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sinto FOUNDRY INTEGRATION

Sand Reclamation Techniques

Exploring our options to Minimize Waste and Save Energy

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Omega Sinto Foundry Machinery Ltd.

**Foundry sand is a crucial component in metal casting,
but its disposal can pose many challenges.**



Let's look at some figures

- Worldwide foundry waste sand is estimated to be around 110 million tons per year.
- No national figure for Australia.
- The Queensland Government previously identified the industry generated approx. 46,000 tons of spent sand.
- 85% of which went directly to landfill.
- Approximately 40,000.00 tons annually.



Pollution

The global warming potential of sand extraction (quarrying and dredging) is between 92-120 g CO₂ per 1 kg of dry silica sand obtained.

4,600 tons CO₂ emissions annually in Queensland alone

There is also air and noise pollution associated with quarrying

Sand extraction involves considerable land take and loss of soil (estimated at 0.4 ha per ton of sand extracted), with associated loss of wildlife habitat.

Energy

Once we have extracted the sand, we need to dry the sand and process to useable state

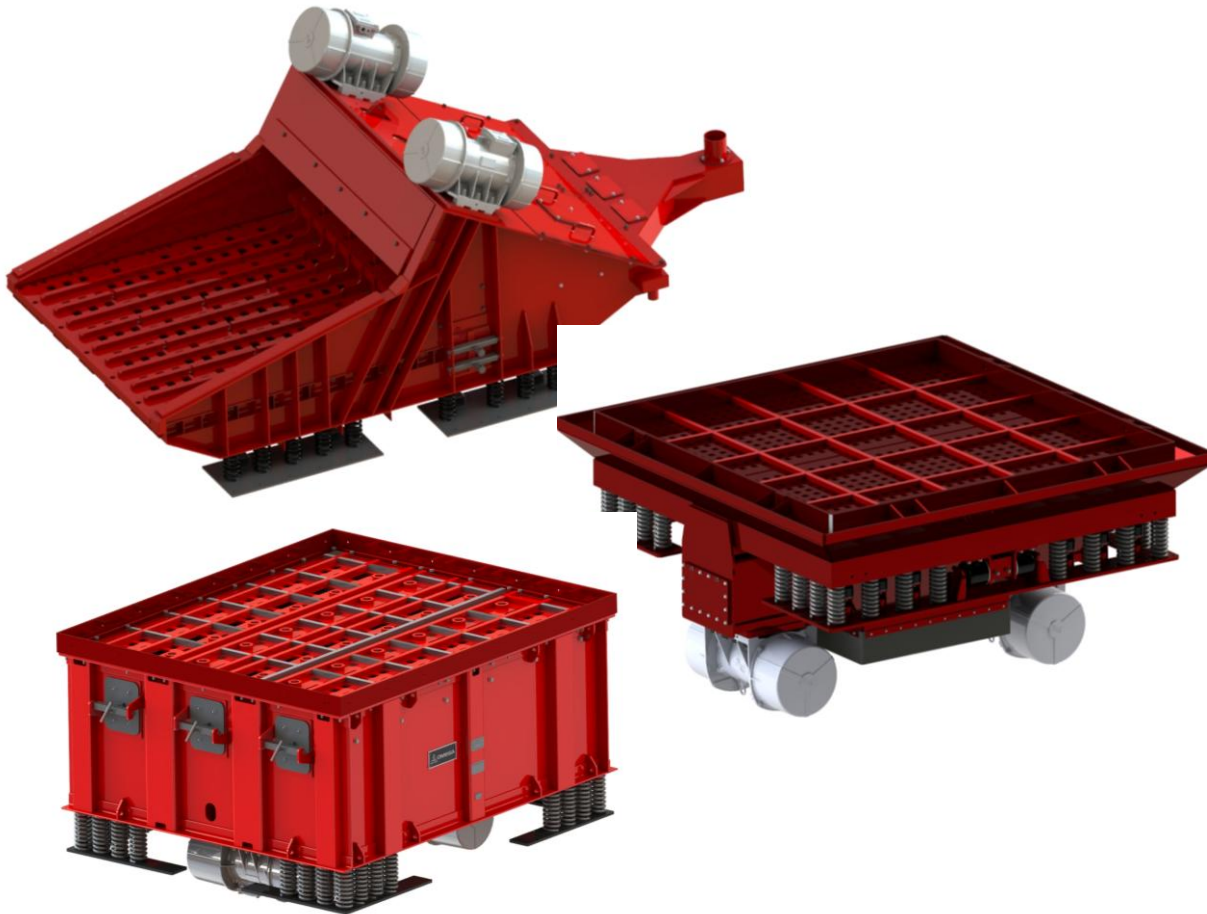
For every 1000kg of sand it takes approx. 25.1 kw/h of Energy to dry the sand

So, to dry 40,000 tonnes of sand extracted to replace the tonnage disposed of in Queensland = 1 million kW/h of energy used

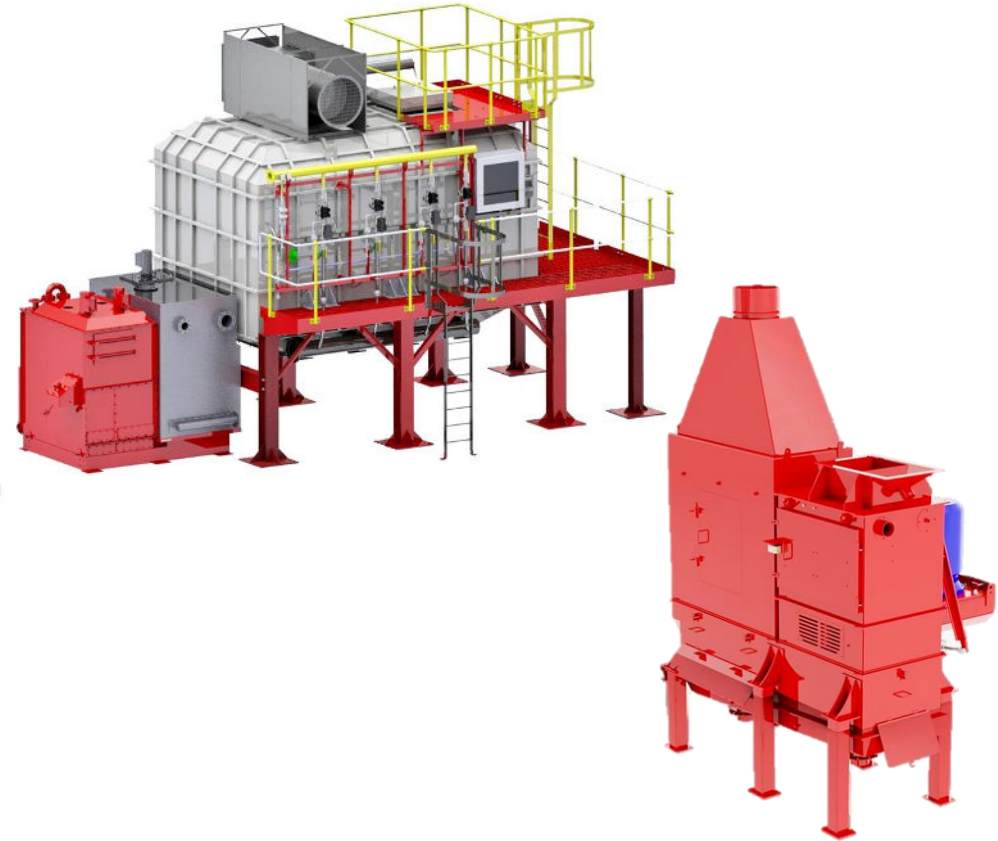
Improving the re-use of foundry sand would dramatically reduce pollution & energy used!

What Options do we have?

