

# HARVESTING THE SUN. CUTTING COSTS IN MINING

**ARCON** SUNMARK



# SOLAR HEATING IMPROVES MINING PERFORMANCE

Every day the sun rises. Besides giving light and life, the sun produces enormous amounts of energy – and heat. Now you can benefit from harvesting the sun, turning it into stable and low heating costs. Arcon-Sunmark provides the necessary large-scale solar installations, which will make you independent of external energy suppliers. The sun is the cleanest energy source as it emits no CO<sub>2</sub> and provides a lot of other performance improving benefits especially for the mining industry. That is why we claim that the world's best energy is yellow and hot. It is cheap, it is clean and it is lean.

## CHEAPER

Over time, solar heating will generate the lowest possible heating costs. Hence, it will stabilize the price of your heating on a low level. While the cost of fossil fuel energy is fluctuating (and rising over a long-term period), the price of solar heating is fixed. And you will know all costs from the start, meaning that the price of a MWh can be fixed over a 25-year period. That is independence.

## CLEANER

The sun is the cleanest of all energy sources, and the most powerful source of sustainable energy. It emits no CO<sub>2</sub>. Furthermore it makes no noise, does not smell and does not harm the environment. Due to environmental regulations this will benefit you and provide future savings.

## LEANER

Even if you only have to find a piece of land to use for the installation and to enjoy the benefits, you should be aware that lean and effective installation of the perfect large-scale solar heating system demands expertise. Our many years of experience and countless references have given us a unique insight into the various stages in planning and installation of a system. We have optimized every single stage. From planning to financing, from construction to installation and to the perfect operations.

# PPA

Except from the land, we deliver everything. You will buy the heating from us and pay an agreed fixed price per MWh. The Power Purchase Agreement (PPA) is a long-term energy service contract. It guarantees energy provided at a certain price.



# INCREASE YOUR EARNINGS AND LOWER YOUR COSTS. IT'S POSSIBLE!

"You can't have both" is something we are often told. But in the case of solar heating, it is possible to have the best of two worlds. Solar heating is the perfect match for the mining industry as it helps to lower your costs and raise your earnings.

## BETTER PRODUCT QUALITY

Mining processes are energy intensive in their operation. One of the processes is electro winning (EW), where it is required to heat water or electrolyte solutions in order to optimize the process and thus to obtain high quality cathodes.

The technology behind solar heating delivers more stable temperatures, optimizing the EW process and thus a better product quality is obtained. Better quality leads to better prices and higher earnings. The stable temperature from solar heating is useful for: Production and purification of metallic and non-metallic salt, drying of concentrate, precipitate and salt, Iodine heap leaching, secondary and primary copper sulphides.

## CONTINUOUS SUPPLY

Solar heating offers independence from price fluctuations of fuel and interruptions of supply, e.g. due to strikes. The less interruptions, the more effective production and the higher earnings.

## LOWER PRICE PER MWH

One unit of heating delivered from the sun is cheaper than one unit of heating delivered from fossil fuels, like diesel. On the next pages, we will let you know all facts.

## PREPARED FOR REGULATIONS

The trend is moving towards increased regulations in favour of the environment. In Chile, mining companies will have an obligation to reach a share of at least 20% renewables by 2025 and further regulations are to be expected. This could be very expensive for the mining companies. A solar heating installation may act as an insurance towards more costs caused by legal regulations as it is the cleanest of all energy sources.

# WOULD YOU LIKE YOUR HEATING BLACK AND EXPENSIVE OR GREEN AND CHEAP?

When evaluating the price of energy, of course you need to compare to the alternative. As the price of fossil fuels is fluctuating over time, your savings from solar heating will fluctuate similarly. When you look at historical data, it becomes clear that, over time, the price of a MWh provided from clean solar heating is lower than the price of a MWh provided from diesel fuel. 1 MWh is 1 MWh. The difference is the color and the price.



