The Critical Enabling Role of Overland Conveying in Electrification Initiatives in Mining

Tony Barr, BEUMER Group

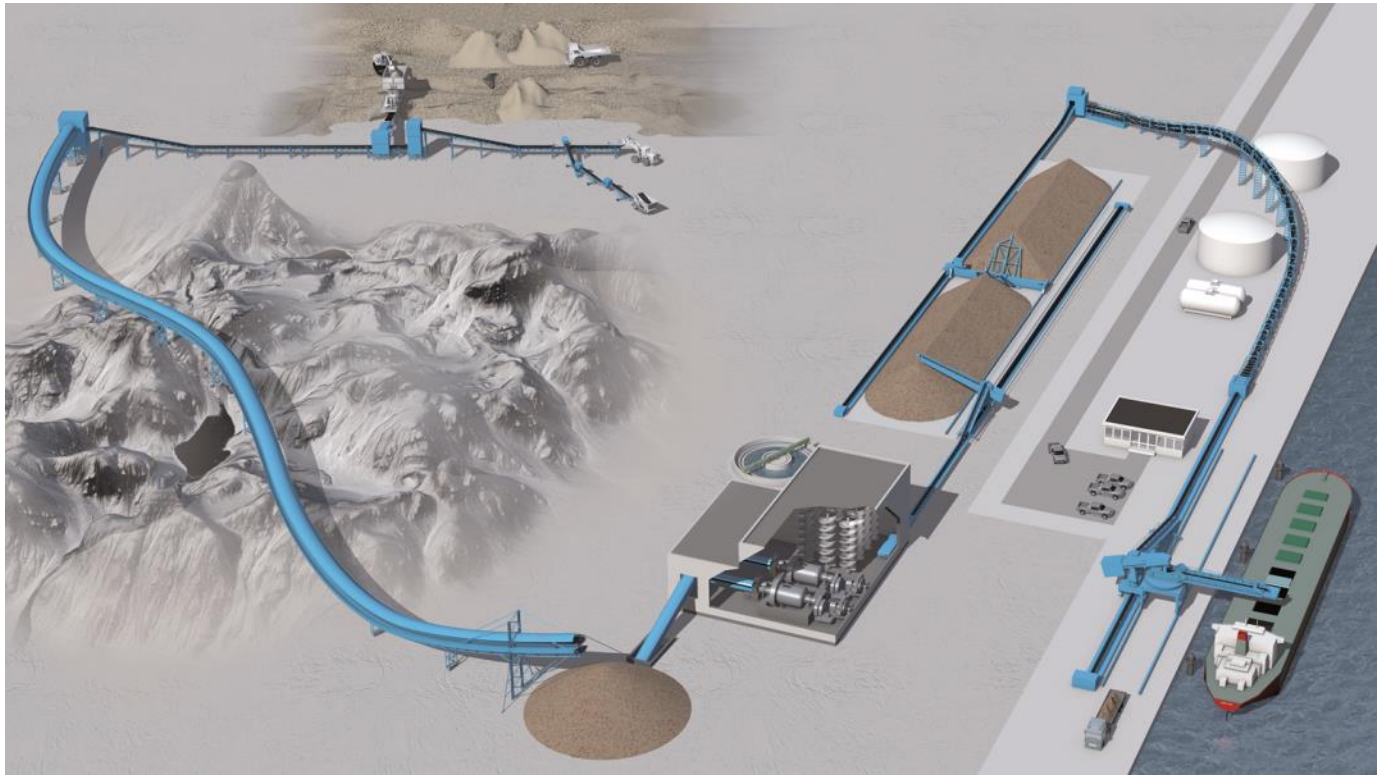
Safety First. Always.

Our Shared Commitment

Zero Accidents

Zero Harm

BEUMER Group: BMH System Provider



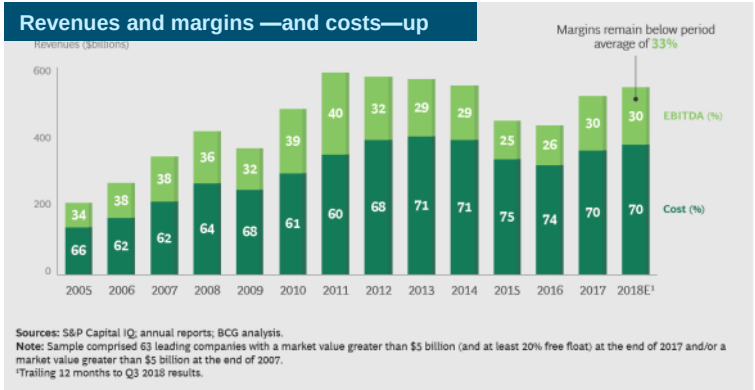
- Conveying & Loading
- Long Distance Conveying
- Stockyard Technology
- Port Technology

