

Integrating Renewables in the Mining Sector

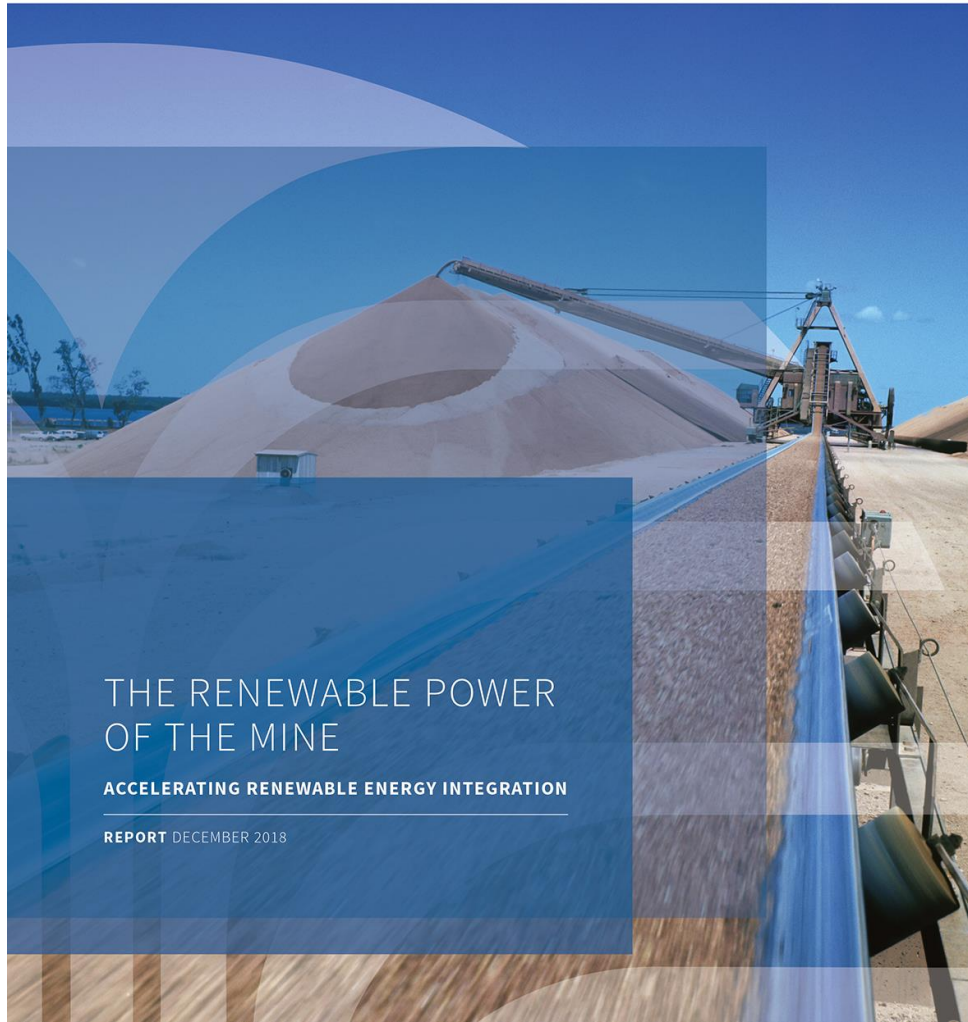
February 2019



**Columbia Center
on Sustainable Investment**

A JOINT CENTER OF COLUMBIA LAW SCHOOL
AND THE EARTH INSTITUTE, COLUMBIA UNIVERSITY

Renewable energy integration: Background



- 🔥 Power arrangements
 - 🔥 Roadblocks
 - 🔥 Trends/Drivers
 - 🔥 Methodology
 - 🔥 Literature review
 - 🔥 38 Case studies
 - 🔥 53 Interviews
 - 🔥 Target audience
 - 🔥 Host Governments
 - 🔥 Mining companies
 - 🔥 Independent Power Producers
 - 🔥 Donors
- } Technical
Expertise
Financing
Regulatory
Interests/incentives

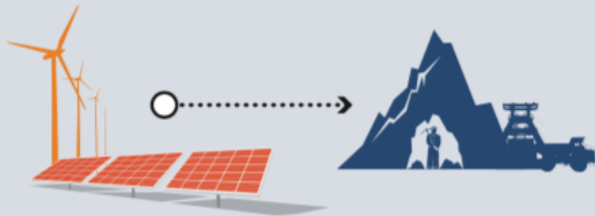


Renewable energy sourcing arrangements

1

SELF-GENERATION

The renewable energy project is built by mining company to serve operations.



