

CEEC – ‘What Next’

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Agenda

1. What are we Optimising?
2. What are the Technical Opportunities?
3. What are the Emerging Technologies?
4. Questions



What are we Optimising?



We are NOT Optimising;

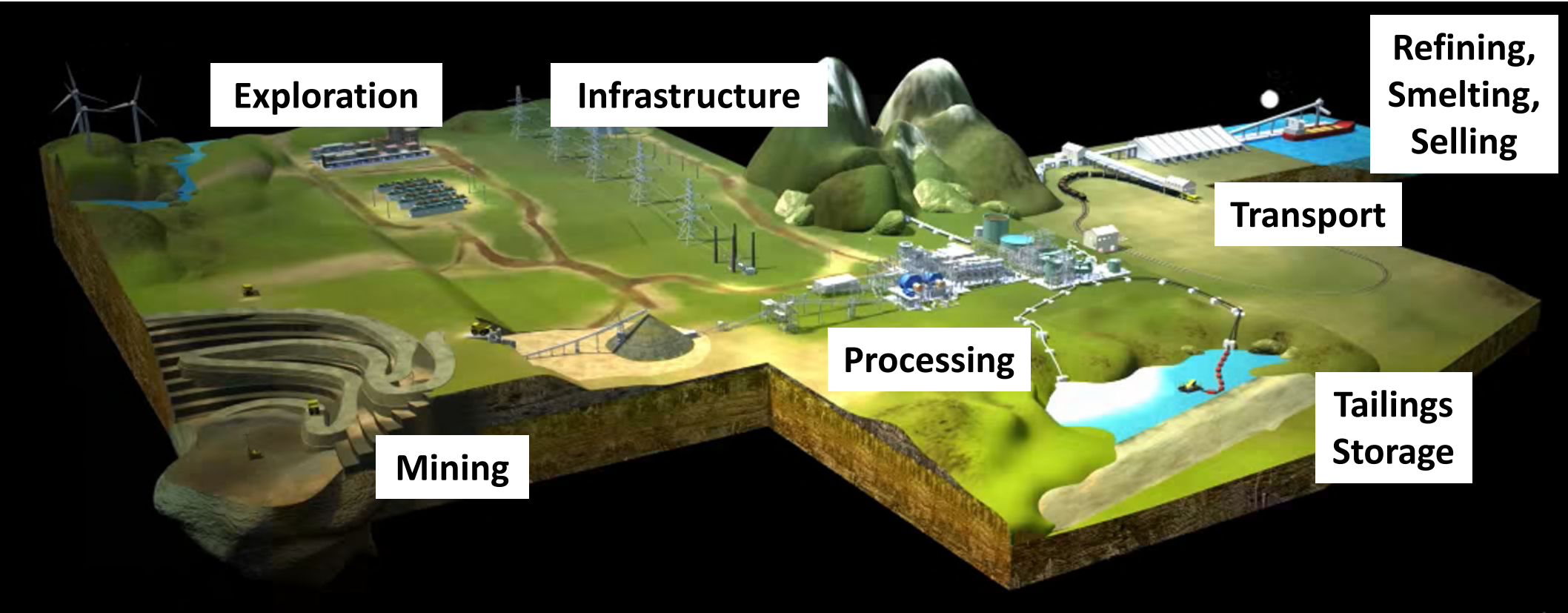
- Recovery
- Throughput
- Operating Cost
- Capital Cost



