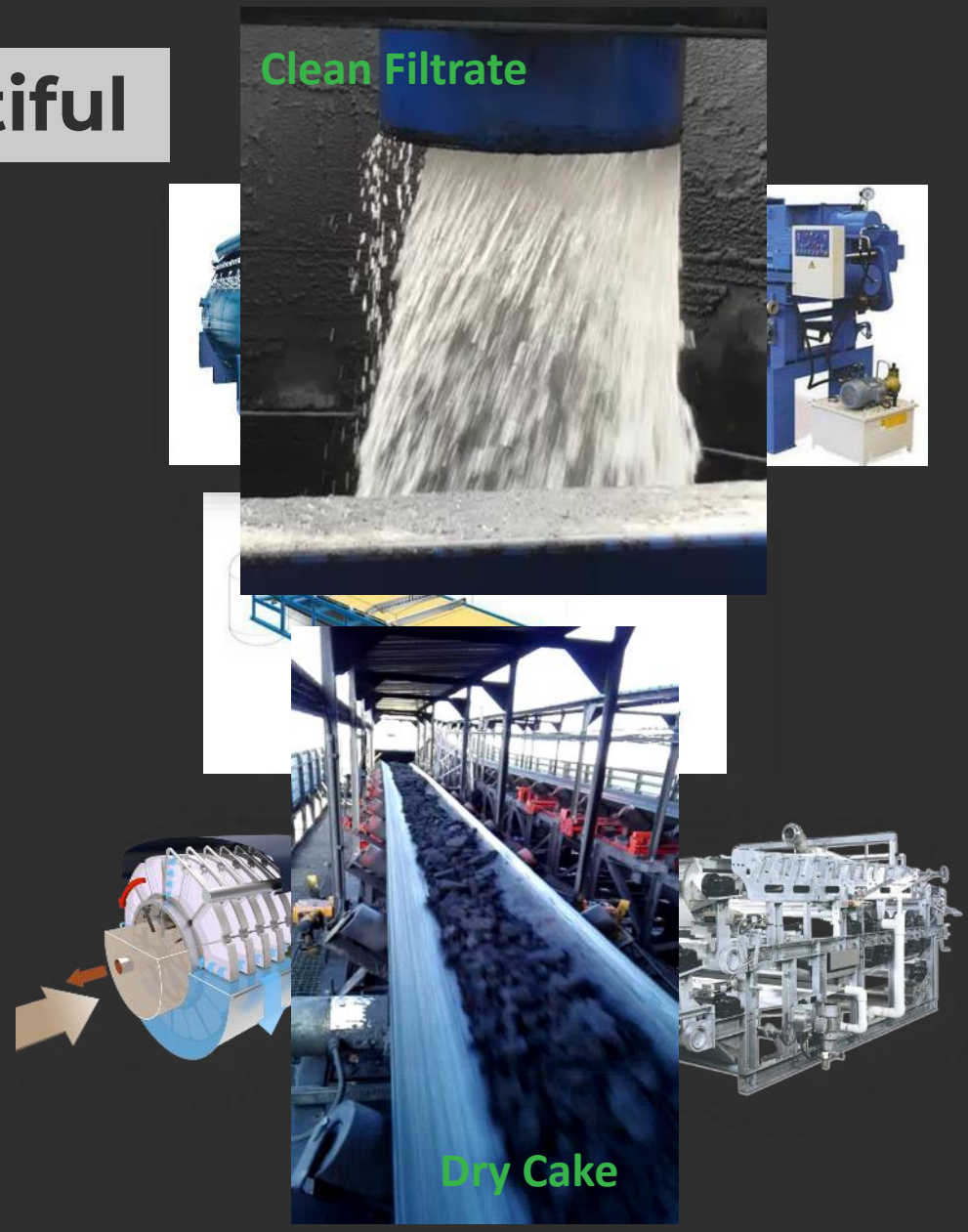
**25% filter cake moisture*

Filtration Technologies are plentiful

- **A filter for each process**
- Filters come in many shapes and sizes and each is suited a particular application:
  - Disc, Belts and Belt Presses, Hyperbaric and Plate & Frame
- Dependent on continuous / batch
- Material characteristics: PSD, SG etc
- Process control such as flocculation requirements

Parts of a Filter

- Although all different, every filter has:
  - Feeding systems (Gravity, pumped)
  - Filtration media (Cloth, membranes)
  - Filtration driving force (Pressure, vacuum, mechanical)
  - Product handling (Cake and Filtrate)