2

POWER PURCHASE AGREEMENT

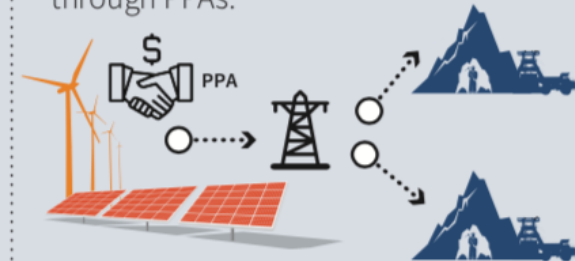
The mine contracts the energy from an independent Power Producer through a PPA.



3

INDUSTRIAL POOLING

Independent Power Producer supplies to several mining companies through PPAs.



4

ENERGY ATTRIBUTE CREDITS (EAC)

Mining company purchases credits produced by renewable energy power plants.



5

GRID CONNECTED SOURCING GREEN ENERGY

Mining company buys green premium products or pays green tariffs to utility.



Source: CCSI (adapted from IRENA 2018).



Renewable energy sale arrangements

1

SELLING POWER INTO GRID

The excess capacity generated by the power plant is sold to the utility.



2

RE POWER INSTALLATION ON MINING CONCESSION

Independent renewable project is built on mining concession or rehabilitated mine site feeding into the grid.



3

ELECTRIFYING SURROUNDING COMMUNITIES

Off-grid renewable power project serves the mine site and/or surrounding communities.



Source: CCSI.



