Technical Mining Analysis

Truck–Shovel vs Dragline Comparative Report

Prepared by Mining Specialist Algorithmic Model

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Indicative engineering economics & ESG overlay. Not a substitute for detailed feasibility or OEM engagement.

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1. Executive Summary

Leader: Dragline. TS total unit cost: 0.60 €/m³ (carbon 0.054 €/m³); DL total unit cost: 0.38 €/m³ (carbon 0.016 €/m³). Annual production TS 4,120,658 m³ vs DL 4,120,658 m³. Carbon intensity TS 0.899 kg/m³ vs DL 0.262 kg/m³. Annual CO, TS 3,704.83 t vs DL 1,080.58 t. Weights: Cost 55% / Carb

1.1 Key KPIs

Metric	Truck–Shovel	Dragline
Annual Production (m³ LCM)	4,120,658	4,120,658
Unit Cost incl Carbon (€/m³)	0.60	0.38
Carbon Intensity (kg CO,/m³)	0.899	0.262
Carbon Tax (€/m³)	0.054	0.016
Bottleneck	Shovel-bound	—
Matching Factor	0.96	—

2. Equipment Configuration

2.1 KPIs

Metric	Value
MF	0.96
Bottleneck	Shovel-bound
Shovels	1
Trucks	2

2.2 Key Formulae

Effective Passes = ceil(TruckBody / (Bucket * Fill * M))

MF = (Trucks * LoadTime)/(TotalCycle * Shovels)

2.3 Specialist Commentary

Fleet sizing check: MF=0.96 (Shovel-bound).
Recommendation: Balanced configuration — maintain ratio and monitor variability.
Pros (TS): modular scalability; Cons: higher labour footprint vs Dragline.
Pros (DL): large batch movement; Cons: high capital concentration.

2.4 Pros / Cons Snapshot

Pros: Pros (TS): modular scalability | Pros (DL): large batch movement

Cons: higher labour footprint vs Dragline. | high capital concentration.

3. Material & OEE

3.1 KPIs

Metric	Value
Fill Factor	1.15
Swell Factor	1.2
A	0.9
U	0.8
Annual Hours	5,760

3.2 Key Formulae

A·U Efficiency = Availability × Utilization

Loose Volume = Bank × Fill × Swell

3.3 Specialist Commentary

OEE multiplier A·U = 0.72. Fill 1.15 and Swell 1.2 amplify loose volume.
Recommendation: Target A"e0.9 and U stabilization via dispatch to avoid com
Pros (High Fill): improved LCM throughput; Cons: potential overfill-induced cycle elongation.

3.4 Pros / Cons Snapshot

Pros: Pros (High Fill): improved LCM throughput

Cons: potential overfill-induced cycle elongation.

4. Cycle Builder

4.1 KPIs

Metric	Value
Total Cycle (s)	560.2
Passes	10
Load (s)	270.0
Queue (s)	120.0

4.2 Key Formulae

Cycle = Load + Haul + Dump + Return + Queue
Haul Time (s) = Distance(km)/Speed(km/h)*3600
MF threshold optimal ~1±5%

4.3 Specialist Commentary

Cycle time 560.2 s; dominant segment: Load. Passes = 10.
Recommendation: Focus on reducing haul distance/speed improvements for haul/return reductions.
Pros (Optimised cycle): lower truck count required for target output; Cons: diminishing returns after 10–15% reduction.

4.4 Pros / Cons Snapshot

Pros: Pros (Optimised cycle): lower truck count required for target output

Cons: diminishing returns after 10–15% reduction.

5. Production

5.1 KPIs

Metric	Value
TS Hourly m^3/h	715.39
DL Hourly m^3/h	715.39
TS Annual m^3	4,120,658
DL Annual m^3	4,120,658

5.2 Key Formulae

Hourly Shovel = (3600/cycle_s)*Bucket*Fill*Swell*M*Units*A*U
TS Constraint = min(Shovel, Trucks)
Annual = Hourly × Hours_y

5.3 Specialist Commentary

TS hourly constraint = 715.39 m^3/h vs Dragline 715.39 m^3/h.
Recommendation: If project demand > 4,120,658 m^3/y consider MF tuning or second shovel tier.
Pros (Dragline high single-unit capacity); Cons: single point failure risk.