All Roads Lead to Electrification

Electrification: Key Drivers

- Safety (underground, above-ground)
- Energy intensity reduction, decarbonization
- Health and environmental stewardship
- Value creation: return on assets
- Innovation imperative (concept-to-execution)

Revenues and margins —and costs—up



Sources: S&P Capital IQ; annual reports; BCG analysis.
Note: Sample comprised 63 leading companies with a market value greater than $5 billion (and at least 20% free float) at the end of 2017 and/or a market value greater than $5 billion at the end of 2007.
¹Trailing 12 months to Q3 2018 results.

Total Shareholder Return outlook tentative

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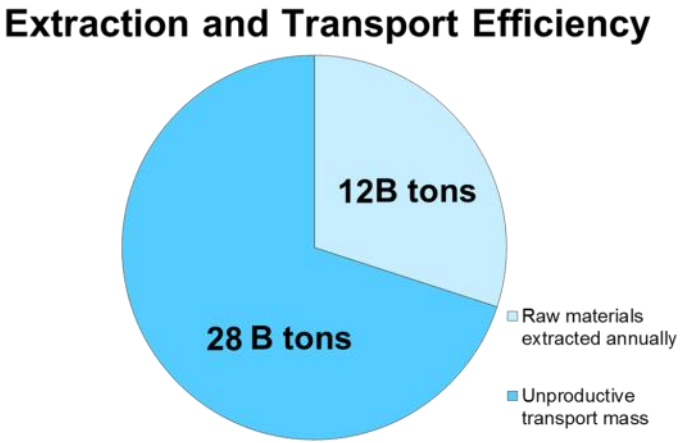
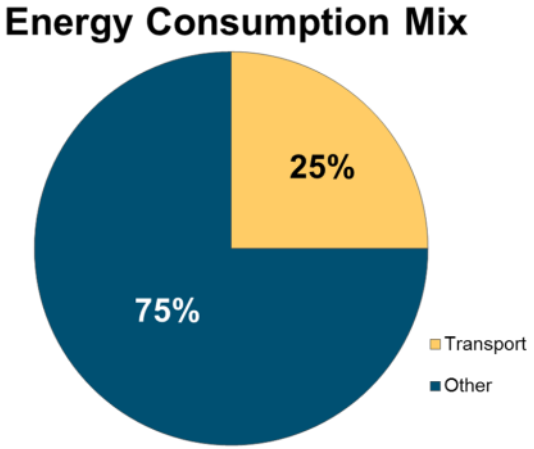
All-in Sustaining Costs creeping upward

Sources: Company annual reports; BCG analysis.
Note: Major gold producers include Newmont Mining, Barrick Gold, Kinross Gold, AngloGold Ashanti, Goldcorp, Newcrest Mining, and Gold Fields.

Source: "Value Creation in Mining 2019: Return to Strategy," Boston Consulting Group

Context: Why the Discussion Matters





Critical Forward Decisions

- Health and safety, related risk costs
- Transport methods and energy sources: efficiencies and impacts
- Business model shifts, including greater flexibility and remote operations
- Evolving criteria for viability assessments, project planning and implementation scenarios
- Strategic emphasis on value creation, return on assets

Transport Options: Truck Haulage

In Summary: Truck Haulage

- Safety: traffic management, risk costs
- CapEx: fleet size-dependent
- OpEx: comparatively high unit cost
- Highly flexible
- Energy-intensive, traditionally carbon-based
- Fugitive dust, mitigation controls and costs
- Road and truck maintenance costs
- Comparatively topo-constrained

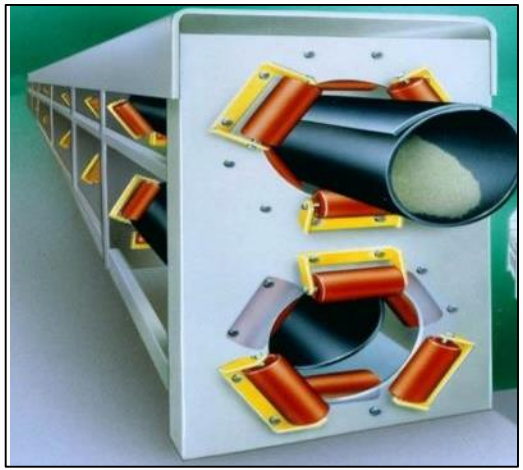
Transport Options: Conveyor Transport

In Summary: Conveyor Transport

- Safety: traffic-segregable, guarded
- CapEx: Fleet size-dependent
- OpEx: comparatively lower unit cost
- Traditionally inflexible
- Energy-efficient, lower carbon emissions
- Dust suppression by design, construction
- Low-maintenance, comparatively long life
- Modular, topo-adaptive, mobile