## WORLD'S LARGEST COPPER PRODUCER BENEFITS FROM SOLAR HEATING

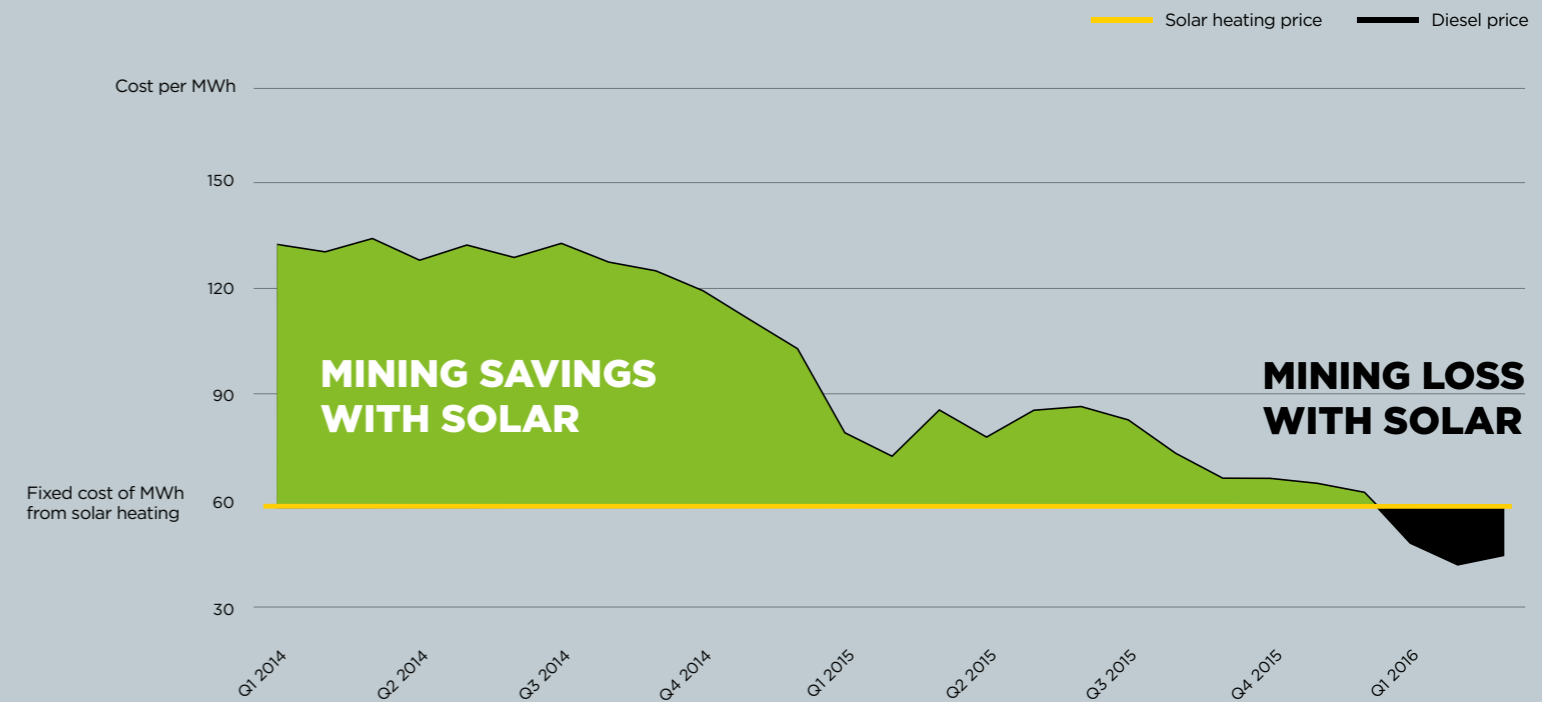
In 2012, Codelco, state owned corporation and world largest copper producer, signed a long-term agreement with Energia Llama and Arcon-Sunmark in regard to their Gabriela Mistral Division in the Atacama desert. Today 80% of the water required for the EW process is heated by the sun, thus avoiding the emission of 15,000 tons of CO<sub>2</sub> per year into the environment. The solar heating contract has meant a significant saving in energy costs for Gabriela Mistral Division, furthermore permitting independence from price fluctuations of fuel and interruptions of its supply.

“ Gabriela Mistral Division has endeavoured to be a benchmark in the mining industry and we work each day to reach and sustain it. Pampa Elvira Solar, the most powerful solar thermal plant in the world, is a proof of this.