5.4 Pros / Cons Snapshot

Pros:

Cons: single point failure risk.

6. TCO

6.1 KPIs

Metric	Value
TS Total €/y	2,231,722.49
DL Total €/y	1,493,793.09
TS Ownership €/y	452,027.98
TS OPEX €/y	1,779,694.51

6.2 Key Formulae

Depreciation = (Cost - Salvage)/Life
AYI = Average Year Investment for capital charge
Ownership = (Dep + IIT) × Units
OPEX = Energy + Lube%×Energy + Maint%×Dep + Break%×Cost + Labour

6.3 Specialist Commentary

TCO TS Annual = €2,231,722.49; Dragline = €1,493,793.09.
Largest TS OPEX component: Energy.
Recommendation: Apply cost reduction program on Energy first (highest leverage).
Pros (TS OPEX flexibility); Cons: Dragline maintenance step-change risk when major component overhauls occur.

6.4 Pros / Cons Snapshot

Pros:

Cons: Dragline maintenance step-change risk when major component overhauls occur.

7. ESG & Unit Economics

7.1 KPIs

Metric	Value
TS Cost €/m^3	0.60
DL Cost €/m^3	0.38
TS CI kg/m^3	0.899
DL CI kg/m^3	0.262

7.2 Key Formulae

CO, kg/h = Fuel L/h × EF kg/L
CI kg/m^3 = (CO, kg/h × Hours_y)/Annual LCM
Carbon Tax €/m^3 = (CO,_y_t × CarbonPrice)/Annual LCM
Composite Score = wC*(Cost/MinCost)+wCI*(CI/MinCI)

7.3 Specialist Commentary

Carbon intensity TS 0.899 vs DL 0.262 kg/m^3 (""H242.9%).
Recommendation: If carbon price trajectory > base, prioritise path with structural CI advantage; otherwise emphasise cost leader.
Pros (Low CI): resilience vs rising carbon taxes; Cons: may require higher capex.