High-capacity Conveyor Transport Options

Pipe Conveyor



Curved Trough Conveyor

In Focus: Safety

EOY 2017: 30% increase in transport-related fatalities in US Mining over prior period

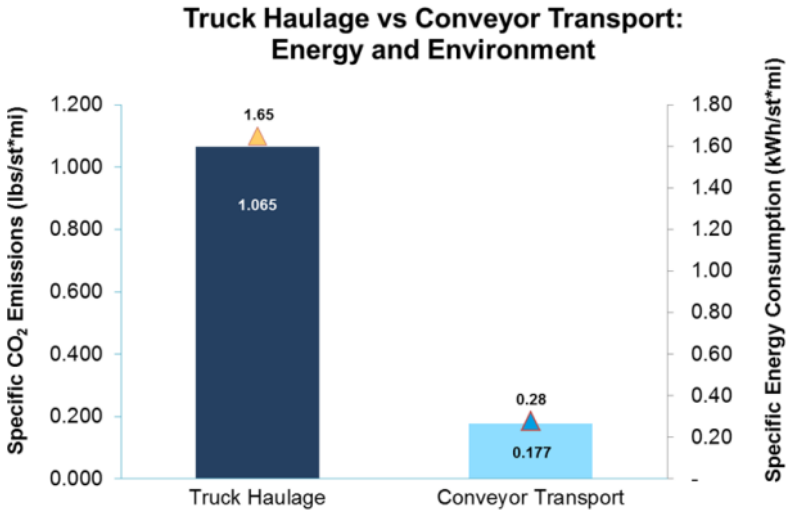
Fully covered conveyors separate humans and moving parts from each other without exception

In Focus: Energy and Environment

Energy Efficiency and CO_2 Emissions

Worldwide Power Production	0.628 lbs/kWh CO_2 emission
Burning of Diesel Fuel	0.646 lbs/kWh CO_2 emission
Specific Energy Consumption of Trucking[1]	1.59 to 1.71 kWh/st*mi
Specific Energy Consumption of Belt Conveying[2]	0.20 to 0.36 kWh/st*mi
Specific CO_2 Emission of Trucking	1.065 lbs/st*mi
Specific CO_2 Emission of Belt Conveying	0.177 lbs/st*mi
Specific CO_2 Emissions Reduction Potential	0.888 lbs/st*mi

Source: TU Clausthal University



- CO_2 emissions: 83.4% reduction potential
- Energy consumption: 83.0% reduction potential

In Focus: Conveyor Transport Innovation

Plan

Define the site (or sites) to map

Choose & configure your high precision methodology (e.g. RTK using VRS)

Survey one or more sites per flight

Capture

Capture high-resolution, georeferenced RGB images

Up to 220 ha (540 ac) at 120 m/400 ft AGL (cover 1,320 ha/3,260 ac per day)

Generate

Process the drone's georeferenced photos (choose local/cloud processing)

Analyse geo-accurate orthomosaic, point cloud & surface model outputs

Act

Create client deliverables (contours, cadastre plans, classified point cloud etc.)

Import drone outputs into third-party software (CAD etc.) as required

3D Mapping: Paired Drone and Software

- High-fidelity measurements and precise modeling of inaccessible structures, obstacles
- Cost-effective observation of dynamic environments in time study scenarios
- Simplifies and accelerates planning in expansive areas and in challeging topos
- Cost-effective and efficient, substantially lower safety risks
- Facilitates measurement of dynamic volumes for civil engineering, deep mining

In Focus: Conveyor Transport Innovation

Planning with Autodesk® InfraWorks

- 3D planning models incl. 3D models for topo
- Route modeling, optimization via "drag & drop"
- Linking of conveyor line(s) and topo
- 3D visualization based on real coordinates
- Intuitive presentation for stakeholders
- Transparency, simplicity for faster decisions