*Nelson Salazar, Plant Manager, Codelco.*

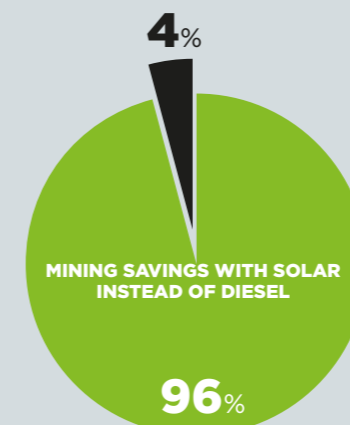
## SOLAR VS. DIESEL

Boiler efficiency at 63%

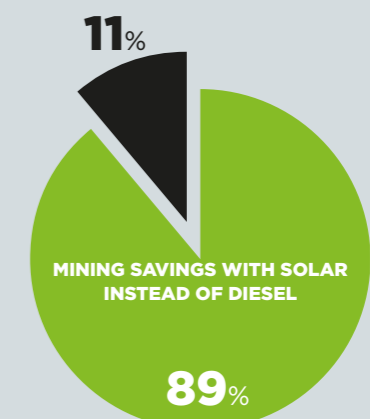


The higher the fossil fuel price, the more you save. Whenever the diesel price exceeds the fixed price of solar heating, the mining company is saving money. Even in a period of relatively low prices on fossil fuels, the sun wins the battle.

If we look at the period from January 2014 to March 2016, where the price of diesel has been at an unusually low level, solar heating has been the better alternative. Even if the boiler efficiency is 75%, the sun outperforms diesel with a factor 9 to 1.



Solar heating cost: USD 60/MWh  
Boiler efficiency: 63%



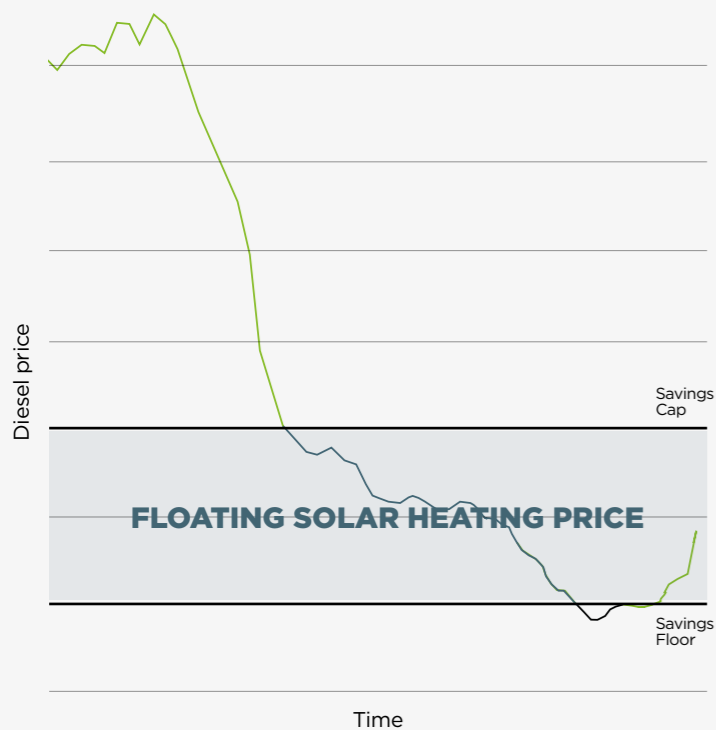
Solar heating cost: USD 60/MWh  
Boiler efficiency: 75%



# THE RISK OF NOT SAVING WAS LOW. NOW IT'S EVEN LOWER.

First things first: The risk of a mining company having too high heating costs is much higher when using diesel fuel, compared to the situation where the company is going for the solar heating solution. But as the price of fossil fuels is fluctuating, of course there will always be a risk that the diesel price could drop to a very low level. That's why we decided to lower the risk of not saving with solar heating - and almost eliminate it. With our 'floor and cap' model of a floating solar heating price, even the finance manager can sleep well at night. Let's look into the principles.

## FLOATING SOLAR HEATING PRICES LOWER THE RISK



Note: This is a simplified visualization of the principles behind the Arcon-Sunmark floor and cap savings model. Exact floor and cap levels and assumptions for the agreement are to be specified.

### FLOOR AND CAP SAVINGS MODEL

The Arcon-Sunmark floor and cap savings model provides protection against low diesel prices (reducing the comparative advantage of solar heating) and market volatility. Your solar heating price per MWh floats with the diesel market between an agreed-upon minimum price of diesel (floor) and a maximum price of diesel (ceiling or cap).

