2020 Energy and Mines Australia Summit: Juergen Zimmermann

Walk before We Run

How incremental mine hybridisation reduces project risks and improves the business case

POWERING GOOD FOR SUSTAINABLE ENERGY

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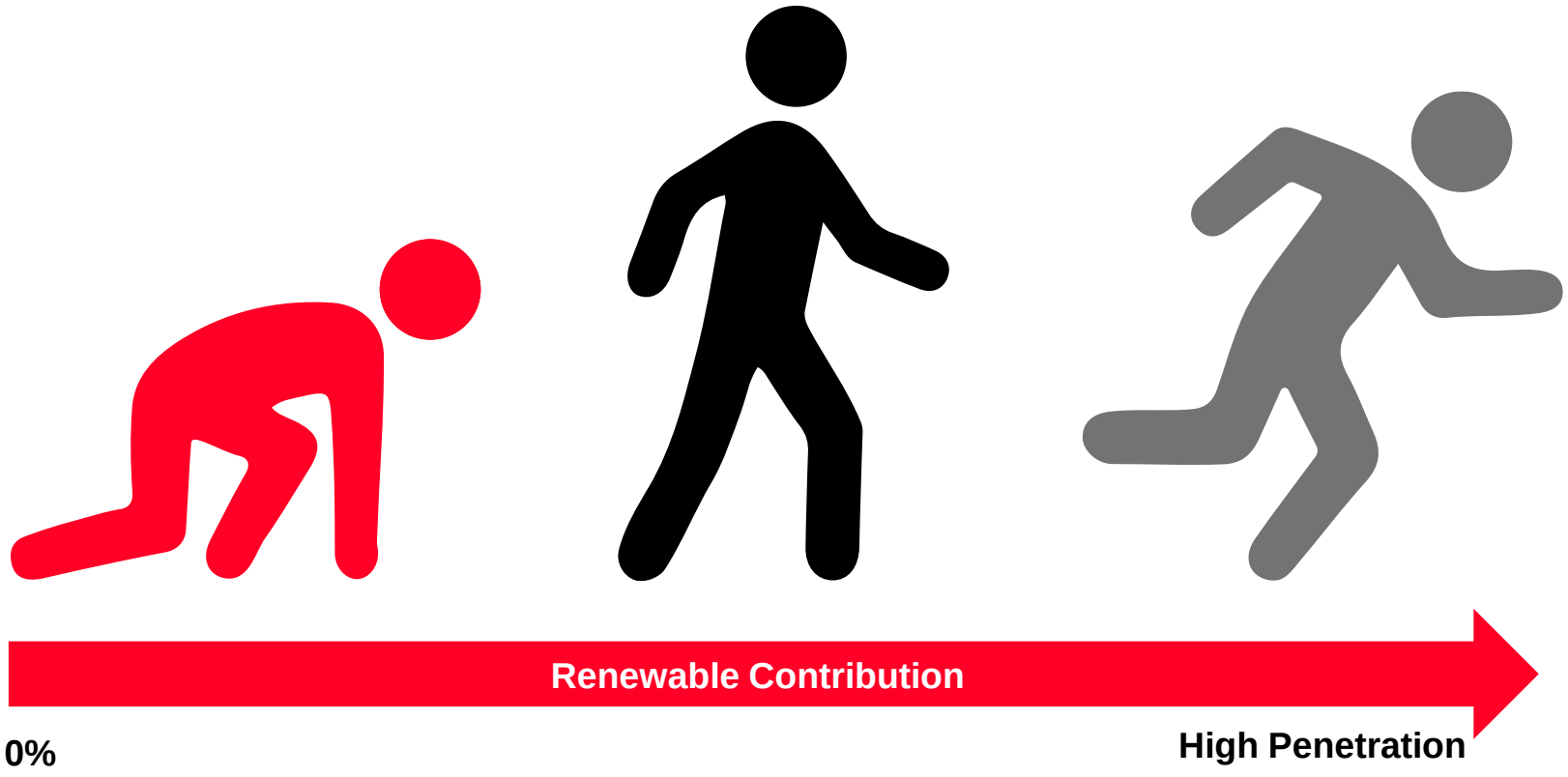
Walk before We Run

From fossil fuel powered to zero carbon emission operation

How to get started with mine hybridisation?

