

HYBRID POWER FOR MINES

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WEBINAR Q&A

QUESTION	ANSWER
Do you know what is the mean lifetime of a mine? And the mean for a small artisanal mine?	Mine life or life of mine are widely used terms in the resources industry to determine the future operation of a mine. Mine life are usually based on proven reserves.
For the future electric only mine scenarios, with a lifetime of only 5 years, have you assumed a positive asset value at the end of the PPA term - including valuing of the batteries after the mine life?	The scenarios for possible future developments of hybrid systems for mines calculated the payback period in years, based on comparable cost of electricity from fossil fuels. Residual asset values are indeed relevant for PPA tariff calculations but were not taken into account for the payback period simulation.
How have you factored the remaining technical lifespan of the PV system (20+ years) into your business model, after the "initial" 5.5 years commercial life?	The DeGrussa project had to achieve financial hurdle rates within the 5.5 year supply period, while supply extensions and a remaining asset value provide additional value to the investor.
Why not thin film deployed at DeGrussa as such high ambient temperatures?	The decision on module technology is driven by various criteria, which are specific to the current state of technology and solar module pricing. juwi has reaslied several hundred MW using thin film technology. In the last years however crystalline modules have expanded their dominance while reducing the temperature advantage vs certain thin film technologies. Crystalline module technology also provides a lower overall technology risk, due to the standard design and being interchangeable between suppliers. Thin film technology today, on the other hand, is highly supplier specific and seems to often result in a higher price of electricity. The highest output at DeGrussa with the best load demand coverage could be acheived with a tracking system using crystalline solar modules. Higher efficiency crystalline solar modules and the pricing of these resulted in best system performance and lowest cost of electricity as compared to thin film modules.

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Is this hybrid system now considered as technical proven technology = bankable?	The project included a project financing, rigorous technical, legal and commercial due diligence by multiple parties and has therefore been bankable.
Long term cost savings were discussed but not really beyond a few years, I'd be interested in finding out whether these take into consideration life span of the technology itself, how long do solar panels and batteries tend to last? And do they lose efficiency over time?	The time horizon chosen for savings calculation was based on mine life rather than on design life of components. Solar modules have power output warranties for 25 years, mounting structures also have a design life of 20+ years and power electronics can operate for more than a decade. In most cases there will be a remaining asset value because mine life is usually shorter than the design life. Solar and Wind power purchase agreements in grid connected applications are normally 20 years or longer.
How is the LCOE calculated? Is it fossil cost per kWh + renewable cost per PPA?	LCOE can be calculated incorporating all generation sources or for individual generation sources. For DeGrussa the solar battery hybrid system LCOE were calculated as well as the Diesel LCOE.
Thanks for an interesting and compelling discussion. While probably relatively minor, I understand that dust is a problem in typical mining environments. Have the yield losses of dirty panels been modelled into your assessments ... and the costs (financial and environmental) of cleaning + water usage.	Yes our yield assessment has taken soiling (dust on solar modules) into account. This is a site specific metric. We also include module cleaning options at intervals that provide value versus the costs for module cleaning.
Has a study been activated on using flow batteries and High power batteries within the same site (or system)?	We are considering both battery technologies. It is conceivable to use both technologies in one system, but we have not seen it being used anywhere so far. Lilon technology has managed to reduce costs per kWh at a rate that remains competitive or is lower than flow batteries. Battery system costs vary significantly depending on the purpose/application of the project. As a pioneer in driving solutions towards 100% renewable energy, we remain interested in both battery technologies. juwi therefore believes that future cost reductions of batteries are a key enabler for a sustainable, reliable and affordable power supply with 100% renewable energy.
Solution to awkward grid utility suppliers to cover PV instability.	Hybrid systems provide a viable alternative to unreliable grids as well as the ability to stabilise grids. We are keen to support interested industrial energy consumers as well as utilities, IPP's and power network operators to improve reliability and economics for power supply and grid stability with renewable energy.

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Does the mine incur any upfront cost, or is the full cost of financing amortised into the cost in the PPA?	A mine does not have to incur any upfront cost but simply signs an energy supply agreement. If a mine owner prefers however to own a power station then juwi is able to provide EPC offers as well.
In the Africa case study you presented, there is no battery storage. What is the hybrid functionality in this case. Is it not a simple grid-tied PV system?	The Africa case study does not contain a battery but simply hybridises the existing grid power supply with solar power generation behind the meter. For a stable grid this is often the most economic configuration. If the grid would be unreliable or the customer would want a back up solution, it would be possible for the system to be changed to include back up functionality that includes a battery system.
How is the PPA structured?	The PPA enables the mine to receive reliable solar power without any upfront investment. Details of power purchase agreements are subject to the specific project requirements.
Would you think that biogas could be also a good device to electrify mines in the future ?	<p>In the case of DeGrussa there was no relevant bioenergy resource available while the solar resource is viable and consistent. Therefore bioenergy was not an option for the DeGrussa project.</p> <p>Biogas requires stable feedstock and operation conditions to operate commercially, due to the high sensitivity of the microbiology to the feedstock. Where sufficient volume and uniformity/homogeneity of the feedstock can be guaranteed - biogas can be a viable option, but this is often not available or the risk of changes to the feedstock composition is too high. juwi has experience in biogas projects and would be able to offer this technology if appropriate for the project - however we have not yet found this to be a viable option for off-grid mining projects.</p>
Mines in USA using electric plant. Size of load haul trucks?	There are mine operations in the USA that are converting to all electric operations right now. We cannot comment on the size of haul trucks used there.