

# NEW RENEWABLES PROJECTS FOR MINES

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Case studies from 2017 projects from global mining leaders including:



By John McCloy, Energy and Mines

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As concerns over energy security and costs grow, the mining industry is increasingly prioritising the hybridisation of renewable energy sources with its traditional means of power generation. As recent projects show, renewable energy allows miners to address key concerns over fuel transportation costs, grid instability and power reliability for off-grid sites. It also assists in fulfilling sustainability and social license goals which are becoming increasingly important for the global resource sector.

A number of new projects from major miners and mid-tier companies demonstrate the viability and rising popularity of renewables hybrids for mines. As the case studies below show, the addition of renewable energy can have wide-ranging fiscal and ecological benefits.

In all cases, the integration of renewable energy is predicted to lead to reduced fuel costs. A lowered dependence on fossil fuels is critical at a time when the oil market is increasingly volatile. B2Gold's solar project for its Otjikoto mine is a prime example of how significant fuel savings from renewable energy can lead to increasingly quick project payback times.

The addition of a green energy solution to IAMGOLD's Burkina Faso mine will reduce Essakane's carbon emissions by 255,000 tonnes over 15 years. GMA Garnet's Port Gregory wind and solar farm will see the company stabilise its energy supply for the mine, while also reducing its carbon footprint by roughly 5,000 tonnes of carbon dioxide per year.

Both IAMGOLD and B2GOLD have plans use their plants to produce renewable energy after mine shutdown, leaving a lasting positive legacy in the local community. In committing to a renewable energy agenda, these mines will benefit from reduced fuel costs, reliable power generation and enhanced corporate social profiles.

## Australia's GMA Garnet: 70% Renewables to Power Mine

GMA Garnet, the world's largest industrial garnet producer, has partnered with Advanced Energy Resources (AER) to develop an AUD\$8 million renewable energy plant at its mine near Port Gregory in Western Australia. The mine has signed a long-term power purchase agreement (PPA) with AER which will be constructing a 3 megawatt wind and solar farm, as was announced at the Energy



Source: GMA Garnet

and Mines Australia Summit this past June. A 2.8 MW battery inverter will provide network support and output smoothing. AER will be the sole renewable energy supplier on-site and will manage the project construction along with all contractors and vendors.

The project demonstrates GMA's strong commitment to sustainability and is part of its move to 100% renewable power. Through the project, the mining giant is expected to reduce its carbon footprint by roughly 5,000 tonnes of carbon dioxide per year.

"Sustainability of our business and the environment we operate in is an important area of focus for GMA," comments Grant Cox, GMA Garnet's Chief Financial Officer. "Moving to renewable energy as the primary source of

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electricity for our operations in Port Gregory contributes towards our goal of minimising our environmental footprint.”

The second consideration is the weakness of the existing electricity network. “The GMA site is 120 kilometres from the substation, very close to the end of the system,” observes AER Managing Director Luca Castelli. “The network is very weak, prone to faults and highly unreliable.” Improved continuity of electrical power supply, alongside reductions in the cost of providing electricity to the plant, were vital factors in GMA’s decision to go ahead with the hybrid plant.

Currently, the project is in pre-construction, with AER progressing network connection approvals, planning permissions and finalising the wind and solar farm’s design. With construction slated to begin early 2019, the major challenge so far has been in producing a PPA that meets the needs of both parties.

“What we’ve encountered in discussions with other mining companies, is that short mine lives can make long-term PPAs difficult to enter into,” reports Castelli. “If there is a 5-year mine life and a requirement for a traditional PPA length of 15 to 20 years there is a real disconnect between the requirements of the project developer and the miner. In AER’s case, securing mining customers with a long mine life and niche output commodities with low price volatility can mitigate most of these issues.”

Fundamental to the successful adoption of

this project are advances in battery technology. Battery storage allows electricity suppliers to avoid the variability of energy output associated with renewable energy. It also functions to facilitate network connection through integration with traditional power station control systems and can provide on-demand network support.

“I believe we will see renewable energy projects progressively become the norm, with project economics improving as a result of advances in the industry,” notes Cox. “In particular, I think accelerating development in battery technology will lead to companies increasingly becoming energy self-sufficient and using 100% renewable energy sources.”