How to integrate with existing generation assets?

How to determine the right technology and contract model?



Mine Hybridization Project Lifecycle

How to make a start: Understanding business case drivers and managing project risks

Hitachi ABB Power Grids is an End to End Solution Provider

Concept → Pre-Feasibility study → Feasibility study → Detailed engineering → Supply → Installation & commissioning → Service & optimisation

Main business drivers

- Social & Environmental
- Economic & Operational

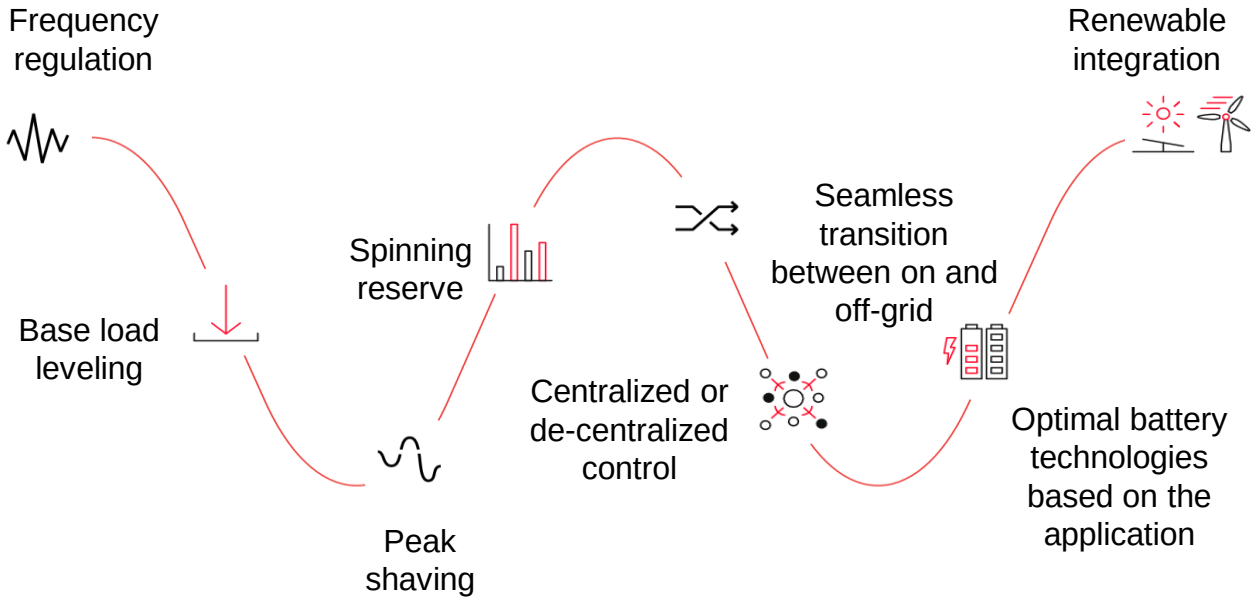
Data collection

- **Technical** Site conditions, solar, wind, generation and load
- **Financial** Subsidies, OpEx Costs, Fuel price

Analysis

- Technical viability
- Financial analysis

Business case



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Integration Technology enabling high penetration

Increasing renewable penetration requires enhanced microgrid control capabilities

Hybridisation Steps	Integration Technology	Energy contribution (Fuel/$ reduction)	Power penetration (At peak solar/wind)
Limited control/ basic fuel saving No Renewables control, **negative load**		**7-10%**	**20-30%**
Power control and optimisation **Controlling** renewables + generator		**10-15%**	**20-50%**
Power control and **forecasting** Controlling renewables + generator		**15-30%**	**50-70%**
Power control and **grid forming** Controlling renewables + generator + storage		**25-40%**	**100%**
Power control and **load management** Controlling renewables + generator + storage + load		**60-80%**	**100%**
Power control + **energy storage** Controlling renewables + storage + load		**100%**	**100%**