We are optimising **project value**



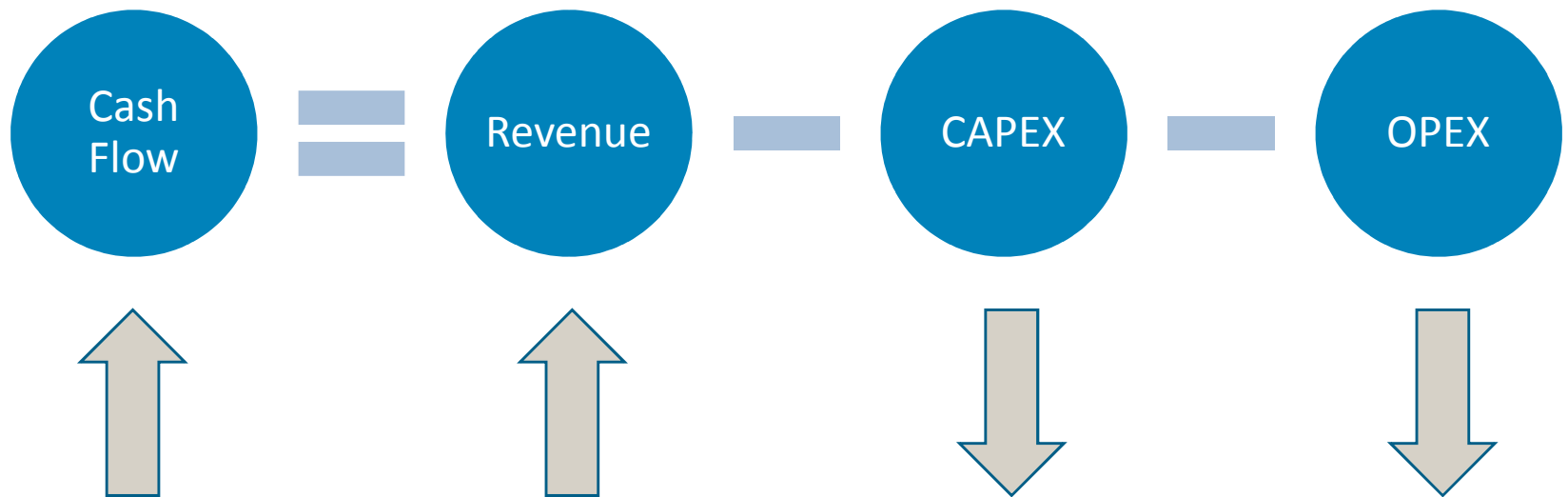
Project



Value

$$NPV = \sum_{t=1}^{LOM} \frac{Cash\ Flow_t}{(1+i)^t} \text{ --Risk}$$

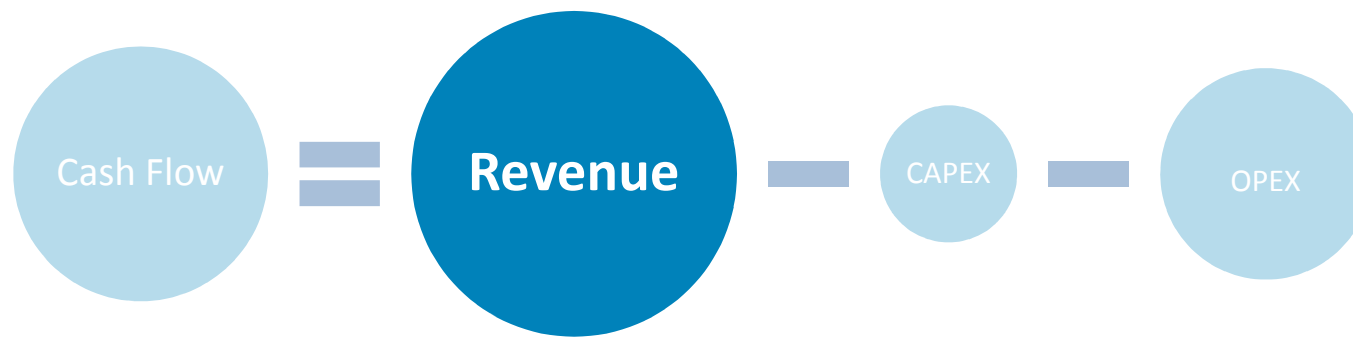
i = 'discount rate' or 'cash cost'