**Realizing the Benefits Solar at Essakane: IAMGOLD**

As part of their progressive sustainability agenda, IAMGOLD Essakane SA has signed a 15-year power purchase agreement (PPA) with EREN Renewable Energy (EREN RE) and its partner African Energy Management Platform (AEMP). This deal will see a 15 MW solar farm, costing more than \$20 million, built to complement the existing heavy fuel oil (HFO) power plant at IAMGOLD’s Burkina Faso mine. The technology group Wärtsilä has been contracted for engineering, procurement, and construction (EPC) and operation and maintenance (O&M) after installation.

“Essakane’s 15 MW solar plant in Burkina Faso will be integrated with the existing 55



IAMGOLD's Essakane Mine  
Source: IAMGOLD

MW thermal power plant, making this one of the largest hybrid solar/thermal projects in the world,” reports Stephen Letwin, President and CEO of IAMGOLD.

“The use of solar energy will reduce Essakane’s carbon emissions by 255,000 tonnes over 15 years, it will save on energy costs, and will be our legacy long after we are gone, as the community will be left with a low-cost power source,” he adds. “By the early part of the next decade, we are targeting to have 15% of our energy generated from renewable sources. Our decision to go with solar was driven by our commitment to corporate social responsibility (CSR) and the location of Essakane in an extremely remote region of the world where the national electricity grid is 330 km away.”

The solar plant will be added to 11 generators, allowing them to switch off one or sev-

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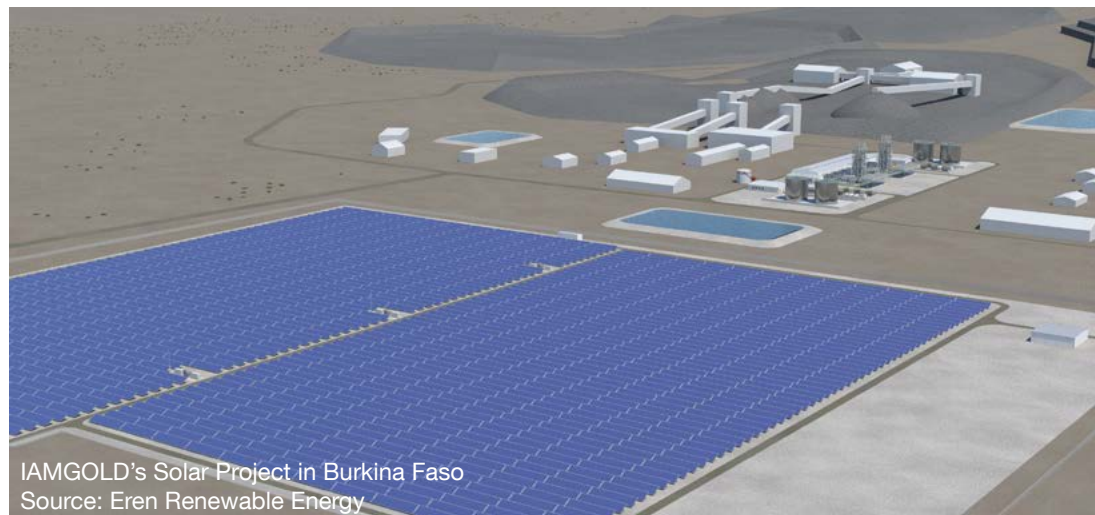


eral engines during the day when the solar power plant is producing electricity. "The key is to integrate photovoltaics (PV) in such a way that we don't decrease the availability of energy to the mine," notes Jérôme Jouaville, African Business Development Manager for Wartsilä. "Reliable power generation is crucial in this situation, so we need to make sure that the system is stable when we integrate the PV into the mine's microgrid."

Currently, the project is still under construction. Leveling of the site is complete, and a drainage system has been added. The arrival and installation of the equipment are expected to begin within a month, commissioning and operation, however, are not due to start until early 2018.

One of the initial challenges in the development of the Essakane plant has been financing the project. "This is a new line of business and the largest solar-diesel hybrid plant in the world, therefore we were among the first to discuss this type of projects with international financing institutions," comments Christophe Fleurence EREN's Vice-President of Business Development in Africa. "The timeline of any power project for a mine is critical as the length of mine is limited. We overcame this by starting the construction on EREN's equity, choosing to refinance the project after initial construction."