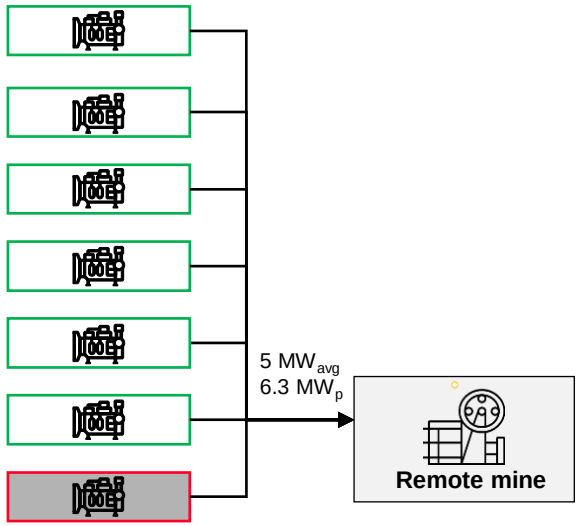
Broad range of technical solutions possible – design choice based mainly on economic criteria

Note: Percentages vary between wind/ diesel and solar/ diesel

Microgrid for Mining - Business Case

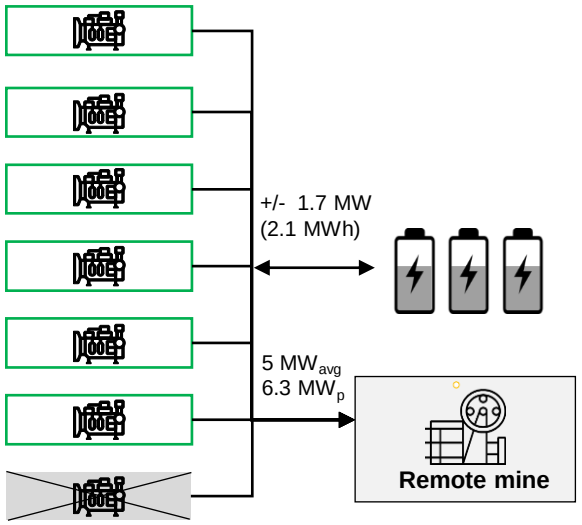
Incremental hybridization options analyzed

1. Base case – Diesel



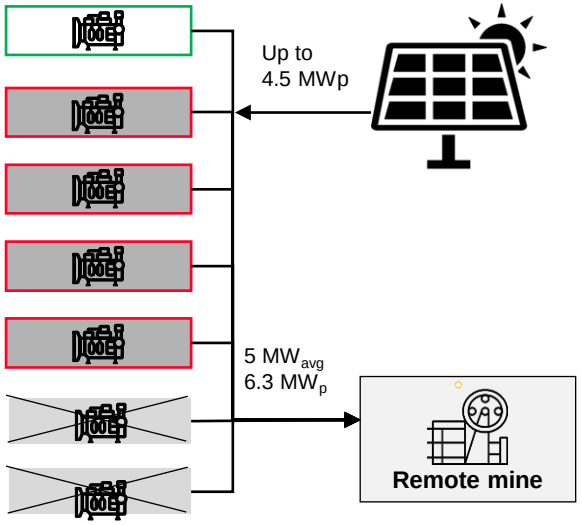
- 6 generator system (1.2 MW each)
- 1 generator equivalent required as operating reserve at all times
- All generators that are on typically operate at same level

2. Diesel + BESS



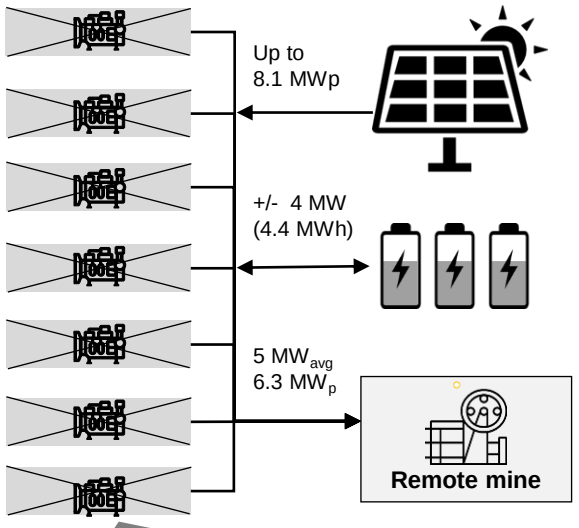
- BESS removes need for operating capacity
- BESS can also delay or remove need to start up a generator during short term peaks