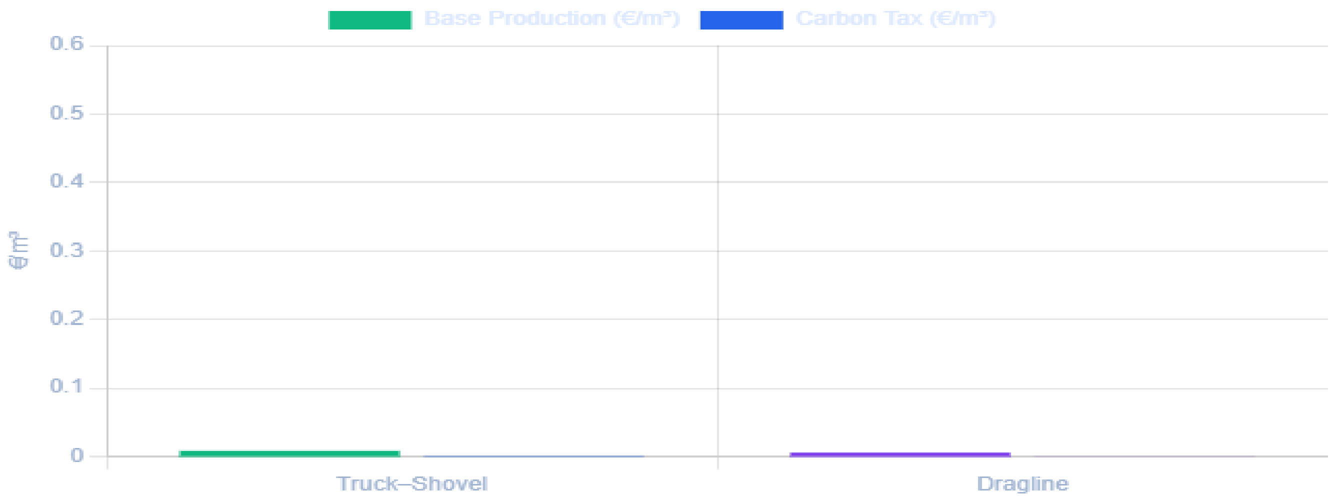
7.4 Pros / Cons Snapshot

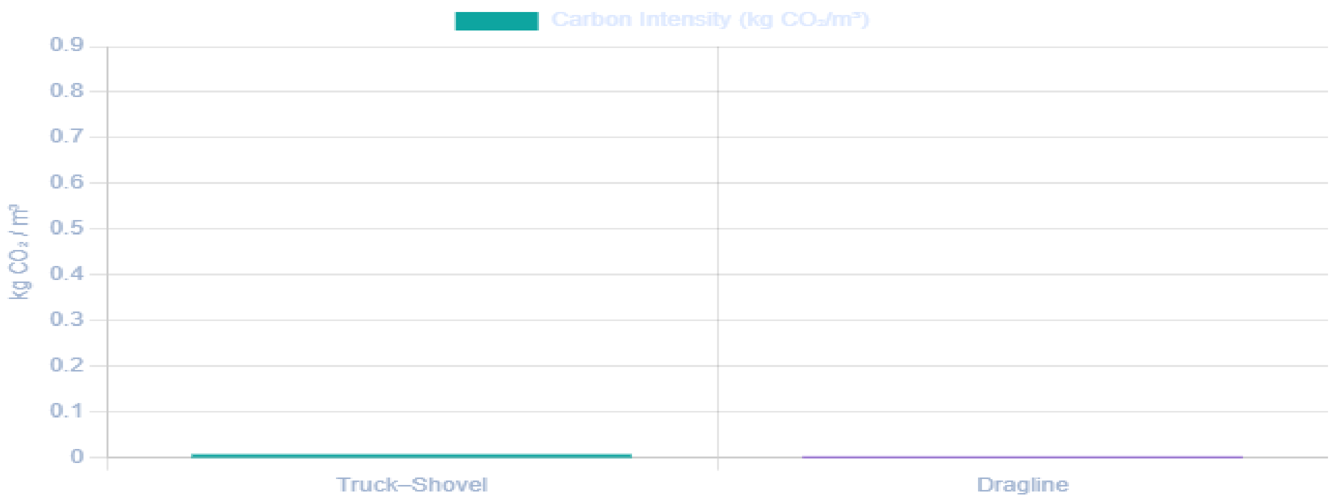
Pros: Pros (Low CI): resilience vs rising carbon taxes

Cons: may require higher capex.

8. Visual Analytics

Charts illustrate cost composition with carbon overlay and comparative carbon intensity.





9. Methodology & Caveats

Model sequence: (1) Capacity derivation via cycle analytics (deterministic). (2) Ownership & OPEX layering. (3) ESG emission and pricing overlay. (4) Weighted economic + carbon scoring. Stochastic queuing, grade resistance, operator variability not explicitly modeled.

10. Recommendations & Next Steps

STRATEGIC RECOMMENDATION

Leader: Dragline
Cost ”: 57.4% | Carbon Intensity ”: 242.9%
Weights !' Cost 55% / Carbon 45%
Dominant margin lever: Carbon intensity divergence exerts more influence.

TS COST €/M³
0.60
DL COST €/M³
0.38
TS KG/M³

0.899
DL KG/M³
0.262
TS CTAX
0.054
DL CTAX
0.016
TS SCORE
2.409
DL SCORE
1.000
TS ANNUAL M³
4,120,658
DL ANNUAL M³
4,120,658

Composite score normalizes cost & carbon vs respective minima. Sensitivity to weighting enables strategic alignment (e.g., decarbonization premium vs strict unit margin discipline). Consider scenario stress prior to final equipment commitment.

Run sensitivity on: Haul distance variance, Fuel price escalation, Carbon price high case, Availability degradation, Alternate Fill factors.

11. Disclaimer

This document constitutes an indicative comparative analysis by an automated mining specialist model. It is NOT a feasibility study. Field trials, OEM data validation, geotechnical review, and financial due diligence required prior to capital commitment.