Primary Reclamation



Secondary Reclamation

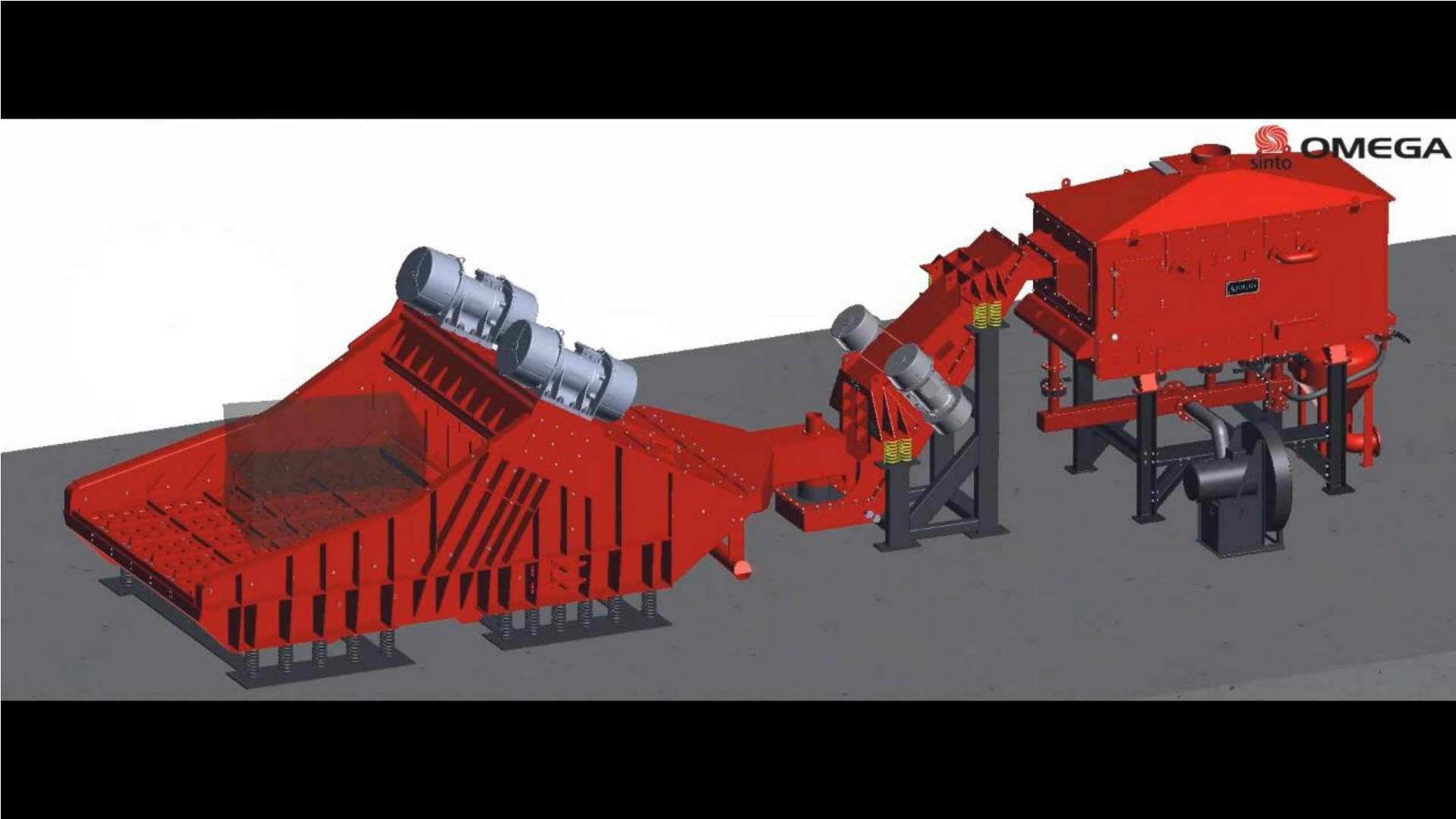


Primary Reclamation

Primary reclamation consists of:

- Breaking down the sand back to grain size
- Screening the sand to remove oversize particles, metallics or sleeve materials
- Create a limited natural scrubbing
- With primary attrition only, chances are that you are still disposing of sand, and you should consider further reclamation.

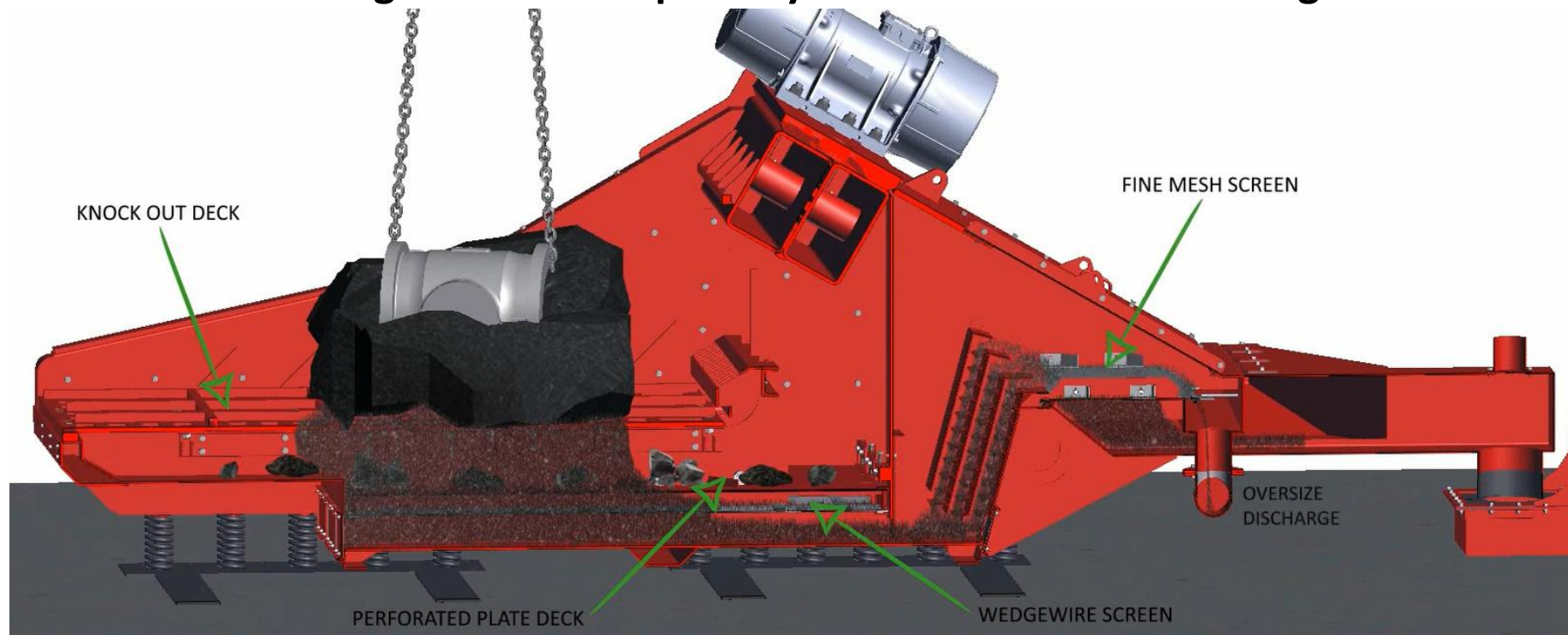
Good Primary Reclamation is the foundation of overall good reclamation rates