3. Diesel + solar PV



- Solar PV size limited in this case due to generator ramping limitation
- Additional generators must stay online in case of shading for 75% of solar production (potential reductions when using advanced forecasting)

4. Diesel + BESS + solar PV



Generators can be off during daytime

- BESS provides required ramping
- During daylight hours all generators can be shut down completely

Genset status: On | On (For reserve) | Off

SOURCE: Based on Homer analysis using proprietary Homer Pro Software

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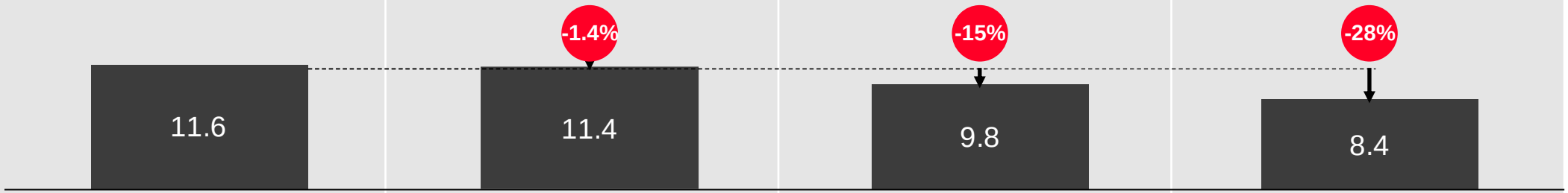
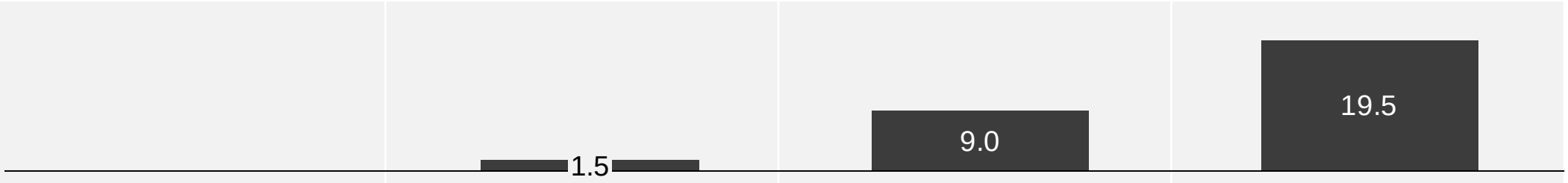
Microgrid for Mining – Business Case

Up to 28% reduction in fuel and CO2 possible when combining diesel with BESS and solar PV

	Base case – Diesel	Diesel + BESS	Diesel + solar PV	Diesel + BESS + solar PV
Fuel consumption (ML)				
Investment ($M)				
IRR (%)	-	36%	16%	16%
LCOE[1] ($/MWh)	304	296 (-1.4%)	289 (-5%)	273 (-11%)
Payback (years)	-	2.7	5.2	5.2

SOURCE: Based on Homer analysis using proprietary Homer Pro Software; all numbers in USD