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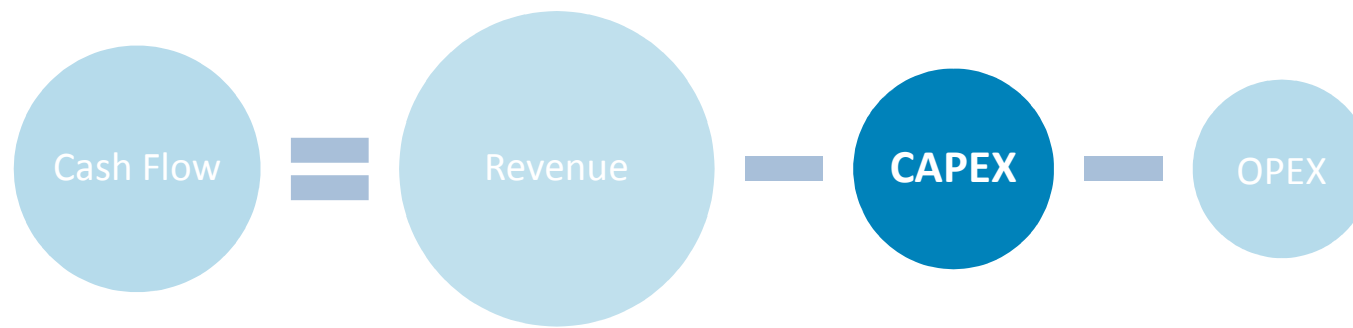
What are the Technical Opportunities?





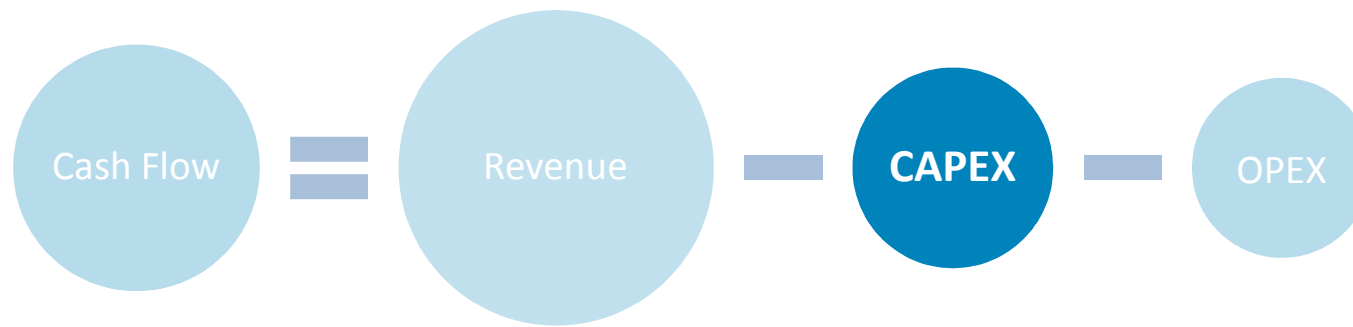
1. Increase 'value' of ore processed
2. Increase throughput
3. Increase recovery
4. Increase product grade





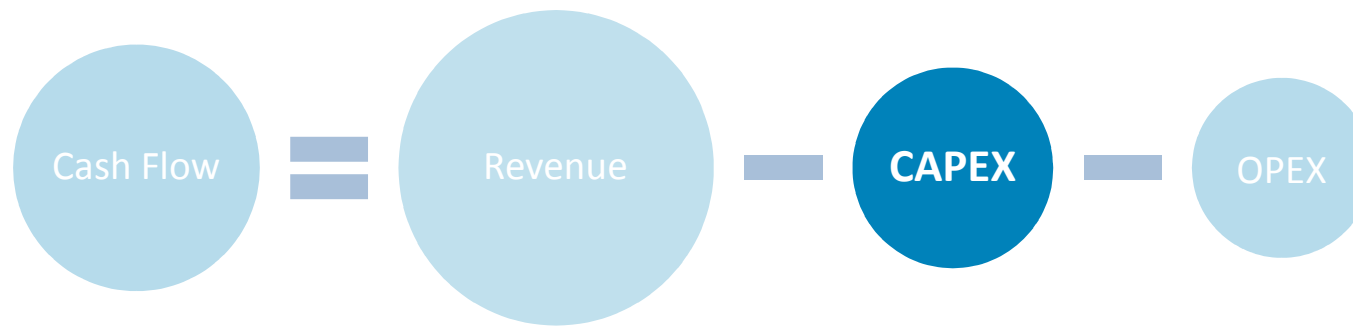
- High capital equipment should **always** bottleneck the plant, i.e.
 - Mills
 - SX/EW
 - Tailings Filtration
- Low capital equipment should **never** bottleneck the plant, i.e.
 - Mining fleet / trucks
 - Pumps / hoppers
 - Concentrate handling





