Energy Diversification for Mining

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Energy Diversification for Mining

- The Economics
- The Technologies
- The Drivers

Reducing Project Power Cost with Renewable Energy

Presenter : **Rob Lydan**

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What is Renewable Hybridization?

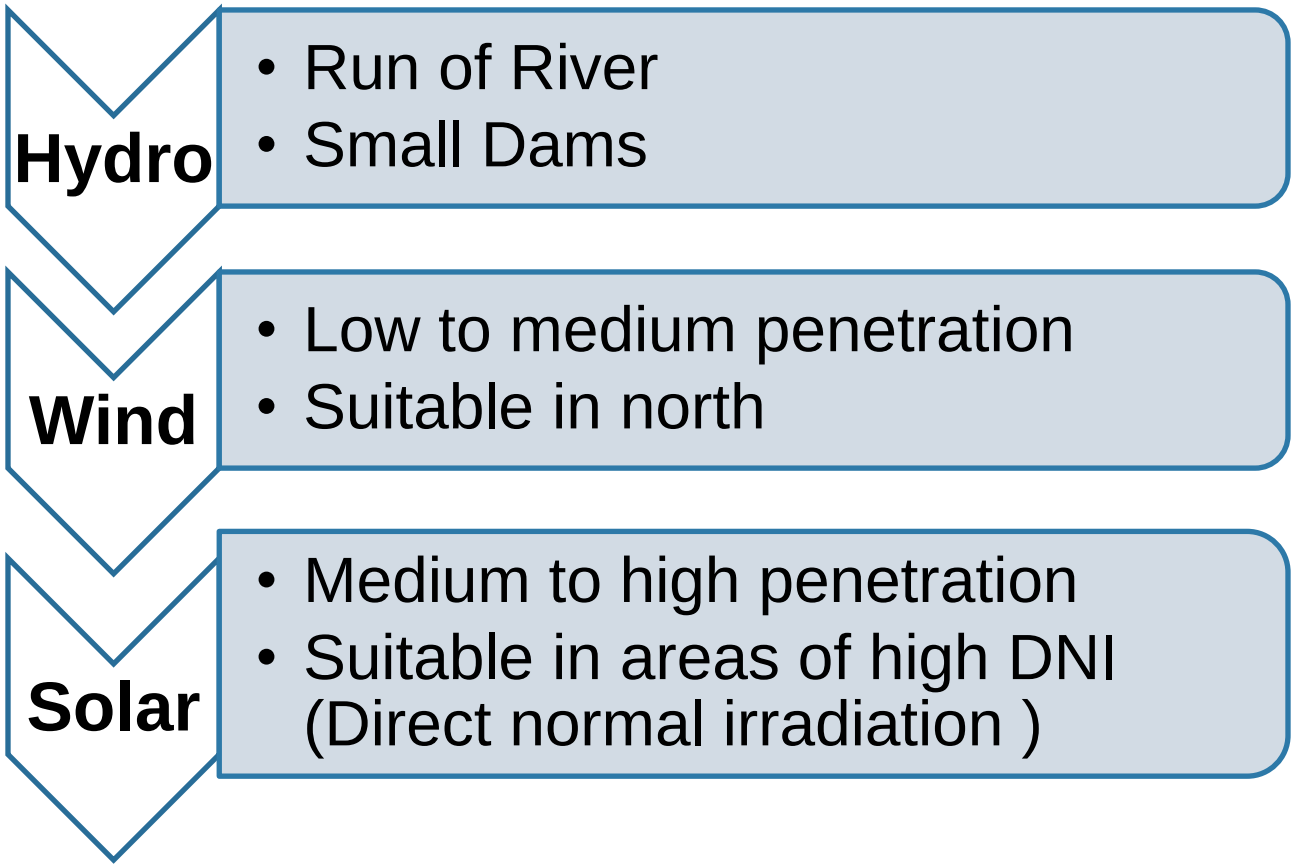
It is:

- The addition of a supplemental renewable power generation source to a new or existing fossil fuel generation set
- Marketed to mining and resource based ventures connected to captive generation sources

It is not:

- A competitor to fossil fuel CAPEX
- A threat to the consistent power production.
- Green washing

Technologies



Primary Value Proposition

Renewable power is not only an attractive social and environmental benefit to our clients but also a significant economic benefit.