In Focus: Conveyor Transport Innovation

Smart Change: Modularity, Adaptability, Mobility, Connectedness

- Modular design: minimizes field mobilization, installation costs
- Topo-adaptability: minimizes cut & fill, civil works
- Conveyor mobility: enables repurposing to future sites
- Adaptive operations: data collection, analytics, condition monitoring

Case Study: Truck Haulage vs Conveyor Transport

Key Variables

Ore volume (remote body)	6,000 TPD (2.2M TPY)
$23M investment scope (curved trough conveyor)	Design, supply, civil, mech/elec installation
Truck haulage (6.9 mi.) cost per ton	$4.40 Y1 (1.3 RT/hr)
Conveyor (5.5 mi.) transport cost per ton	$0.381 Y1
Inflation rate for costs	3% per year

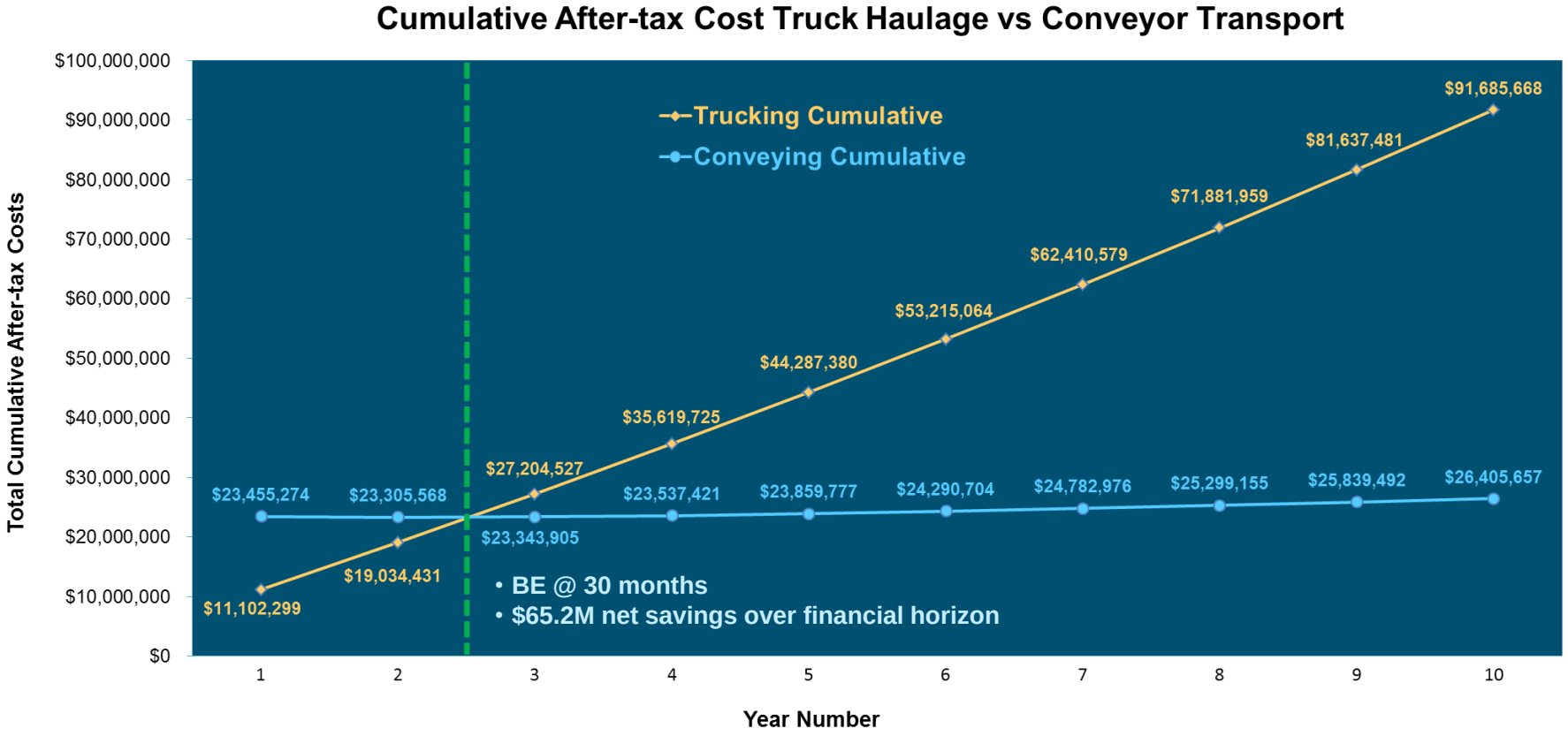
Jumbo covers on conveyor as environmental shield