The successful development of the Essakane Solar project has been prompted by the close interaction and communication between the stakeholders. "A key attribute



IAMGOLD's Solar Project in Burkina Faso  
Source: Eren Renewable Energy

that allowed us to move forward was the relationship we have developed and built with IAMGOLD," continues Fleurence. "You really need to engage with the customer in detailed discussions about all aspects of the project to shape the right solution together and fully address his specific needs. It would be very difficult to make a project like this happen through a competitive tender in a pre-made format."

As the largest off-grid solar plant under construction for a mining customer, the Essakane plant demonstrates the benefits of integrating renewable energy into the mining industry. "We are looking to replicate this type of hybridisation, especially in Africa where the mines cannot rely on the national grid" notes Jouaville. "Renewable energy has the benefit of bringing both financial savings and enhancing the positive contribution of

the mines to the environment."

### Reducing Oil Price Volatility for a Namibian Mine: B2Gold

Namibia represents an ideal location for the integration of renewable energy into mining operations. Its solar resource is the second best in the world and mining operations in the area have traditionally had issues with power cost and supply issues.

"The energy challenge is not as severe as two or three years ago because a lot of our power is imported from South Africa and, whereas in the past they weren't investing in power plants and alternative energy, South Africa now has an excess of energy, mainly generated from green power initiatives," says Mark Dawe, Managing Director and Country Manager for B2Gold Namibia. "For

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– JÉRÔME JOUAVILLE,  
AFRICAN BUSINESS  
DEVELOPMENT MANAGER  
FOR WÄRTSILÄ

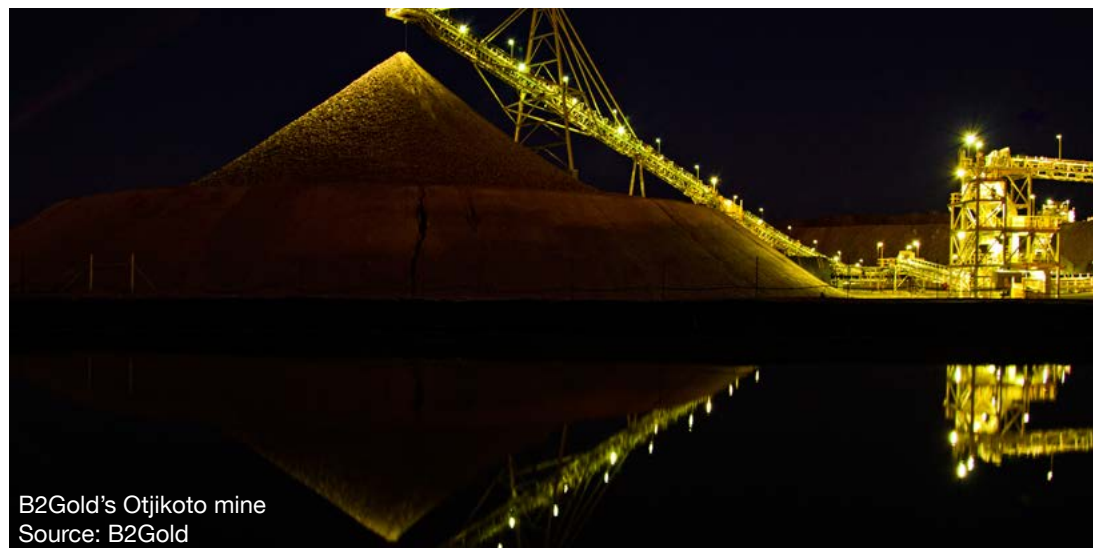


now, power constraints have eased for local mines, but energy remains very expensive.”

Oil price volatility continues to be a significant concern for the mine. The integration of a solar plant will reduce both fuel costs and the mine’s exposure to an unpredictable market. Both these factors contribute to a swift projected payback for the plant. Otjikoto mine will be producing for approximately ten years, and the project has a payback of just 4.3 years. “We carried out a lot of financial modelling and have a quick [project] payback,” says Dawe.

In addition to the obvious power supply benefits, the project is projected to contribute to the mine’s CSR initiatives. Plans are in place for B2GOLD to assist in the construction of a new national park in Namibia and may use proceeds from the solar plant to support this and other CSR projects. Additionally, the plant may continue to supply green renewable power to the community after the mine has shutdown. “This contribution alone will actually provide a massive contribution to the environment and the communities that depend on it,” Dawe comments.