Having identified the underlying economic case, this discussion centers upon the mechanism to commercialize.

Why?

Energy from renewable sources is cheaper than the L.C.O.E. derived from the singular input of fuel cost, HFO and LFO.

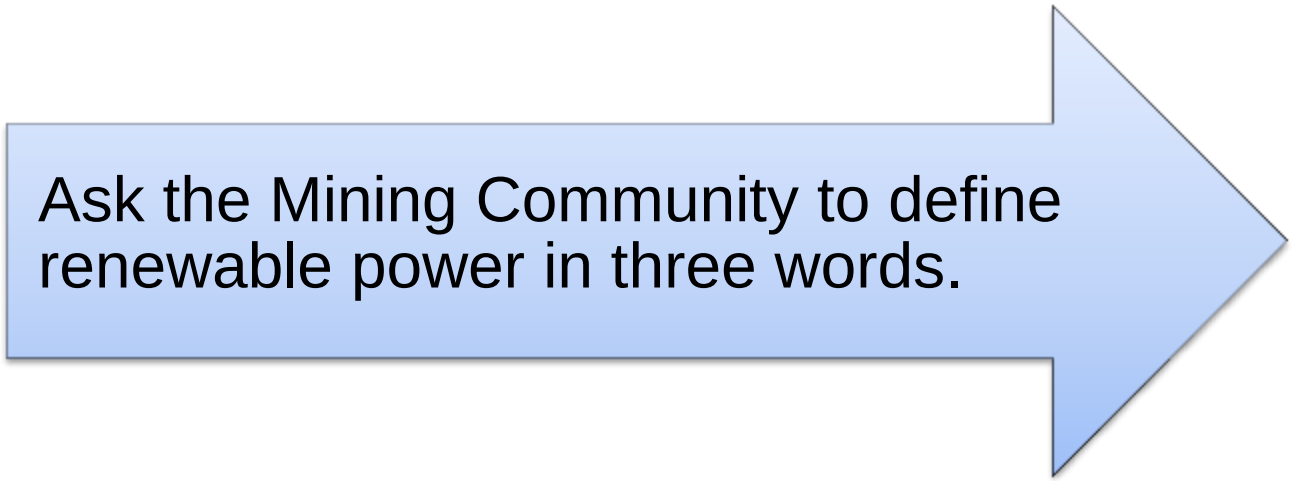
Intrinsic Value Proposition

Obvious benefits we know:

- Environment stewardship
- Optics and green energy participation

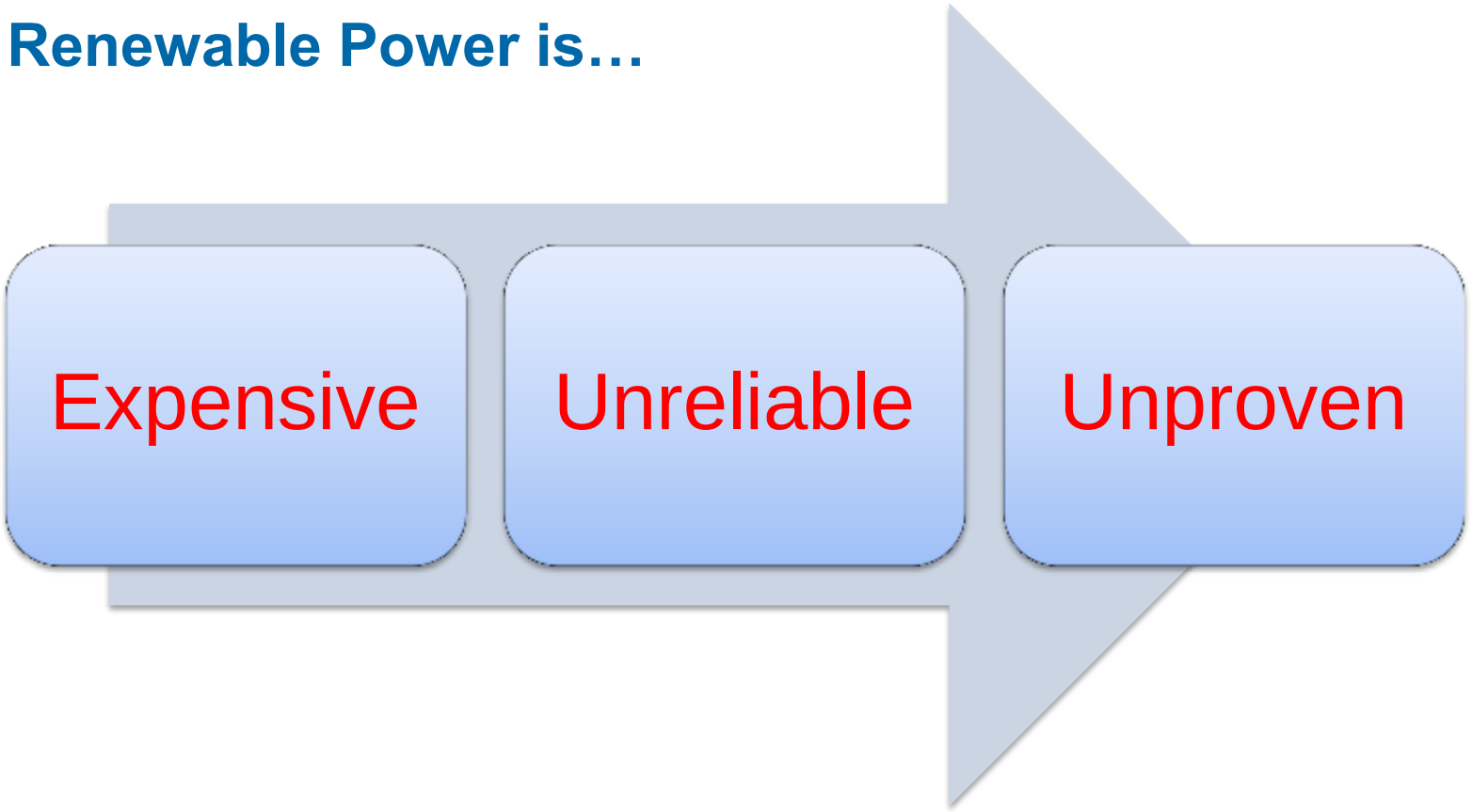
- **Latent community impact:**
  - Renewable power assets outlive the economic life of the mining / resource process and form a legacy contribution to the community
  - Economic diversification occurs as energy production assets create sustainable and differentiated employment opportunities

Levels of Resistance



Levels of Resistance

Renewable Power is…



Levels of Resistance

Expensive

Liquid Fuels costs for off grid installations are $.28 to $.32 / kw/hr. Solar energy is $.17 kw/hr wind is $.14 kw/hr.

"Integration costs are unmanageable and poorly understood." Truth is the integration is manageable utilizing existing interface technology combined with appropriate process knowledge.

In Fact

Renewable power projects have relatively high capital cost when compared to conventional generating methods.

Mining clients prefer a high, variable and long-term fossil fuel cost to the relatively high upfront CAPEX of renewable.