Modular design to facilitate remobilization after 5 years' operation

Truck Haulage CapEx includes initial road(s) construction

Conveyor Transport CapEx includes construction-access-only road

Case Study: Break-even (BE) Analysis

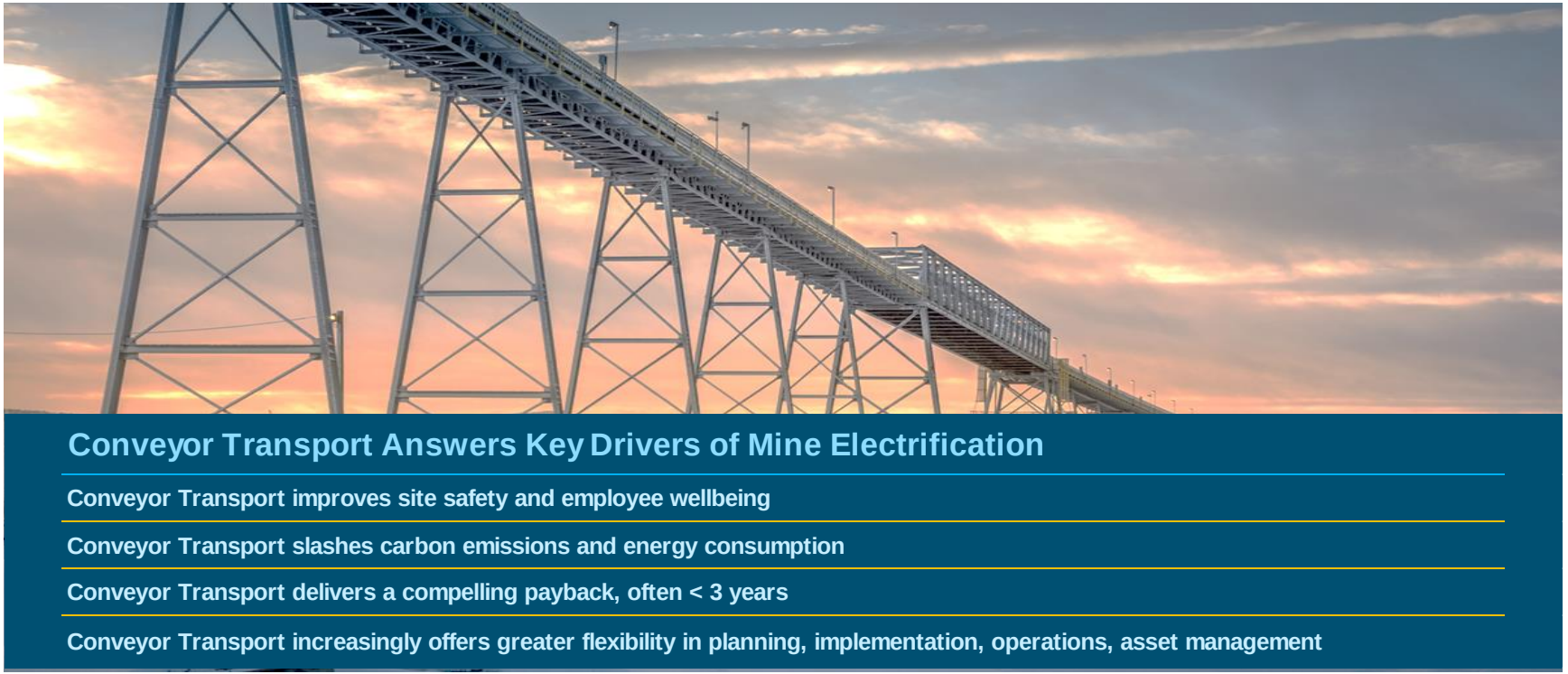


Case Study: Takeaways

Summary of Results

Health and safety	Substantially less traffic, lower risk costs
Energy and environment	Energy de-intensification and de-carbonization
Operating flexibility	Modularity and mobility
Cumulative savings (gross) over project life	$ 102M
Net cash flow generated over project life	$ 86M
Net Present Value discounted to time zero	$ 56M
Return on capital (time zero + future periods)	35%
Break-even point	Between Y2 and Y3

Conclusions



Conveyor Transport Answers Key Drivers of Mine Electrification

- Conveyor Transport improves site safety and employee wellbeing
- Conveyor Transport slashes carbon emissions and energy consumption
- Conveyor Transport delivers a compelling payback, often < 3 years
- Conveyor Transport increasingly offers greater flexibility in planning, implementation, operations, asset management