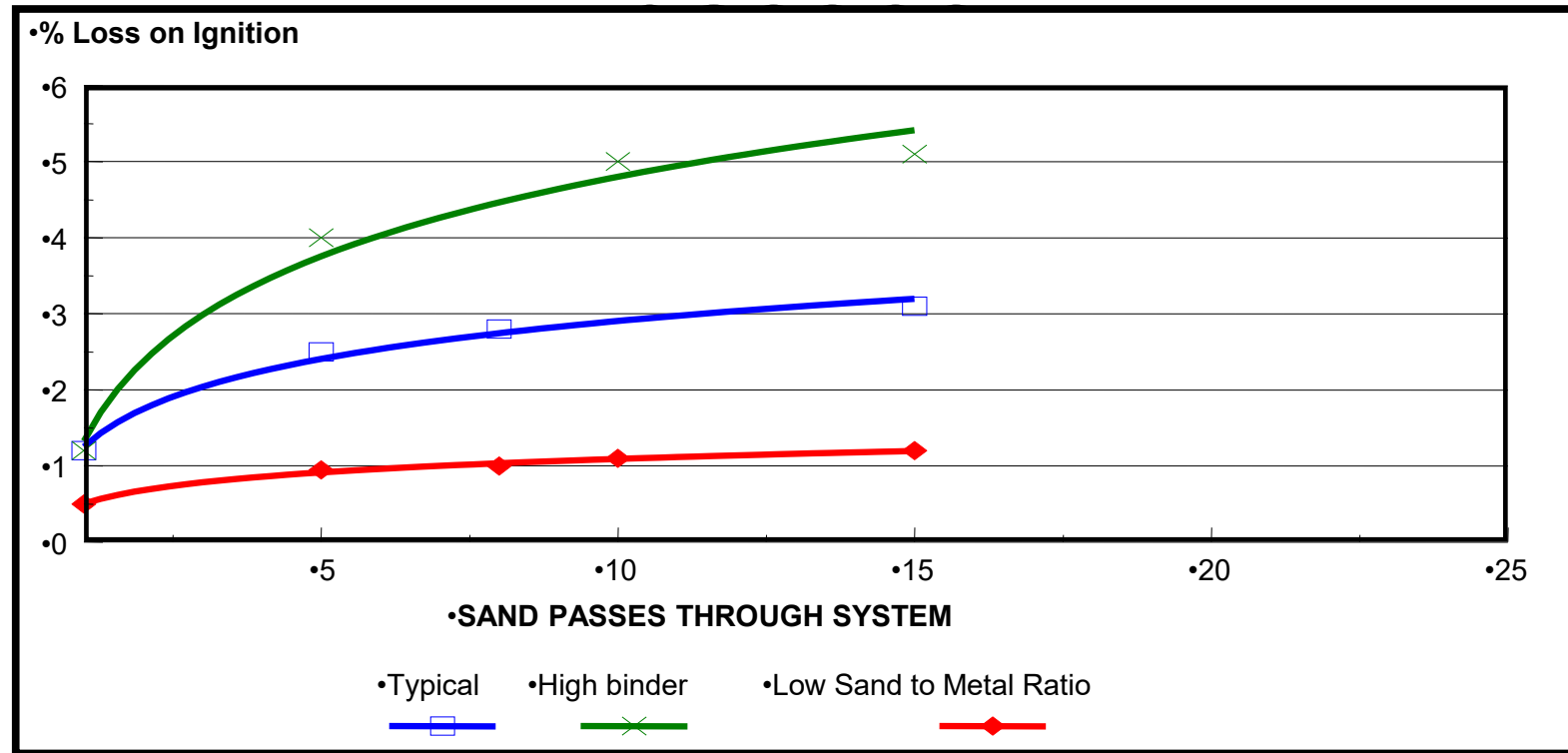
At Omega we use a 4-stage screening process:

1. Knockout Deck
2. Perforated screen
3. Wedge-wire screen
4. Fine mesh 'Final' screen

The screening along with the natural scrubbing of this process allows us to achieve the highest levels of primary reclamation at the 1st stage



Loss on Ignition build up related to No. of reclamation

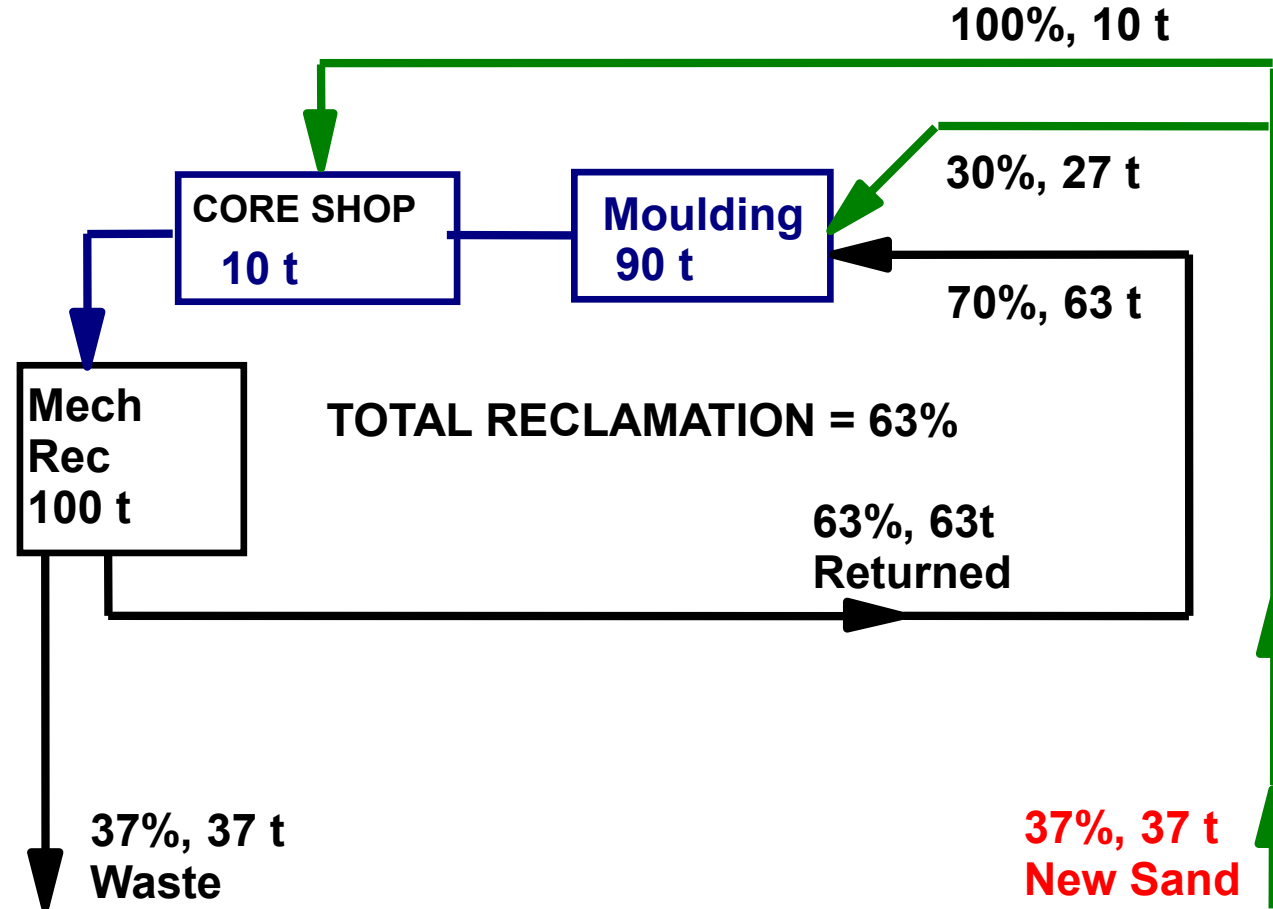


Loss on Ignition will stabilise and flattened out after about 15 passes through a mechanical reclamation plant.