Barloworld will oversee the installation of a full Caterpillar system, including PV solar modules and the microgrid master controller (MMC). The solar plant will serve to reduce the mine’s reliance on the existing HFO power plant. In addition to its role as EPC contractor, Barloworld will handle the labour requirements for the project.



B2Gold's Otjikoto mine  
Source: B2Gold

Currently, the project is still under construction. “According to the current schedule, installation should be completed in 2017 with only very little running into 2018,” notes Cobus Van Schalkwyk, Barloworld’s Operations Manager for Electric Power & Onshore Petroleum. “But then there is an extensive commissioning and optimizing process which will follow because this is a quite technical solution, being totally off grid and having quite a few different types of generating equipment connected to that same installation.”

One of the major hurdles faced in the implementation of this project was the complexity of interacting HFO generators, high-speed diesel generators and PV solar power. “Optimization of the solution is important because this is a fully automatic system,” comments Van Schalkwyk. “The system will determine

which of the generating methods is the best to use at any given point of time.”

In addition to the Caterpillar MMC managing the flow of power from every available source, including the main electricity grid, it will also allow for real-time collection and communication of on-site performance data that can be monitored and analysed remotely. Analysis of this data will provide further insights into the supply of continuous power at the lowest possible cost.

Moving forward, B2GOLD may look to add battery storage to their Otjikoto project to reduce the mine’s reliance on costly HFO generators. “The important thing is the spinning reserve on our engines,” comments Dawe. “If you can incorporate battery storage to overcome dips in the solar power sup-

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FOR ELECTRIC POWER &  
ONSHORE PETROLEUM,  
BARLOWORLD



ply as a result of a rainstorm or a cloud that comes past, you don't need to keep engines running to maintain a minimum spinning reserve. This alone will result in huge fuel savings as you can shut the engines down and rely on the batteries when the solar power lags behind the [power] demand."

### Tata Steel's First Solar Plant

Tata Steel India & SEA, in collaboration with Tata Power Solar and Tata Power Trading Company, have commissioned a 3 MW solar PV power plant at Noamundi to advance Tata's initiatives towards reducing its carbon footprint. The PV plant, estimated to cost \$5.5 million, will be the first renewable energy plant to be installed at an iron ore mine in India.

The project, which will serve Tata's captive requirement at its Noamundi mine, is located on a 19 acre site at a reclaimed mining hill. The site has a maximum potential power generation capability of 4.5 MW. In the event of a complete outage, it is also capable of synchronising with the existing distributed generation (DG) bus at the Noamundi processing plant.

DHYBRID, a Germany-based market leader for hybrid power generation and control systems, has been contracted to provide the UPP system that connects the newly constructed photovoltaic system with the existing diesel generators. Diesel, PV, grid power supply and all switching devices for the medium voltage systems are now fully automatic and ensure a stable power supply and



Source: GMA Garnet

maximum diesel fuel savings. In addition, a comprehensive SCADA monitoring and automatic fault detection system (DHYBRID WebPortal) has been installed.

"The project has been successfully put in operation and has been running smoothly since then," notes Benedikt Böhm, DHYBRID'S CEO. "The next step will be working on potential extension scenarios and possibly storage integration. Having the DHYBRID platform already in place, TATA is prepared to extend their plant in the future, irrespectively of manufacturers and technology."

Looking to the future, DHYBRID sees the integration of renewable energy for off-grid mines as the most practical solution to an unreliable power supply. "Since the beginning of DHYBRID, we always thought of re-

newable hybrid systems as professional and mature utility-grade solutions," continues Böhm. "The key to success is comprehensive technical design and planning. The better the planning and the technical considerations, the smoother the integration and operation of the hybrid system. The sum of that is, in the end, the valuable gain for our clients."

### A Bright Future For Renewable Energy for Mines

Advances in technology have made renewable energy sources an increasingly practical solution for the for the mining industry. Reduced fuel costs, reliable power generation and increased environmental sustainability are tangible benefits and will continue to accelerate the adoption of renewables for mines. ■

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- BENEDIKT BÖHM, CEO, DHYBRID



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