DeGrussa: Off-grid, Outsourced, Solar PV



Source: Sandfire.com

Exploration

Operation

Post Closure

Diavik: Off-grid, Owned, Wind



Source: Riotinto.com

Exploration

Operation

Post Closure

Kidston Mine: On-grid, Outsourced, Solar PV & Pump Storage, Feeding the Grid

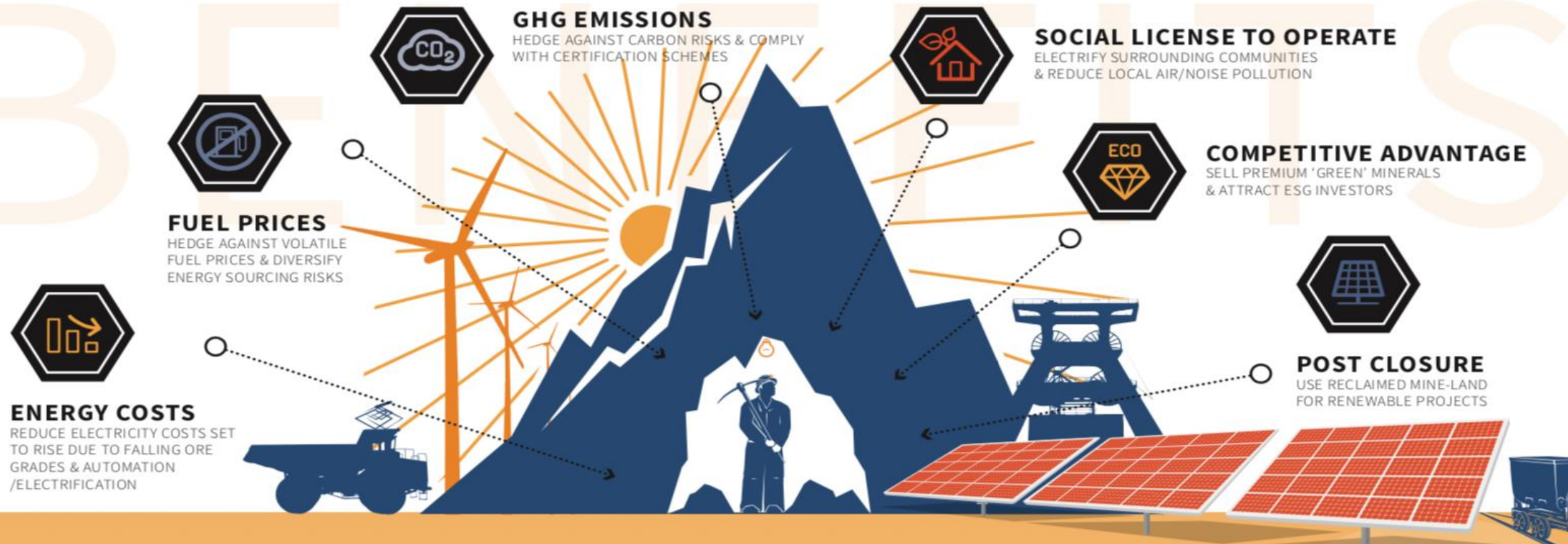


Source: genexpower.com.au

Exploration

Operation

Post Closure



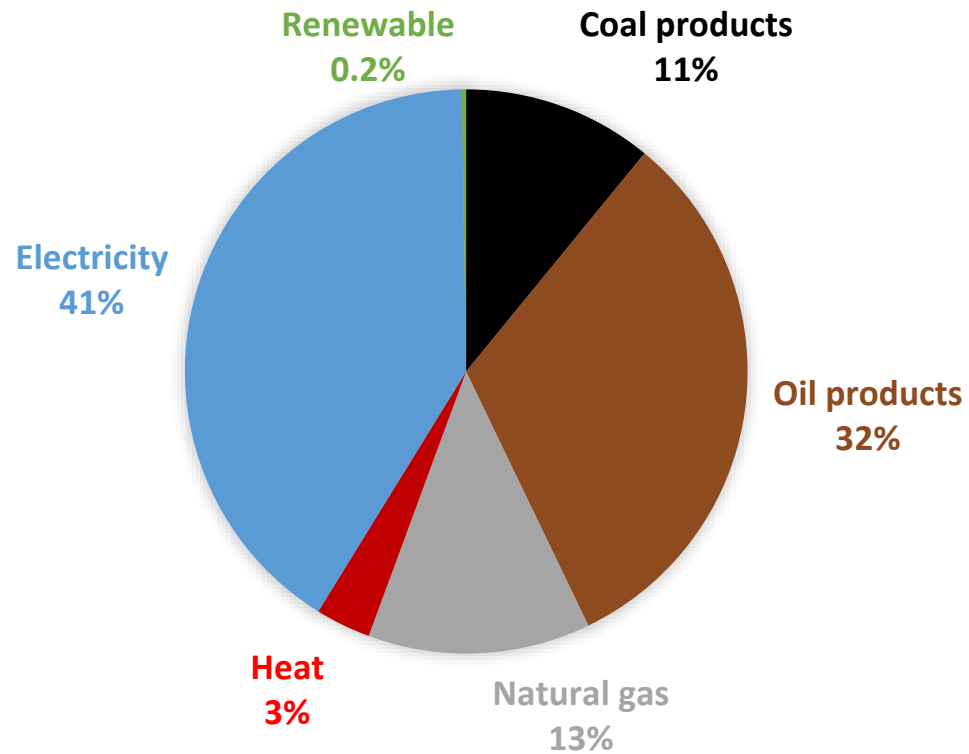
THE RENEWABLE POWER OF THE MINE

ACCELERATING RENEWABLE ENERGY INTEGRATION

	TECHNICAL	EXPERTISE	FINANCING	REGULATORY	INTERESTS
ROADBLOCKS	<ul style="list-style-type: none"> Intermittency vs low tolerance for power supply disruption Location constraints 	<ul style="list-style-type: none"> Inexperience Complexity Accountability 	<ul style="list-style-type: none"> Up-front capital costs Cost for IPPs Life of mine vs long off take time Donor support 	<ul style="list-style-type: none"> Fossil fuel subsidies/tax exemptions National utility monopoly Insufficient renewable regulations Limited incentives or obligations 	<ul style="list-style-type: none"> Vested interests Lack of corporate operational incentives