Controlling the LOI

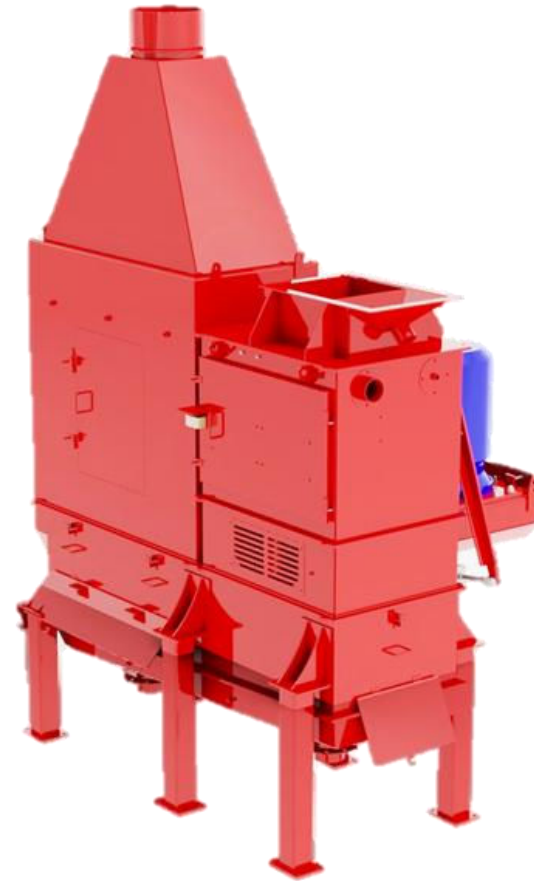
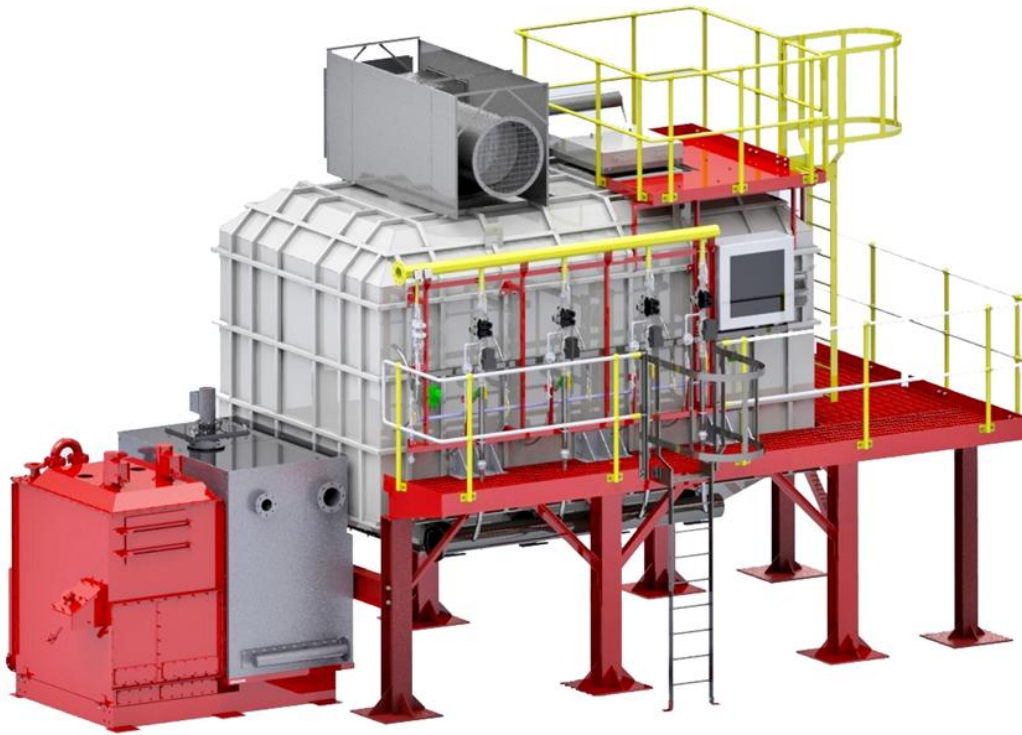
- Sand to metal ratio and binder addition required become established.
- Subsequently the principle controlling mechanism will be to introduce **new** sand into the system and dispose of an equivalent amount.
- If there were no losses or dilution, then the graph would be a straight line continually rising.

Typical sand balance diagram for Alkaline Phenolic mechanical reclamation



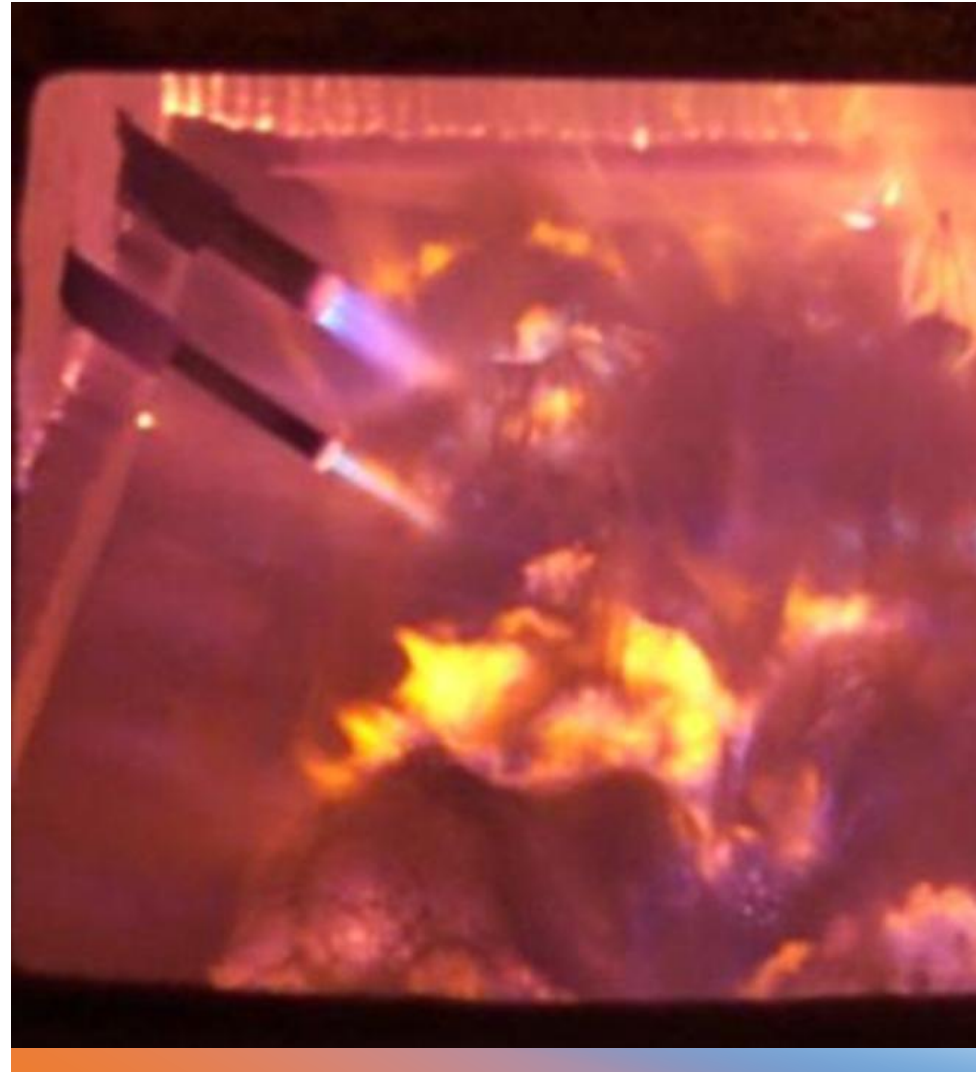
- The open loop shown in the sand balance diagram shows that with mechanical reclamation, there is a considerable waste stream.
- This can be reduced by the introduction of some form of secondary processing to reclaim the sand that is currently being disposed.

Secondary Reclamation



Thermal reclamation

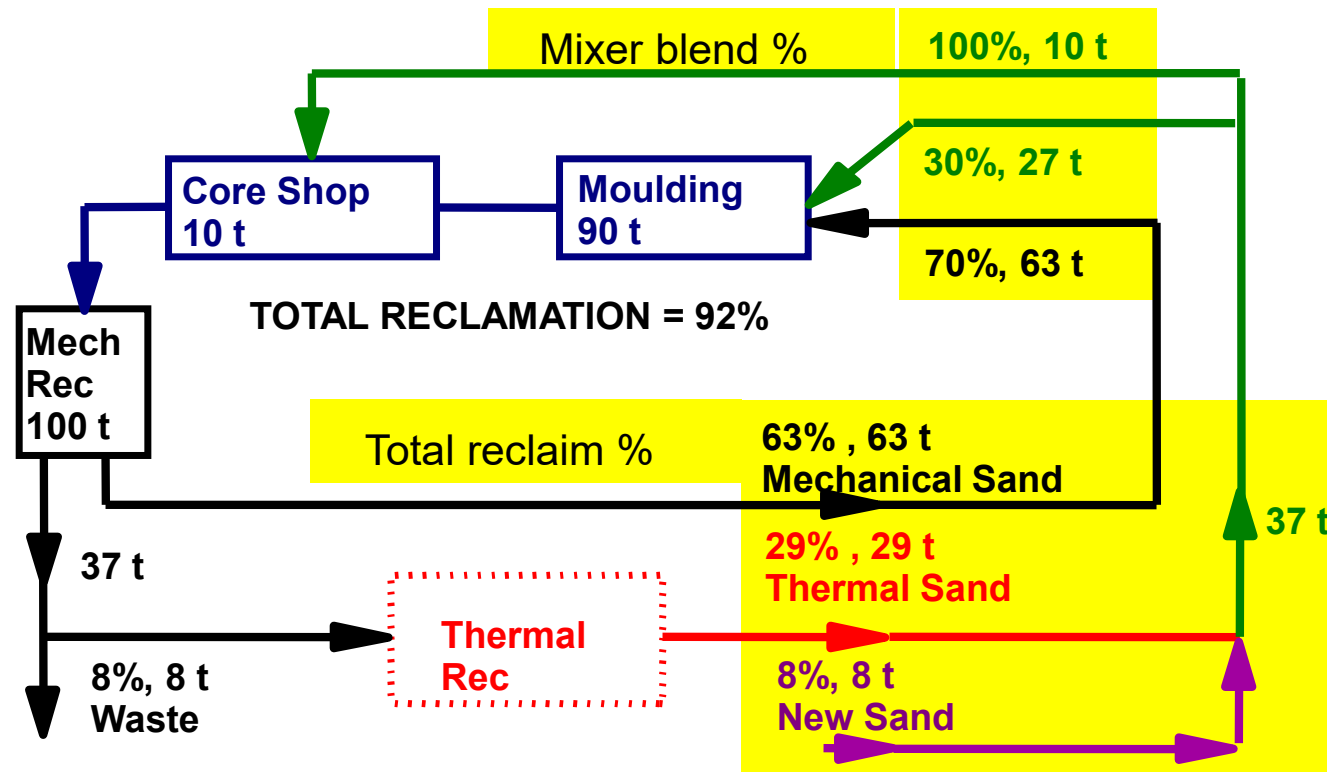
Thermal reclamation is a well-known way to reclaim sand. It works by reclaiming our waste sand stream to be re-used as new sand