Levels of Resistance

Unreliable

"The sun doesn't shine all the time, the wind comes and goes." ***Whilst that's true the predictability of the resource and penetration levels proposed form no risk to power reliability.***

"My process plant will experience transients and disruptions rendering the saving null." ***Integration strategies for renewable power are built around the dynamic response model for the mine. Not as a burden to it.***

In Fact

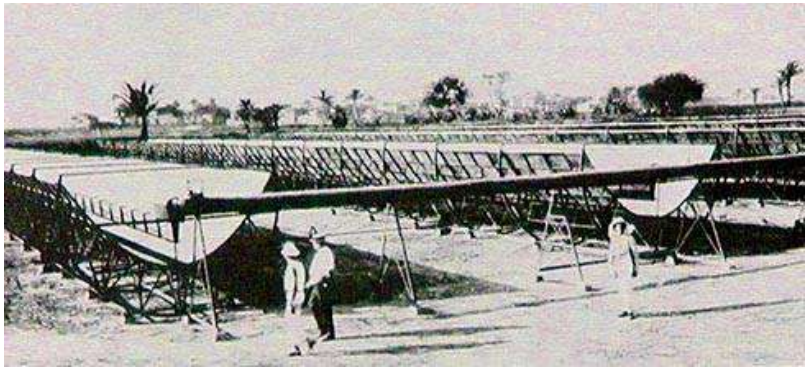
"Renewable power project performance is so well understood that risk premiums associated with their adoption in utility markets are lower than risk premiums in mining projects."

Levels of Resistance

Unproven

"The technology is changing all the time." ***Technology evolves and costs fall but we know today that in the not distant future renewable power will become a normal, expected component of the energy mix for remote projects.***

"I don't see this being used elsewhere. " ***You will see in the variety of the presentation from Hatch and others that adoption is growing and lessons learned are shared.***