TRENDS & DRIVERS	<ul style="list-style-type: none"> Electrification & automation Cost competitive Battery storage development Other renewable/storage solutions Modular Blockchain 	<ul style="list-style-type: none"> Lessons learned from successful examples NGO & government initiatives Donor support 	<ul style="list-style-type: none"> Rapid growth of financing solutions Insurance products Falling capital costs 	<ul style="list-style-type: none"> Near tripling of renewable-specific regulations in last ten years Carbon pricing initiatives 	<ul style="list-style-type: none"> Institutional investors Consumers & government Affected communities Standards & certification

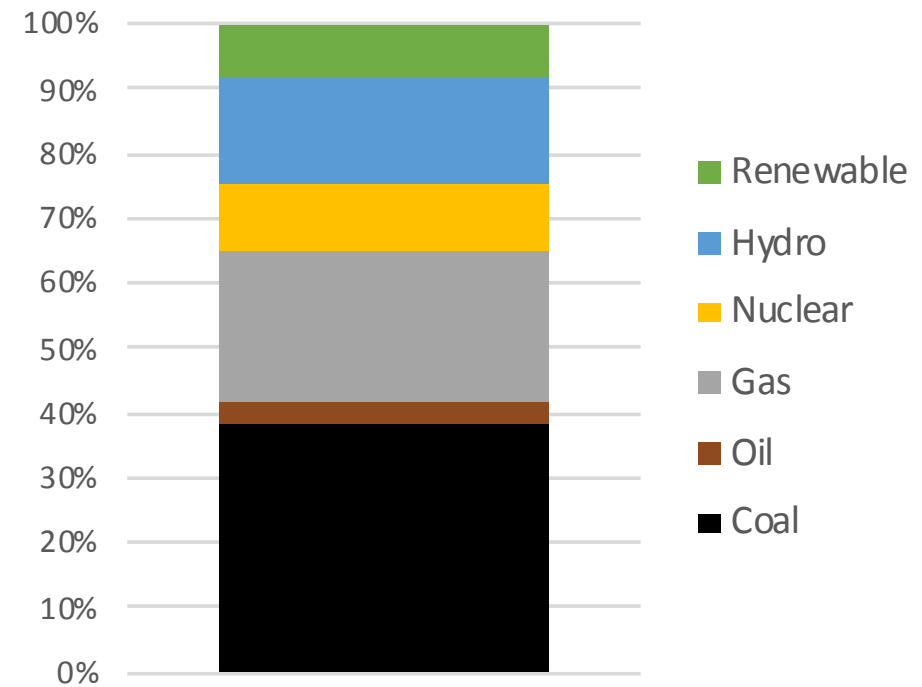
In perspective

ENERGY DEMAND MINING IN QUARRYING (2016)



Source: IEA

ELECTRICITY GENERATION MIX (2017)



Source: BP

🔥 82% of energy based on fossil fuels

🔥 Energy demand to increase by 36% by 2035

Roadblock: Interests/incentives



- 🔥 Government
 - 🔥 Appealing to voters
 - 🔥 Public utility
 - 🔥 Beneficiaries from incumbent system
- 🔥 Private sector
 - 🔥 First mover problem
 - 🔥 Corporate vs. operational incentives
 - 🔥 Contractors
- 🔥 Consumers?



Consumers?