OMEGA

Sand balance diagram for a thermo /mechanical reclamation system



Advantages

1. 100% reclamation of all organic binder systems
2. Uses waste sand to replace new sand consumption
3. Thermally reclaimed sand near 0 LOI
4. Sand is more thermally stable vs virgin sand – Reduces expansion defects
5. Omega Thermal passes all European VOC emission legislation
6. 100% thermally reclaimed sand can be used for core production

Disadvantages

1. High initial capital cost
2. Higher running costs vs other Omega Solutions
3. Increase in fossil fuel consumption
4. Cannot reclaim inorganic binders
5. Must use an additive for alkaline phenolic.
6. Require regular emission checks to make sure local standards are maintained.

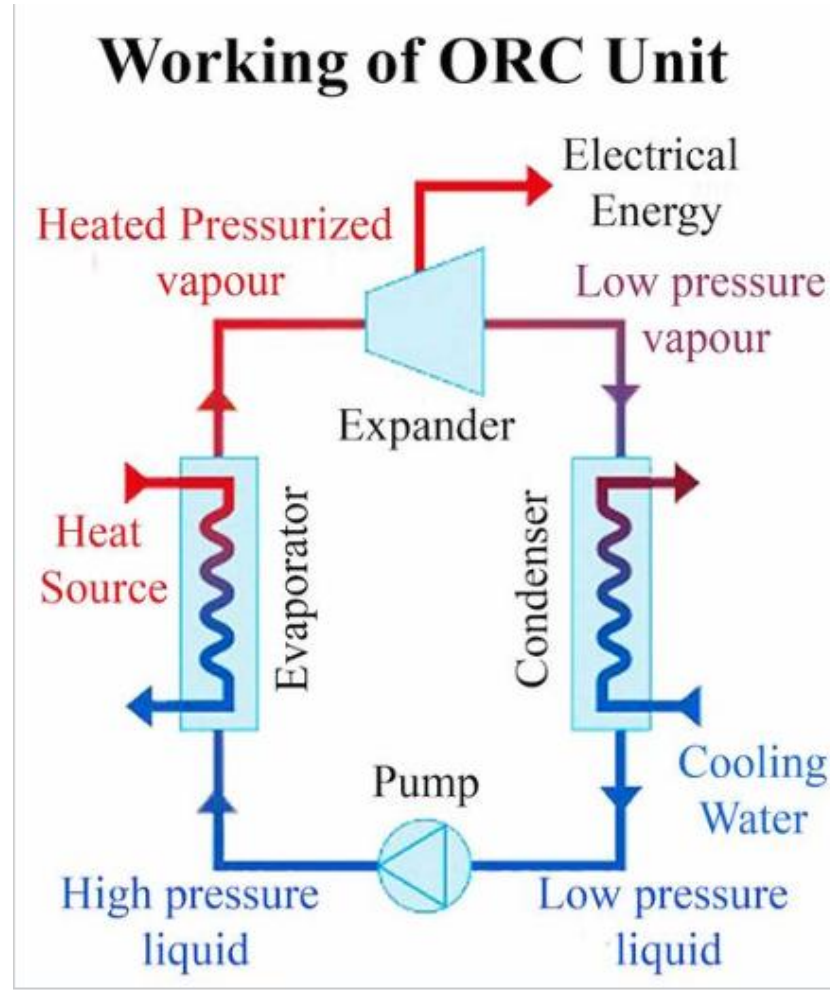
Omega Regen ©

Turns Waste Heat into Profit

Converts low-grade waste heat into usable electricity, improving overall energy efficiency.

- **Reduces Energy Costs**
Generates on-site power, lowering dependence on grid electricity.
- **Sustainable & Low Carbon**
Cuts CO₂ emissions by utilizing existing heat sources.
- **Operates at Lower Temperatures**
Unlike steam systems, Omega Regen works efficiently with low-to-medium temperature heat sources.
- **Minimal Maintenance**
Closed-loop system with fewer mechanical stresses = high reliability and low servicing costs.
- **Flexible Integration**
Can be added to existing processes (Thermal Reclamation Plants , Furnace stacks, boilers)

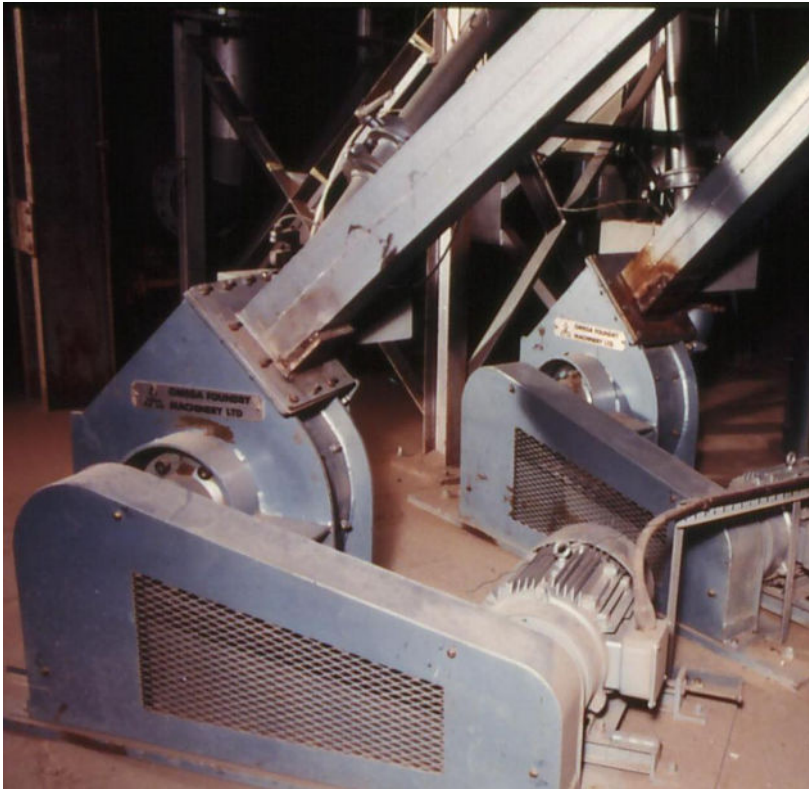
Organic Rankine cycle



Potential for energy saving

	Existing TSRM	With ORC
Exhaust Flow Rate	15,436 m ³ /hr	3,921 m ³ /hr
Exhaust Temperature	180°C	100°C
Thermal Energy Captured	0 kW	715 kW
Electricity Generated	0 kW	107.25 kW
Net Power Impact	+60 kW (load)	-50.25 kW (generation benefit)

Is there an alternative to thermal?