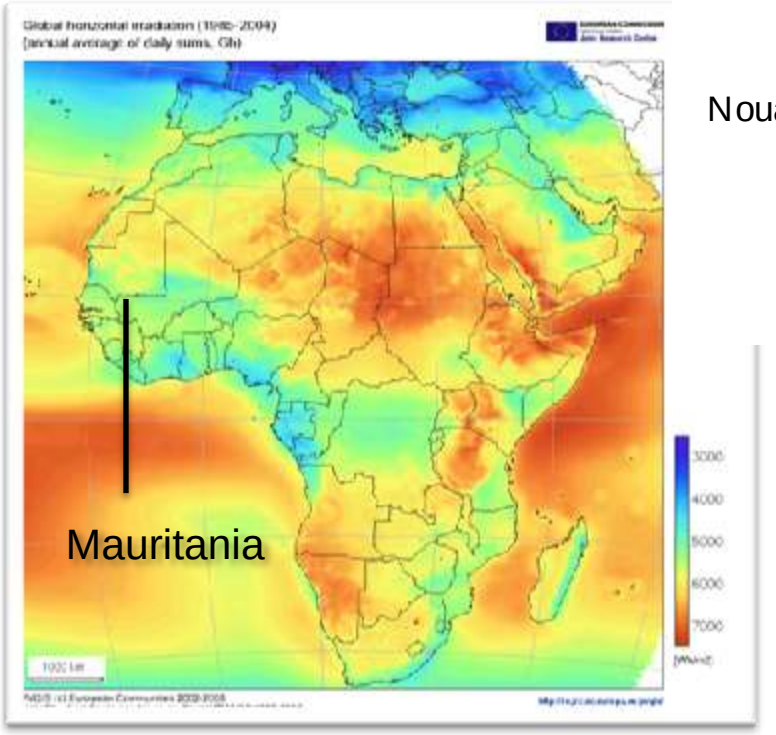


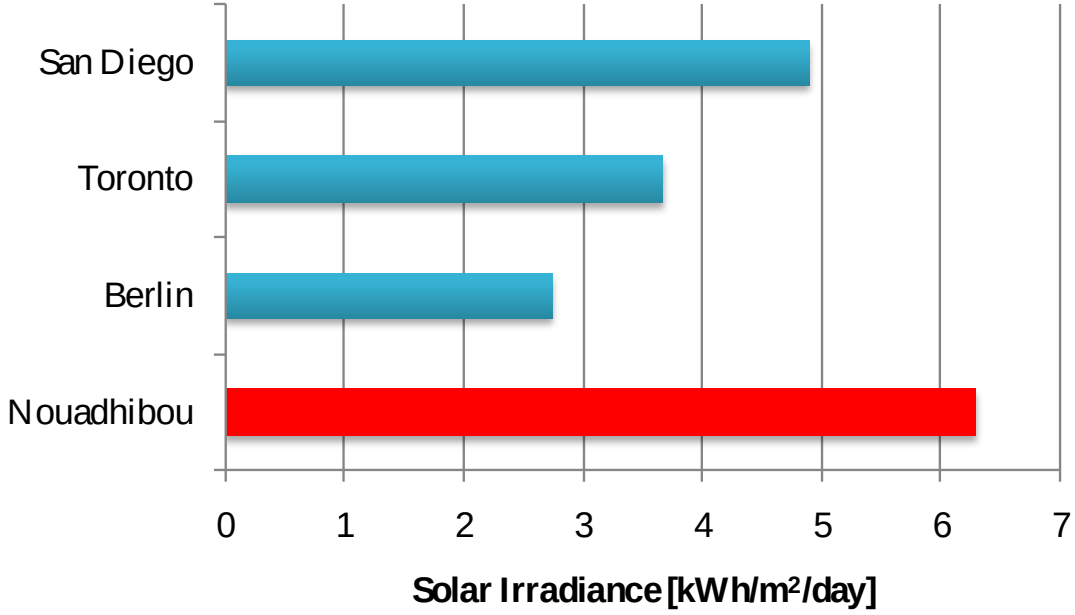
Frank Shuman Array 1912 Egypt

In Fact

The Renewable power technology proposed is the same utilized in commercial utility interconnection. Solar , Wind and Hydro are historic sources of power. Diesel is the new technology.

Example case





- Project mine is expanding
- Power requirements of ~130 MW
- Current base case for generation is heavy fuel oil (HFO)-powered generators
- 20 year life
- Hatch has been asked to investigate solar as a possibility

Examples – Punta Colorada, Chile

- Barrick Gold Corp, the world's largest gold miner, built $70M Punta Colorada wind operation, the first wind farm built by a mining company in Chile.
- The site has 10 turbines now generating 20 MW of energy, with capacity to expand to 18 turbines, producing 36 MW of electricity, or enough power for 20,000 homes.
- The operation connects to a substation that supplies energy to Chile's national power grid. Barrick is credited for the power it contributes to the system.

Examples –, Veladero mine Argentina

- At 4,110m ASL the highest turbine in the world
- Supplies up to 20% of the mine's load
- DeWind D8.2-2 MW - $8.5M

Examples – Diavik Diamond Mine NWT, Canada

- First large scale wind farm in Northwest Territories
- Four 2.3 MW turbines
- Offset about 10% of diesel fuel costs
- Reduce CO_2 emissions by 12,000T
- Offset 4M litres of diesel fuel
- $31M CAPEX
- $5M/year savings

Examples – Suncor-Teck, Wintering Hills, Canada

- Owned by two large mining companies: Suncor and Teck
- 80 MW wind power project
- Located near Drumheller, AB
- 52 GE 1.6-MW turbines
- Hatch-led construction management through an integrated team approach