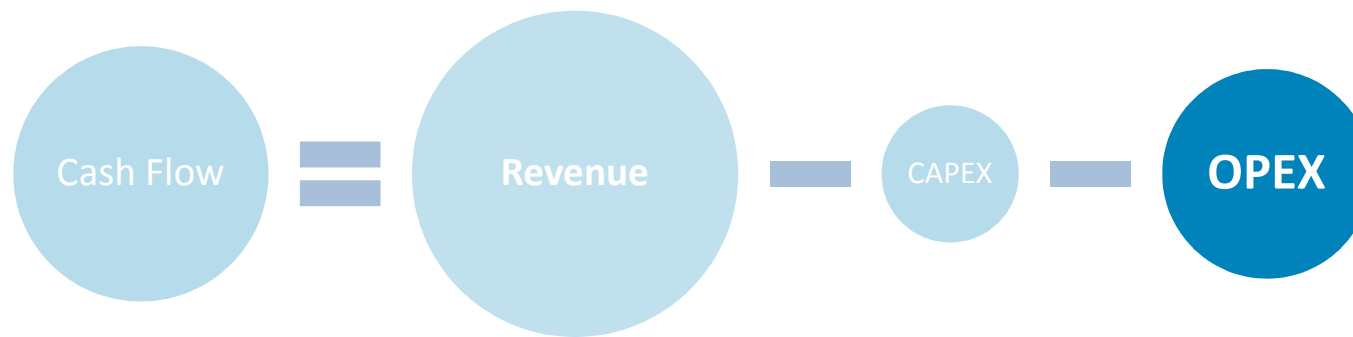
- Minimise design margins for high-capital equipment;
 - Sample selection
 - Testwork interpretation
 - Process design
 - Mechanical design
 - Vendor design / selection
 - Benchmarking
- Mine designs need to bottleneck multiple plant areas **simultaneously**



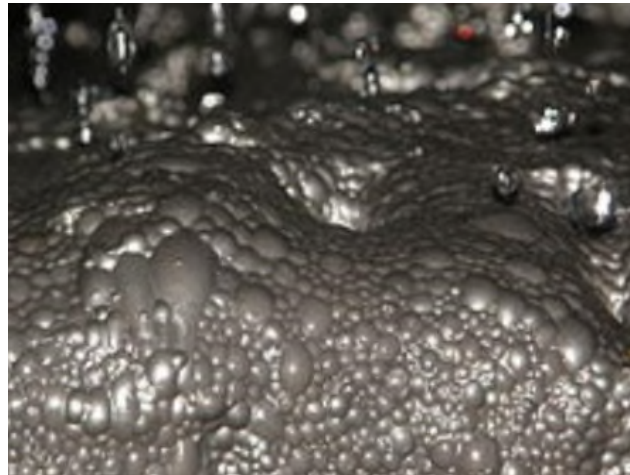
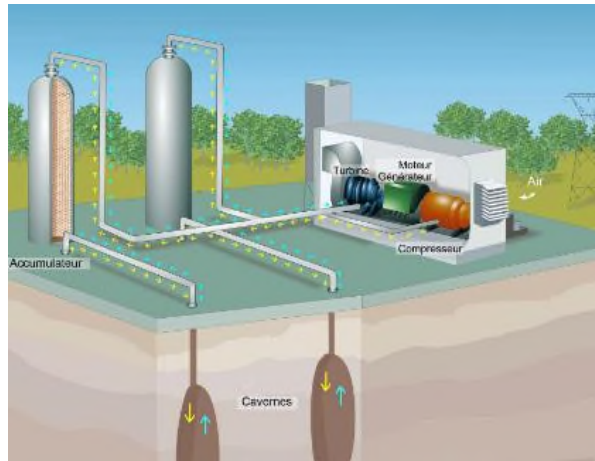


- Reduce bulk quantities and capital cost
- Optimise earthworks vs concrete vs steel





- Reduce power
- Reduce water
- Reduce reagents
- Reduce labour
- Understand, cost and manage risks better



3

What are the Emerging Technologies?