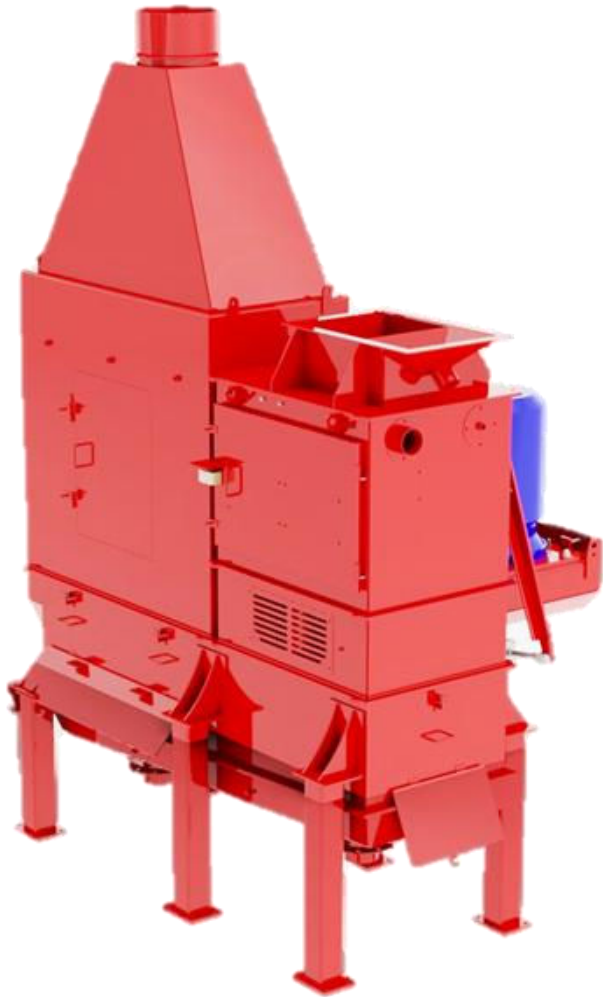
Rotary Reclamation

Hammer Mill



Drawbacks with previous designs

- Damage to sand grains.
- High wearing parts.
- Multiple units required to effect LOI reduction, increase space required
- Power consumption.
- Hard to control rate of resin removal.



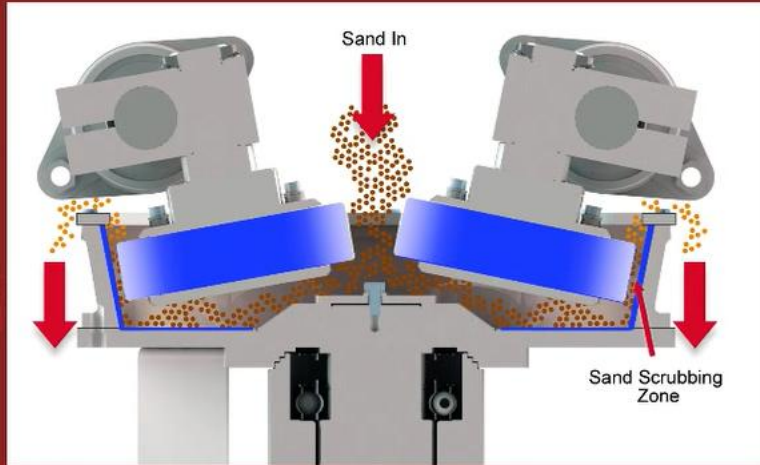
USR

- Using the USR we can reclaim up to 90% by mechanical scrubbing alone depending on the chemical process
- This system removes the need for any direct fossil fuels
- Can be used on organic & inorganic binders
- Lower capital investment cost compared to Thermal reclamation
- Small footprint