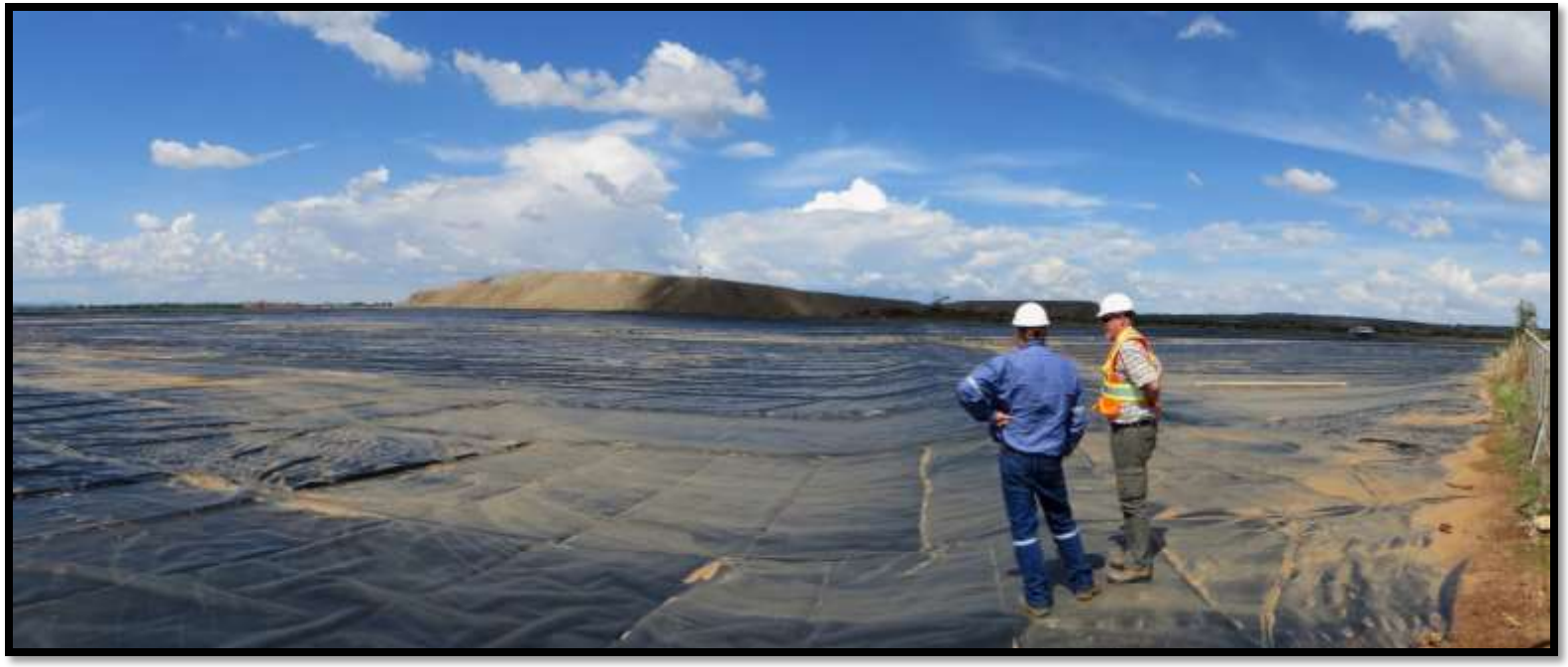
Examples – Taconite Ridge Wind Energy Center, Minnesota

- The 25 MW facility produces enough wind energy to power about 8,000 homes annually
- Located on property owned by United States Steel Corporation near its Minntac mine in Mountain Iron, MN.
- 2.5 MW turbines supplied by Clipper
- CAPEX $50M