In Summary

- **We have a responsibility to drive toward a cleaner mining future**
- This means:
  - Maximising the value of each ton of coal and minimising discard
  - Reducing the demand on scarce raw water
  - Eliminating environmental pollutants
  - Protecting our communities through employing safer residue storage techniques

Production Plants

Thorncliffe Platinum Filtration

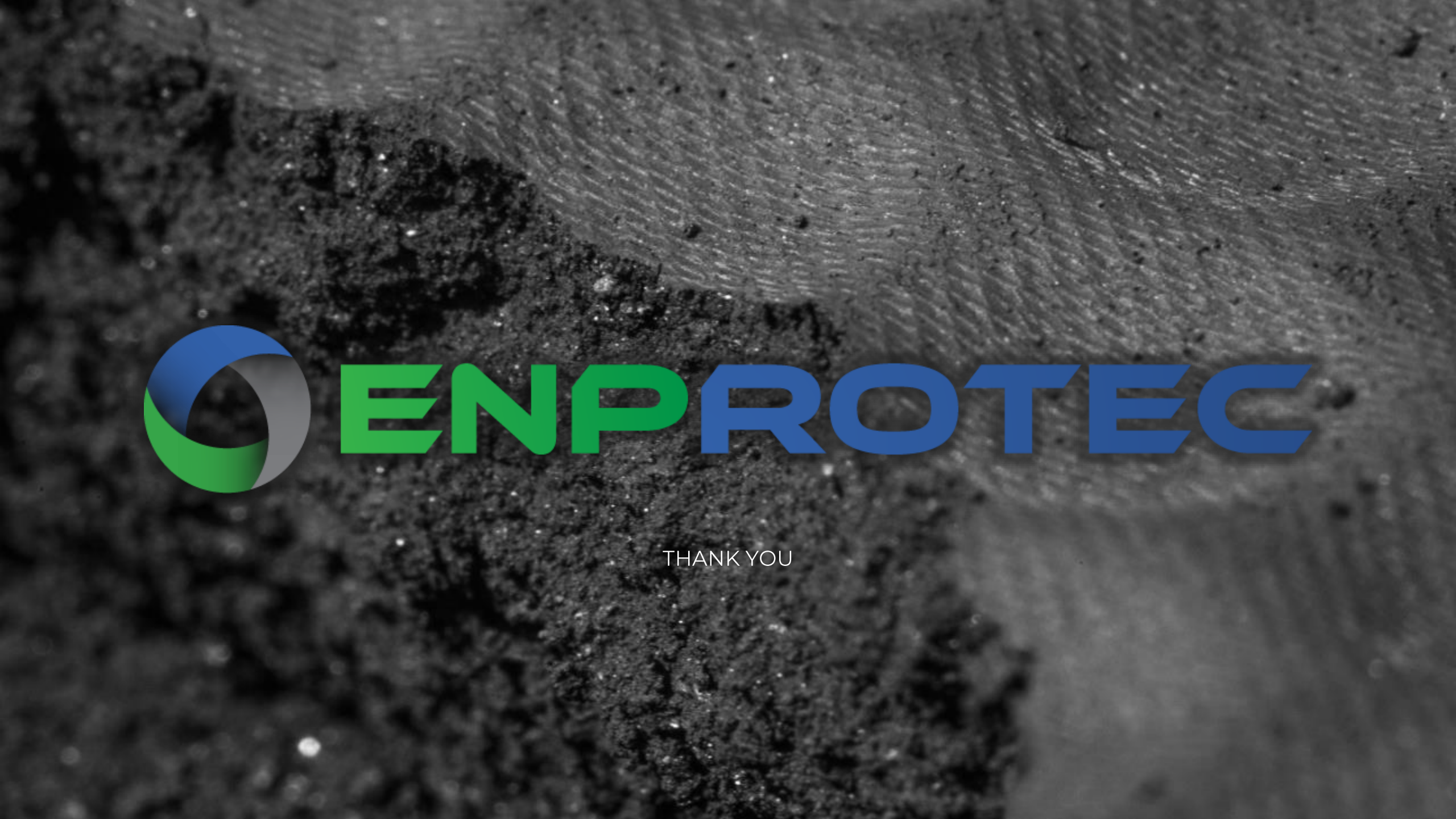
- Filtration of ultra-fine PGMs
- 380m^2 filter area per unit

Grotegeluk Colliery

- Plate and frame filter presses
- 670tph filtration capacity

Greenside Colliery

- Coal Flotation
- 45tph in 4 banks



THANK YOU