How it works

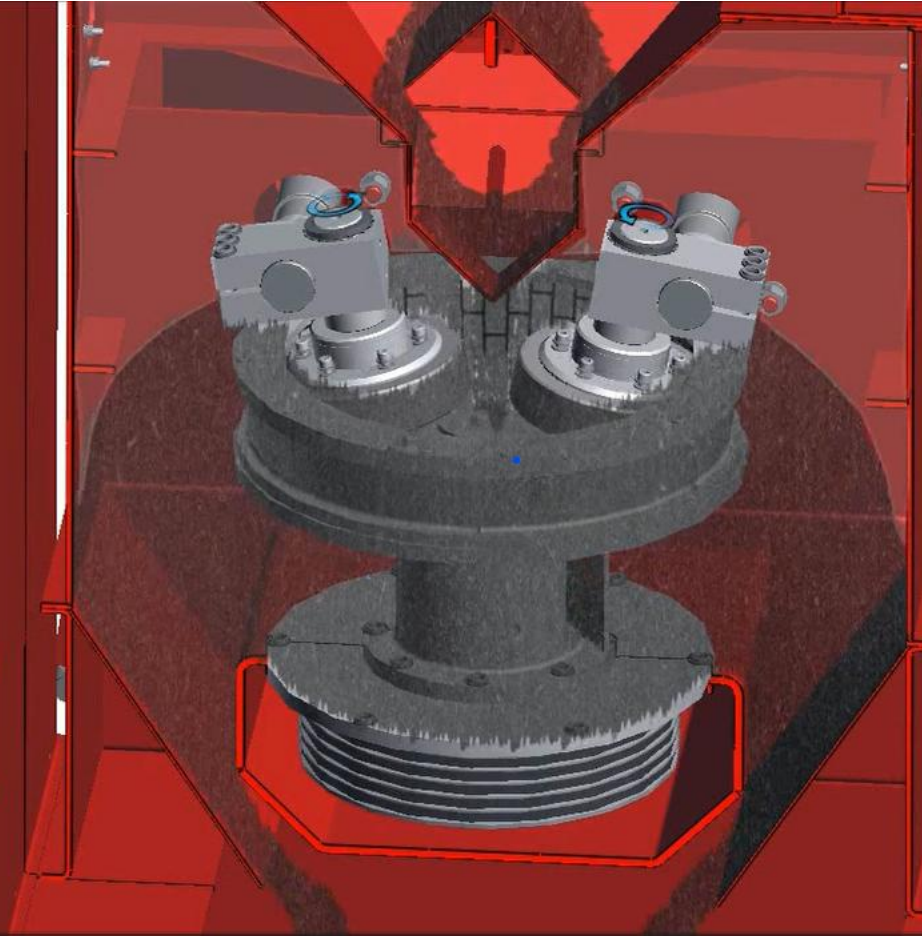


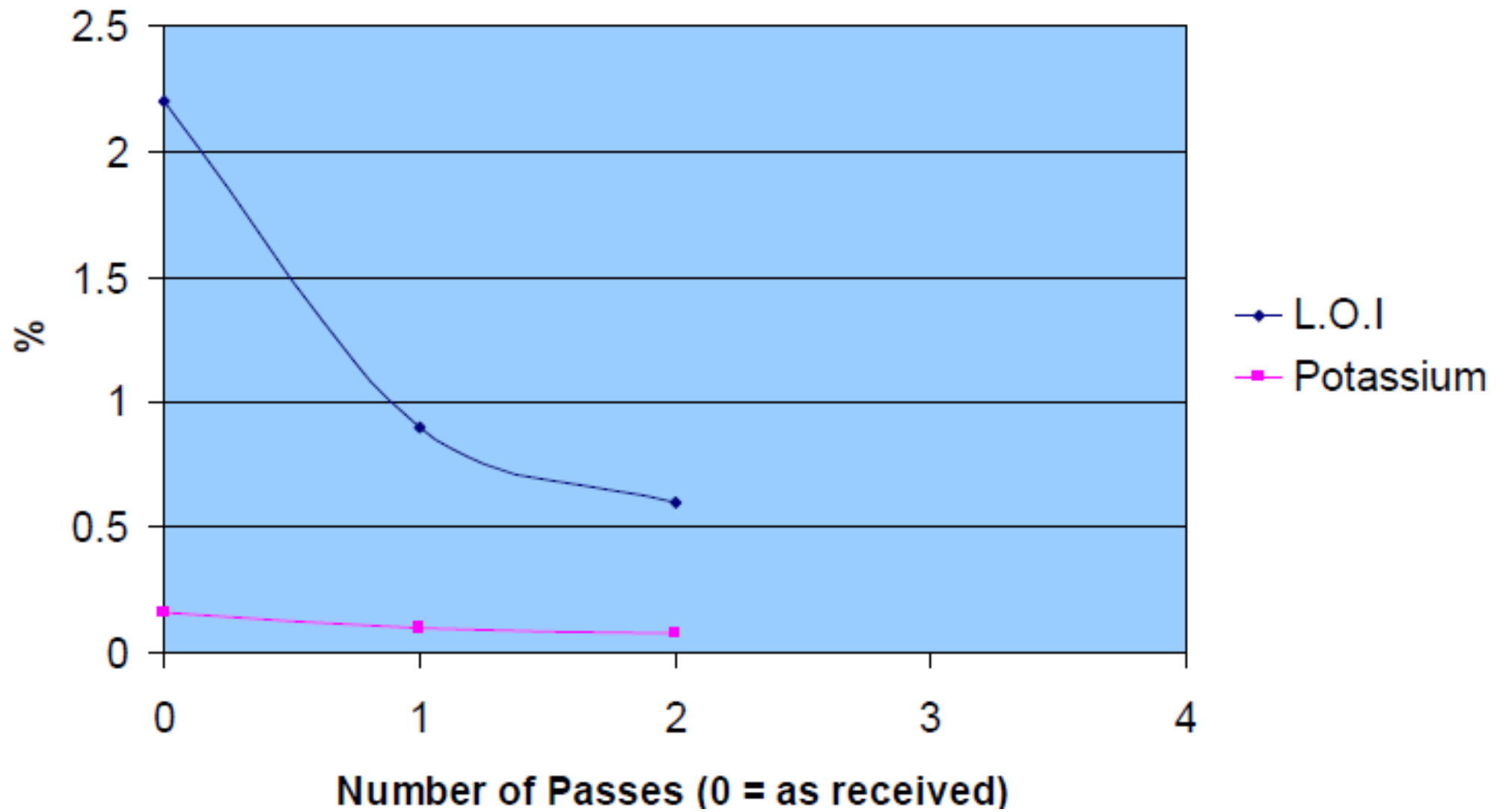
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The sand enters the high speed rotating drum and ceramic rollers intensify the binder removal

Variable drum rim for control of sand retention

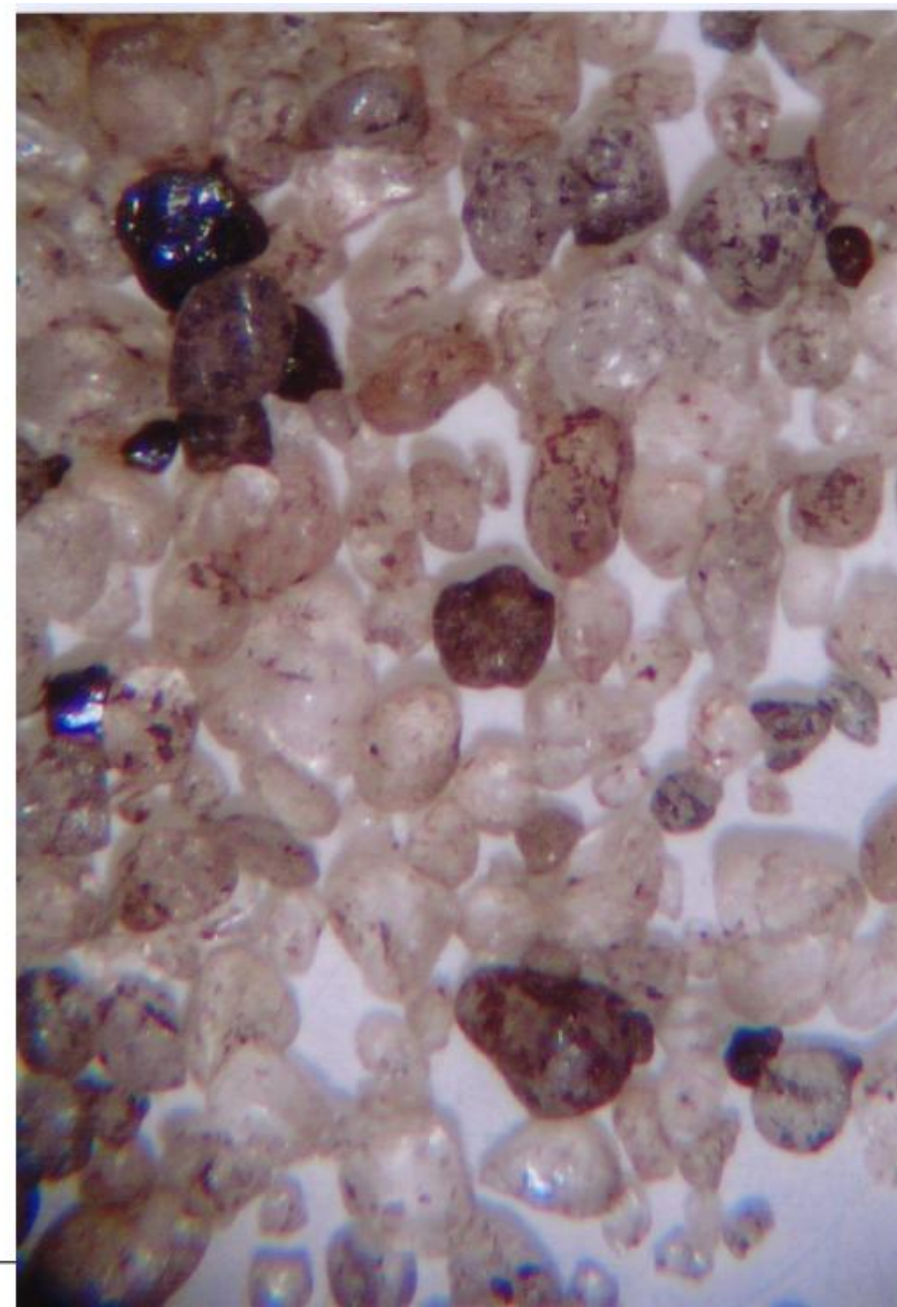
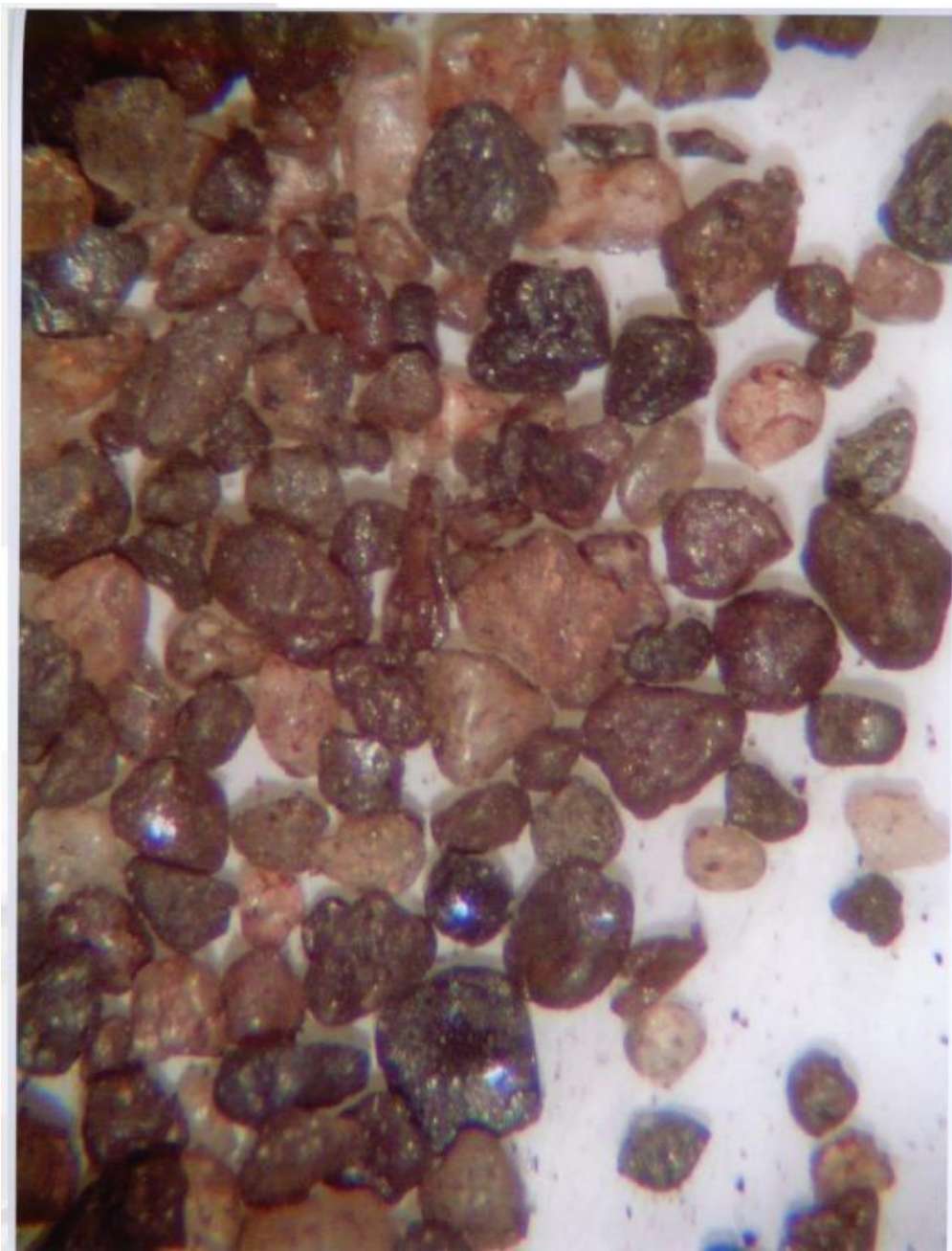