Examples – New Caledonia –Nickel

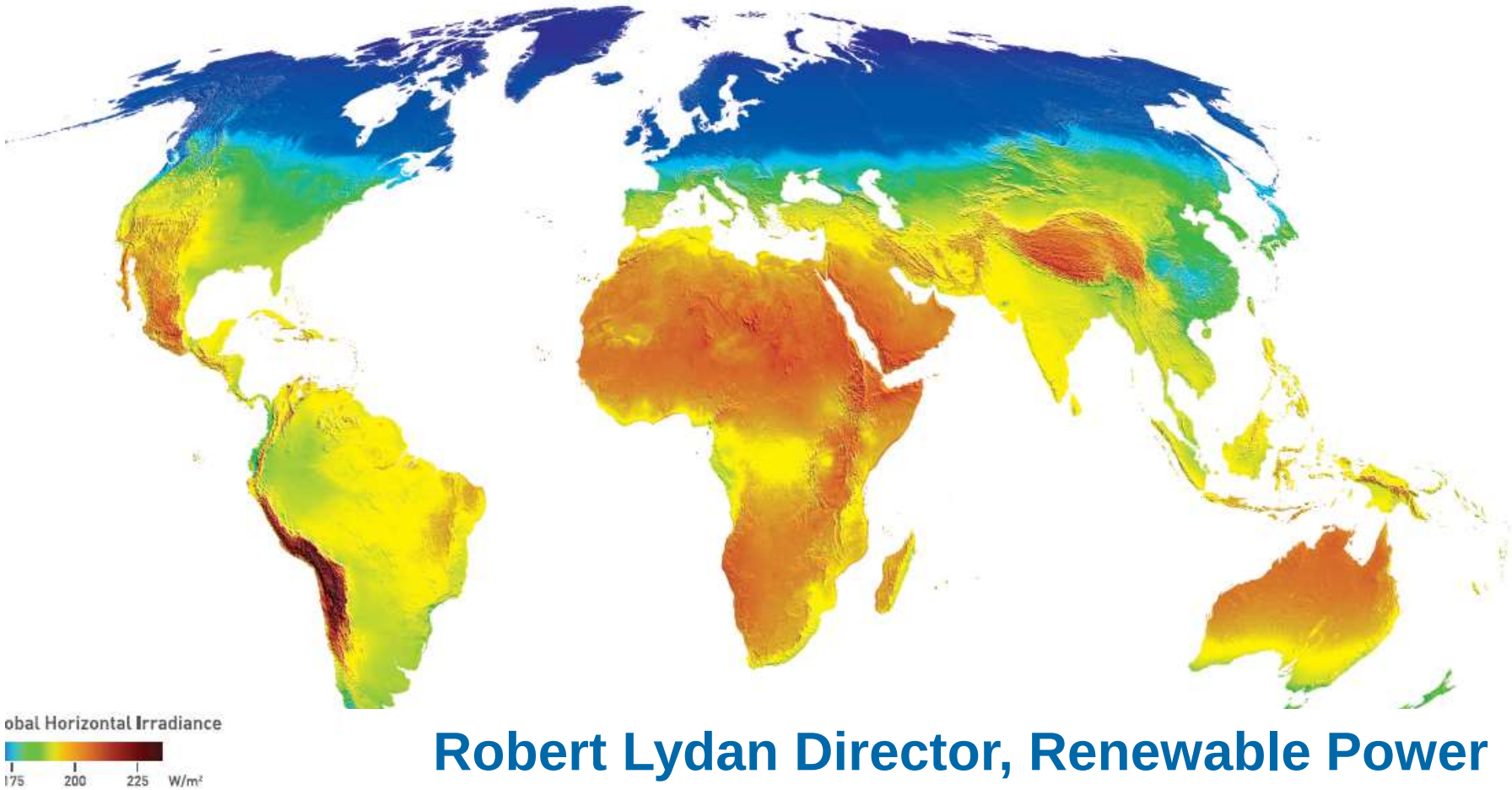
- Renewable power is a significant source of electricity in New Caledonia
- Two-thirds of the country's total power production is consumed by the metal industry
- 78 per cent of New Caledonia's power production comes from fossil fuels
- 60 wind turbines installed in the Southern Province, overlooking the construction site

Study Bugwazi Gold (Africa Barrick Gold)



The site has space, sun and 20 MW of load. Hatch had the responsibility to provide feasibility studies and recommendations.

Questions?



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