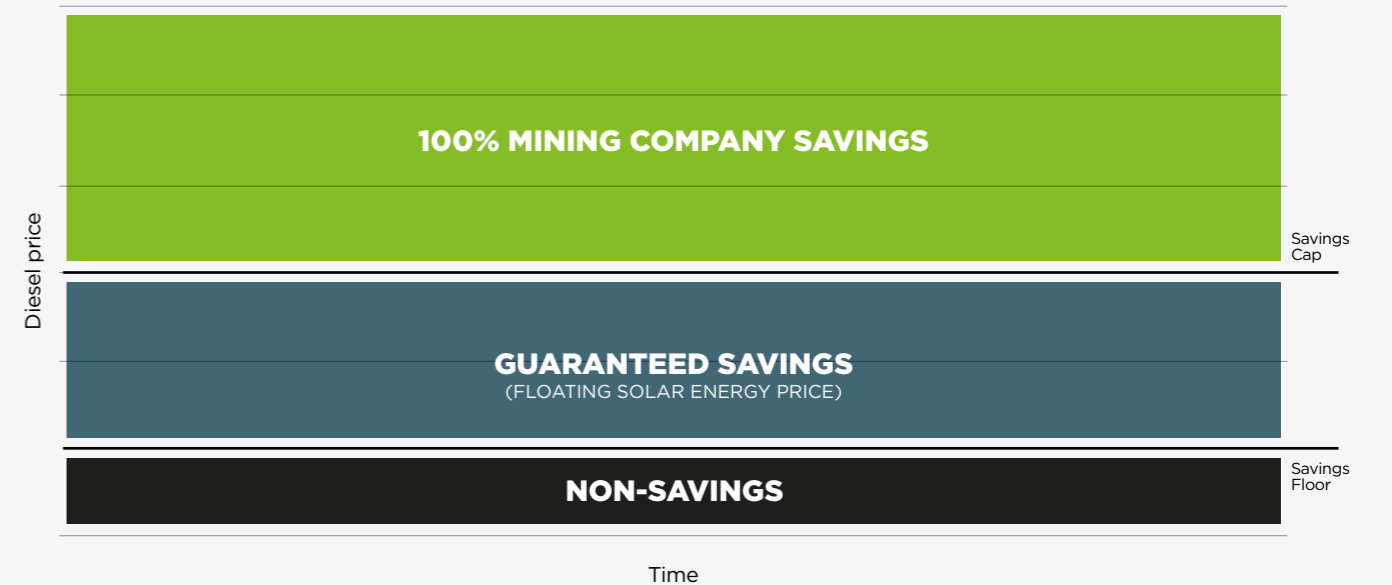
### SAVINGS FLOOR

If the diesel price drops to a very low level, where it normally would be beneficial for the mining company to use diesel instead of solar heating, we will lower our price of solar heating. The floating solar heating price will follow the diesel price down to a very low level, meaning that we put a guarantee on your savings to this level.

### SAVINGS CAP

If the cost of a MWh from diesel exceeds the regular price of a MWh from solar heating, you will share the upside with us - up to the level of what we call the cap. We think this is fair, as we help cover the potential risk of non-saving if the diesel price drops. Above the cap, the mining company takes home 100% of the savings.

## THE ARCON-SUNMARK FLOOR AND CAP SAVINGS MODEL



Note: This is a simplified visualization of the principles behind the Arcon-Sunmark floor and cap savings model. Exact floor and cap levels and assumptions for the agreement are to be specified.

# YOU MAKE THE SAVINGS. **WE TAKE CARE** OF THE REST

Planning

Financing

Construction

Installation

Operations

You only have to enjoy all the performance improving benefits, which arise from the use of solar heating. But you should know that it takes more than effective collectors to establish a solar heating plant. We are the experts, and we take care of all project stages. From consideration, planning, decision making and approval, financing, authority approval, earthworks and installation, to testing and commissioning. And of course we will follow up and perform service checks including onsite inspections to ensure optimum system operation. Together we can tailor the best solution individualized to fit your specific needs.

#### ABOUT ARCON-SUNMARK

No one knows more about large-scale solar heating plants than us. Since 1974 we have installed hundreds of thousands m<sup>2</sup> of solar collectors in a great variety of locations – and early 2016 our installations surpassed 1 million m<sup>2</sup> collector surface installed in district heating plants, breweries, mines and in the greenhouse industry. We have installed the largest solar thermal plants in Europe – and even the largest plant in the world. Our team has extensive experience in all aspects of solar heating plants.

- We have the most efficient solutions (including special desert collectors, a collector cleaning system and mining installation procedures)
- We guarantee the performance
- We have the references to prove our performance
- We deliver high quality, at low cost
- We are as solid and future-proof as can be





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