Thank You …

Appendix

Case Study NPV Analysis

Year	1	2	3	4	5	6	7	8	9	10
Volume (tons per year)	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000
Trucking Cost per Ton at 3% Inflation	$4.40	$4.53	$4.66	$4.80	$4.95	$5.10	$5.25	$5.41	$5.57	$5.74
Operating Costs	**$9,626,374**	**$9,915,165**	**$10,212,620**	**$10,518,998**	**$10,834,568**	**$11,159,605**	**$11,494,394**	**$11,839,225**	**$12,194,402**	**$12,560,234**
Conveyor Costs per Ton at 3% Inflation	$0.38	$0.39	$0.40	$0.42	$0.43	$0.44	$0.45	$0.47	$0.48	$0.50
Operating Costs	**$834,224**	**$859,251**	**$885,028**	**$911,579**	**$938,926**	**$967,094**	**$996,107**	**$1,025,990**	**$1,056,770**	**$1,088,473**
Difference in operating costs	$8,792,150	$9,055,914	$9,327,592	$9,607,419	$9,895,642	$10,192,511	$10,498,286	$10,813,235	$11,137,632	$11,471,761
Cumulative Difference in Cost	**$8,792,150**	**$17,848,064**	**$27,175,655**	**$36,783,075**	**$46,678,716**	**$56,871,228**	**$67,369,514**	**$78,182,749**	**$89,320,381**	**$100,792,142**
MACRS Depreciation Factors Used DDB	*0.1000*	*0.1800*	*0.1440*	*0.1152*	*0.0922*	*0.0737*	*0.0655*	*0.0655*	*0.0656*	*0.0655*
Tax Depreciation Available	$2,325,295	$4,185,532	$3,348,425	$2,678,740	$2,143,922	$1,713,743	$1,523,068	$1,523,068	$1,525,394	$1,523,068
Taxable Income (after depreciation)	$6,466,854	$4,895,409	$6,029,970	$7,006,034	$7,856,422	$8,611,639	$9,137,101	$9,481,933	$9,834,784	$10,202,942
Income tax @ 20%	$1,293,371	$979,082	$1,205,994	$1,401,207	$1,571,284	$1,722,328	$1,827,420	$1,896,387	$1,966,957	$2,040,588
Net Savings After Taxes (net cash flow)	$7,498,779	$8,101,859	$8,172,402	$8,283,568	$8,429,060	$8,603,054	$8,832,749	$9,108,615	$9,393,221	$9,685,422
Cumulative Net Cash Flow	**$7,498,779**	**$15,600,638**	**$23,773,039**	**$32,056,607**	**$40,485,667**	**$49,088,721**	**$57,921,470**	**$67,030,085**	**$76,423,306**	**$86,108,728**

Cumulative Savings
$86.1M

10-year NPV using 8% discount factor →	$56,323,063
10-year NPV using 12% discount factor →	$47,121,057
10-year NPV using 20% discount factor →	$34,560,488

Case Study IRR Analysis

Year	1	2	3	4	5	6	7	8	9	10
Volume (tons per year)	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000	2,190,000
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Operating Costs	$834,224	$834,224	$834,224	$834,224	$834,224	$834,224	$834,224	$834,224	$834,224	$834,224
Difference in operating costs	$8,792,150	$9,080,941	$9,378,396	$9,684,774	$10,000,344	$10,325,381	$10,660,170	$11,005,001	$11,360,178	$11,726,010
Cumulative Difference in Cost	$8,792,150	$17,873,090	$27,251,486	$36,936,261	$46,936,605	$57,261,986	$67,922,156	$78,927,157	$90,287,335	$102,013,345
MACRS Depreciation Factors Used DDB	*0.1000*	*0.1800*	*0.1440*	*0.1152*	*0.0922*	*0.0737*	*0.0655*	*0.0655*	*0.0656*	*0.0655*
Tax Depreciation Available (DDB method)	$2,325,295	$4,185,532	$3,348,425	$2,678,740	$2,143,922	$1,713,743	$1,523,068	$1,523,068	$1,525,394	$1,523,068
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Yearly Returns from $23.2M Capital Investment (10-year project life)

Resulting IRR: 35%	$7,498,779	$8,101,859	$8,172,402	$8,283,568	$8,429,060	$8,603,054	$8,832,749	$9,108,615	$9,393,221	$9,685,422