1 LCOE: Levelized Cost of Electricity

Mining References in Australia

30+ years of building Grid Stabilising and Microgrid knowledge

2005

Leinster Nickel Mine

BHP

2MW 20MW

2016

DeGrussa Mine

SANDFIRE RESOURCES NL

4MW 20MW 16MW

2017

Roy Hill Mine

alintaenergy

35MW 40MW

2020

Carrapateena Energy Hub

OZ MINERALS

120kW 110kW 250kW 120kW

Technology evolved from off-grid to grid-connected Microgrids

Vertical Integrated End to End Solution from 100kW to 100MW

Applications
SaaS Apps for improved performance

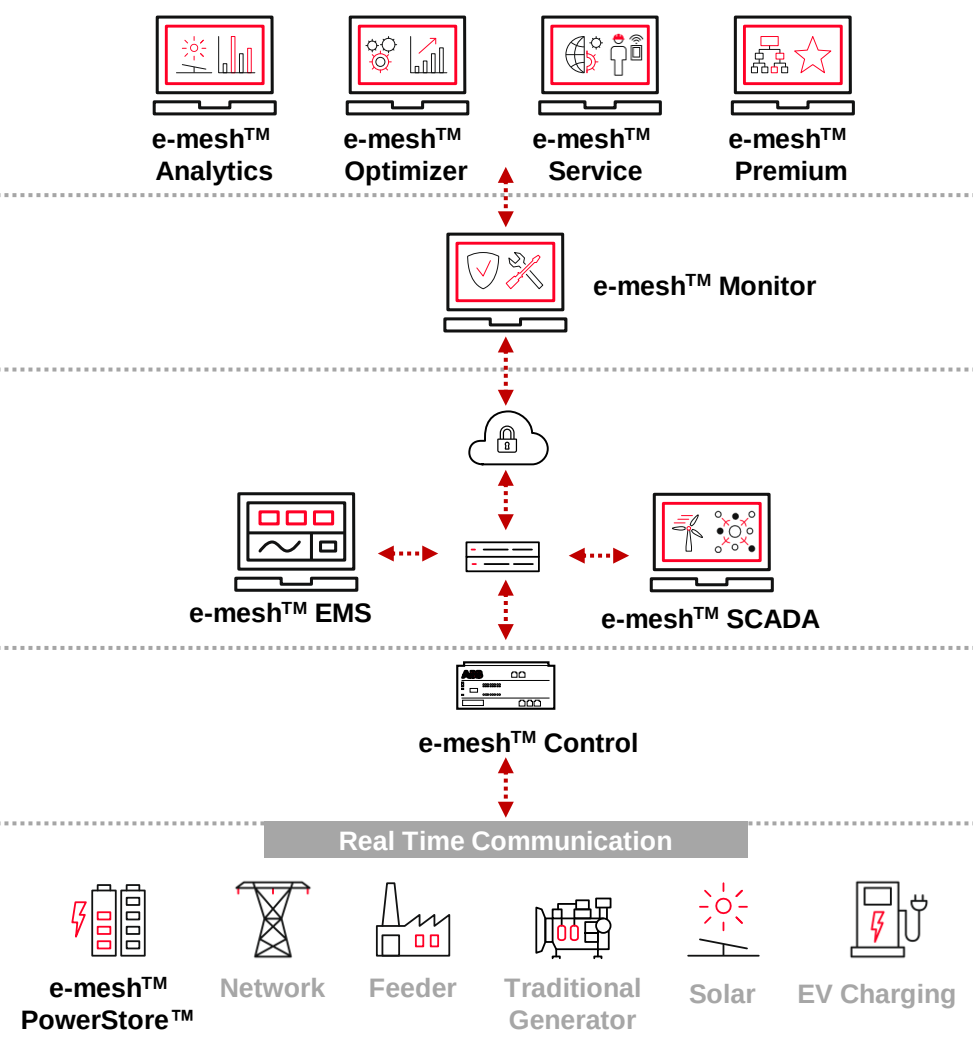
Monitor
Cloud enabled remote monitoring and control

EMS
On-premises energy management solution

SCADA
On-premises plant automation solution

Control
Intelligent and efficient power management

PowerStore
Grid Stabilizing & energy storage solution



In the cloud

- Energy forecast, production and optimization planning
- Business KPI dashboards and reports
- Improved productivity and profitability

- Monitoring and control
- Bi-directional data flow
- Remote access

- Monitoring & control
- Optimal energy production
- Operational & maintenance cost reduction

On premises

- Renewable power generation grid code compliance
- Network voltage control
- Feeder & Load demand management

- Smart battery energy storage solution
- Support for various applications including islanding, seamless transition, black start, spinning reserve, etc.