Car Industry

Green credentials

Average lifecycle for car in US midwest



Production emissions (kg CO₂ equivalent)

12,204

8,190

4,752

Use emissions - 270,000km (kg CO₂ eq)

48,600

95,310

46,980

End of life emissions (excluding battery, kg CO₂ eq)

311

351

159

Lifecycle emissions total - 270,000km (kg CO₂ eq)

61,115

103,851

51,891

Lifecycle emissions per km - intensity (g CO₂ eq/km)

226

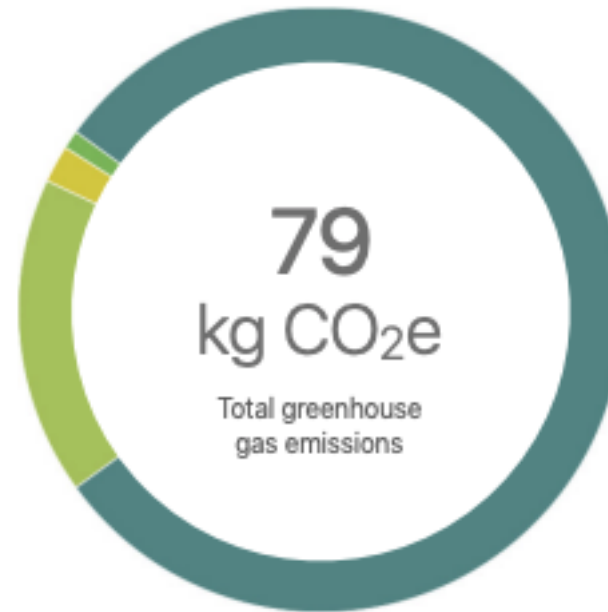
385

192

All data are based on vehicles driven in the US midwest
Source: Trancik Lab, MIT
© FT

Electronics

iPhone X



80% Production

17% Customer use

2% Transport

1% Recycling

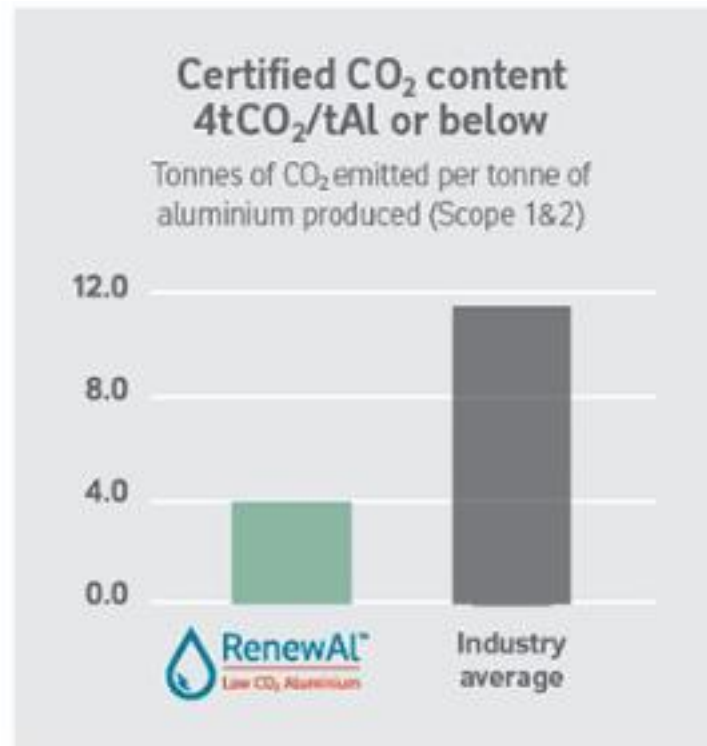
Renewable power



- Steel and iron materials 84,4%
- Glass/Carbon composites 7%
- Aluminium and alloys 1,1%
- Electronics/electrics 1%
- Copper and alloys 0,5%
- Lubricant and fluids 0,5%
- Polymer materials 5,4%
- Not specified 0,1%

85-90% of CO₂ emissions related to materials and suppliers (Source: Vestas)

Low carbon minerals at a price premium?



Customised services

- Certification** Third-party certified CO₂ emissions (Scope 1&2)
- Technical expertise** Assistance in leveraging low CO₂ aluminium
- Traceability** Product tracked from mine to metal
- CO₂ reduction strategies** Support to optimise your low CO₂ sources
- Life cycle analysis** Contribution to specific calculation on lifecycle
- Co-branding** Unique partnerships with RenewAl[™]

Source: Rio Tinto



Thank you!

www

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