Emerging Technologies

- Improved waste definition
 - Ore tracking / grade control tools
 - Reduced recovery / product grade
- Reject waste earlier (at coarser sizes)
 - Pre-concentration i.e. mine grade control, grade engineering, bulk / particle sorting, HMS, jigging
 - Coarser milling with coarse particle flotation, flash float
 - Use ore heterogeneity
 - Coarser liberation
- Energy efficient processing
 - High intensity blasting / comminution through mine design
 - HPGR / HRC
 - Hydromet vs physical processing



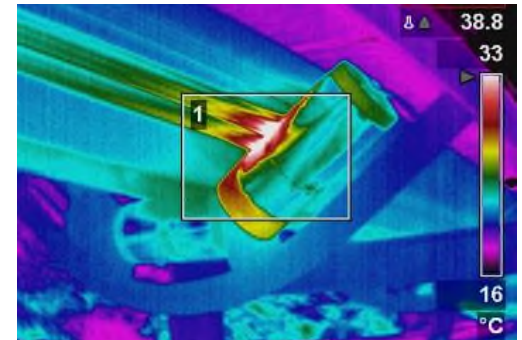
Emerging Technologies

- Upgrade to product faster
 - Rougher / cleaner scalper flotation circuits (i.e. Jameson cells, Staged Flotation Reactors)
- Reduce water consumption
 - Dry processing
 - Tailings filtration and dry stacking
- Improve recovery
 - Ultrafine & coarse flotation
 - Thiocyanate gold leaching
 - New and improved reagents
- Improve grade
 - Finer regrinding
 - Concentrate purification (leaching)



Emerging Technologies

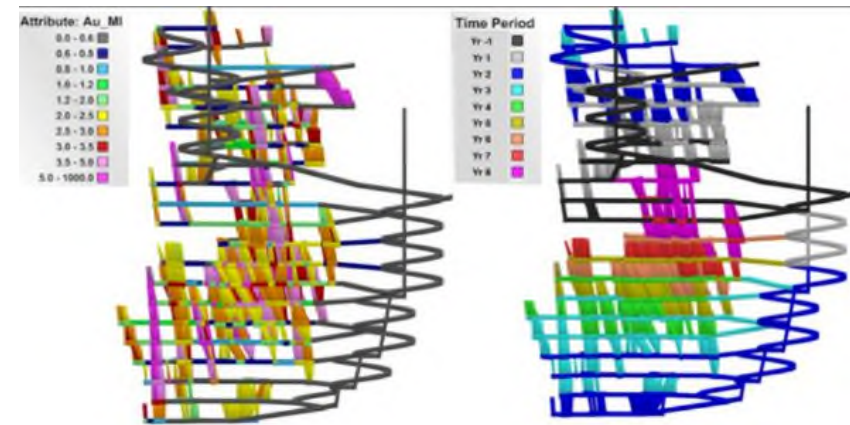
- Advanced Process Control
 - T'put, Opex, Recovery, Grade, Power, Water
- Modelling / twinning
- Remote operations centres
 - Labour
- Increased operating time
 - Predictive maintenance, reliability engineering
- Increased economies of scale
 - Sacrifice recovery for throughput for low grade deposits
 - Modularisation



Adoption of Emerging Technologies

Drivers are project specific:

- Small, higher value/t deposits
 - Maximise recovery
 - Reduce CAPEX
 - Tailings filtration?
- Large, lower value/t deposits
 - Reduce OPEX
 - Reduced CAPEX
 - Economies of scale
 - Maximise use of orebody heterogeneity



How to Make it Happen?

- Focus the discussion on the economics
- Blended teams of Equipment Suppliers, Engineers, Consultants and Clients
 - Forward thinkers
 - Engage openly
 - All levels must be aligned
- Opportunities and risks
 - Clearly understand
 - Economically evaluate
 - Actively manage



Questions?

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