**Improves sand properties by
rounding and conditioning the sand
grain, this:**

- Improves permeability
- Improves flowability
- Leads to higher strength moulds or cores
- Reduces chemical consumption





Chemical Process – Typical usage with Secondary Reclamation

- **Furan**

Up to 90-95% to be re-used. Main advantage is the reduction organic content as well as Nitrogen & Sulphur levels, reducing casting defects and improving the working environment for operators.

- **Alkaline Phenolic**

Up to 90% reclamation. Reduces organic content plus alkaline salts, which allows high levels of reclamation

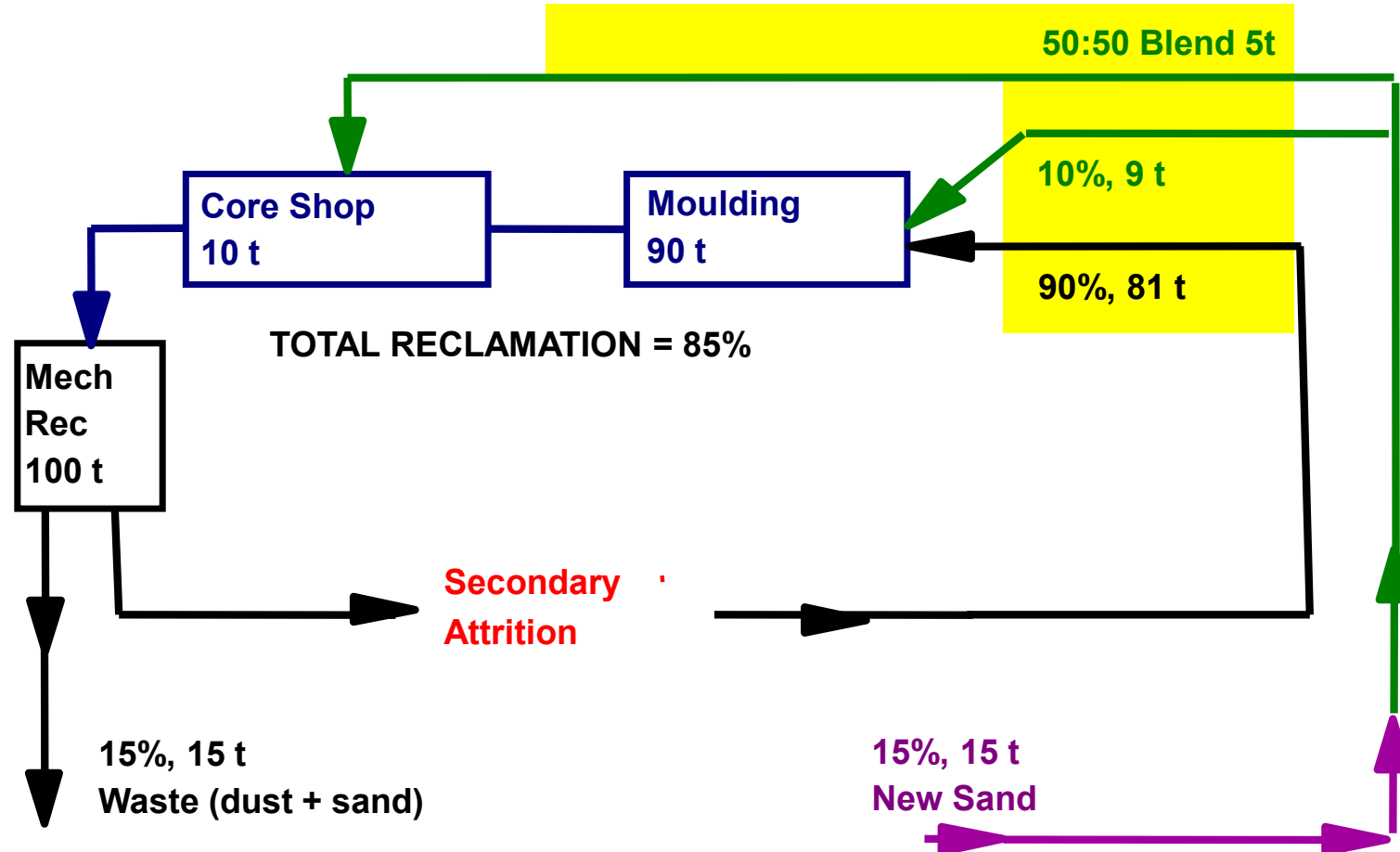
- **Silicate-ester**

Standard silicate ester bonded sand can be reclaimed using primary reclamation at less than 50%. With Secondary reclamation we can reclaim up to 70%*. Secondary reclamation reduces the amount of Soda content build up allowing higher levels of reclamation.

- **Green Sand for Coreshop reuse.**

70% reclamation after 3 passes with a USR system

Sand balance diagram for mechanical primary and secondary reclamation for Alkaline Phenolic



Typical Payback

***Using a typical investment cost and including running costs including spare parts**

Capital Investment Aus \$		
Omega Sinto	Shipping/Commissioning	300,000.00
Local supply	Fabrications/dust ex	400,000.00
Total Investment		700,000.00
Running cost / tonne Aus \$		
Power	10kw/hr/t @ 0.19/kw/hr	19.00
Consumables	4.5/hr /5	1.70
Total running cost		20.70
New sand cost Aus \$		
New sand	tonne	95.00
Disposal	tonne	115.00
Total Sand cost		210.00
New Sand saving/tonne		189.30

Sand consumption per month		
Production	net castings/month	200
Current	Reclamtion	60%
	New sand	500
	Reclaim Sand	750
With USR	New	85%
	New Sand	190
	Process through USR	1060
Potential return		
Sand saved	310 x 189.30	58683.00
USR tonne	1060 x 20.70	21942.00
Monthly Saving		36741.00
Capital cost		700000.00
Months		19.05

Back to the figures



46,000 tons a year of waste sand in QLD alone.



15% used in other industries = 7,000 tons – *Best case scenario*



This leaves us with 39,000 tons of waste sand

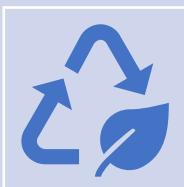


What if we can use the reclamation systems mentioned to reclaim even at an average of 80%?

Back to the figures



We will only be putting to landfill 7,800 ton that's a **82% overall reduction of waste sand in QLD.**



This also means a reduction from 4,680 ton CO2 emissions to 936 ton and a reduction of 783,000 kW/h of electricity



Imagine that on a global scale, when we are currently disposing of 110 million tons of silica.



Thank you Listening