SaaS: Software as a Service

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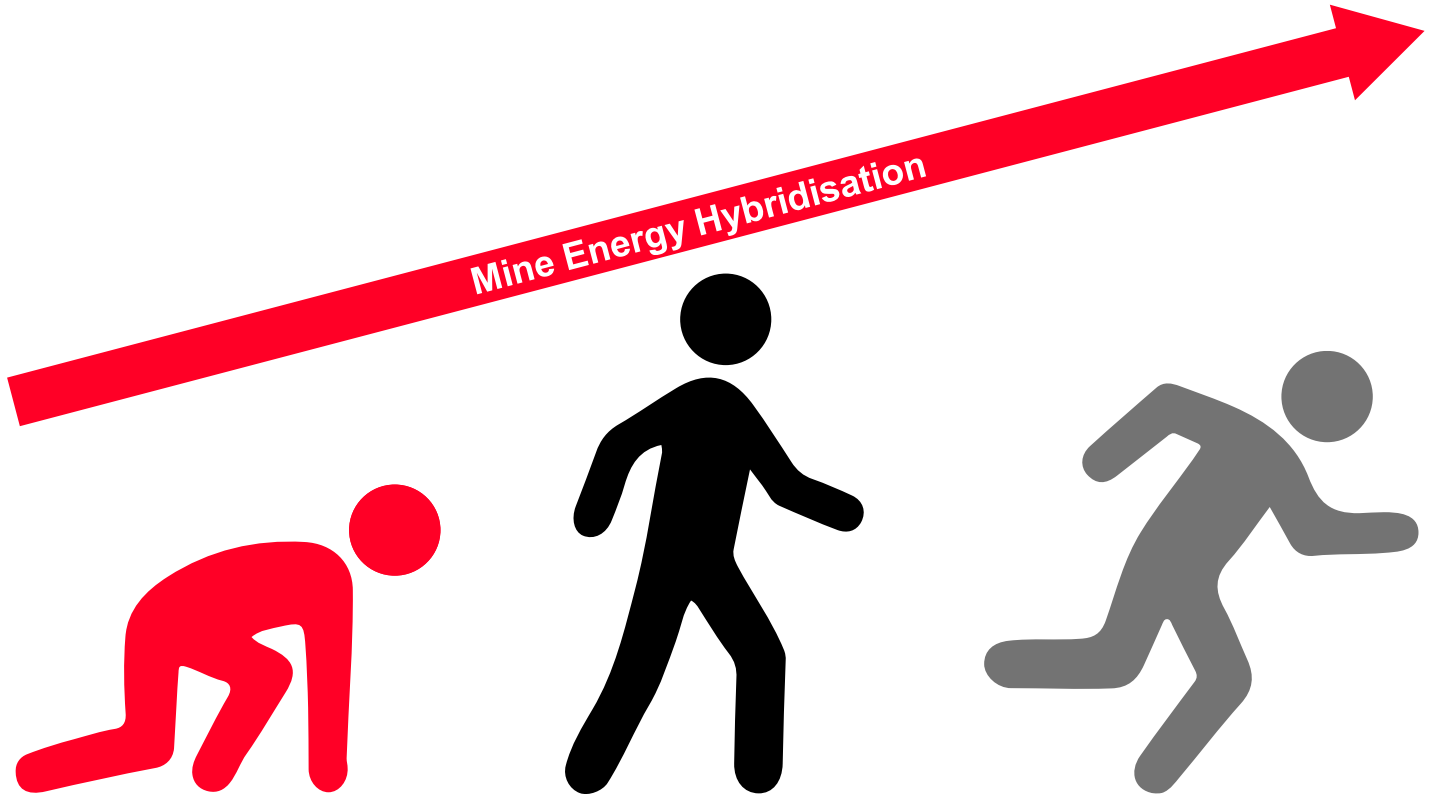
Incremental Mine Hybridisation

Key takeaways

Pathway to reduce energy cost and lower emissions

- **Unsubsidised business cases** highly depending on site conditions and mine life
- Mature integration technology allows seamless and **vendor independent integration** into brownfield sites
- **Begin with Spinning Reserve** and Finish with High Penetration Renewables
- Grid Connected Mines: Be **aware of grid connection requirements** for renewables
- Maximise opportunities for **mining process integration**



Get in touch with us

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To know more about our solutions, please visit:

https://go.hitachi-powergrids.com/grid-edge-solutions

If you've any specific questions about our microgrid solutions, please write to me at

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Or visit our Virtual Booth and book a time.

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