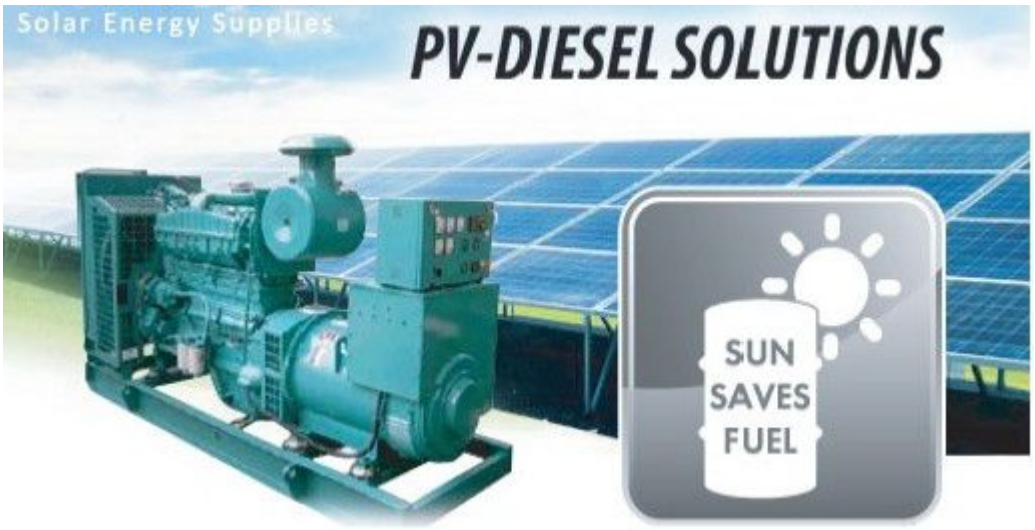


HOW SOLAR DIESEL HYBRID ENERGY SYSTEMS WORK AND ENFORCE HUGE FUEL SAVINGS IN YOUR COMPANY OPERATIONS

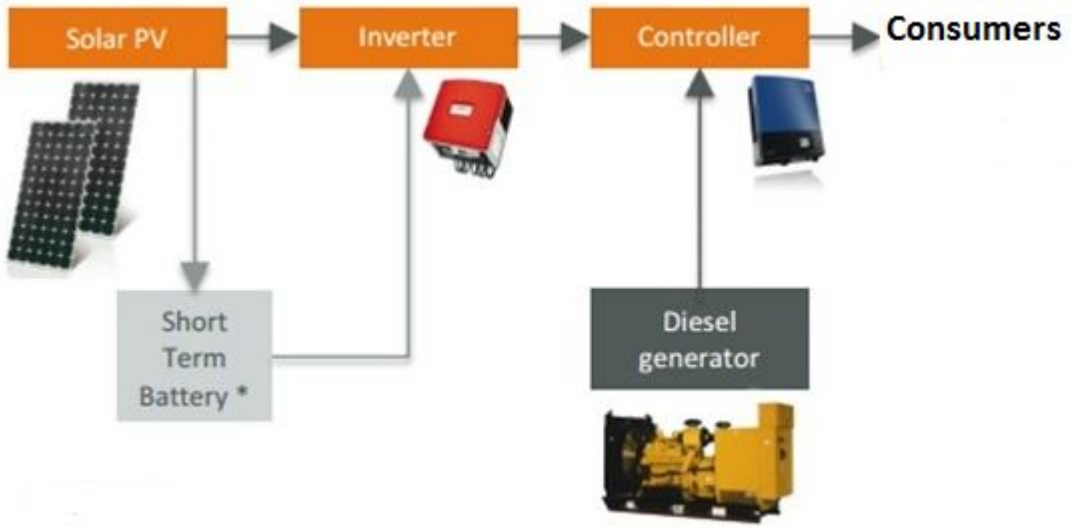
In remote locations, large-scale diesel generators are usually the most convenient way to generate electricity. But with rising and volatile fuel costs and increased concern about carbon emissions added on one side and the reliability required for power supply to sensitive manufacturing processes unavailable with the public grid (when accessed), the market is hungry for energy alternatives.

Solar panels require a significant up-front investment not readily available to many companies which moreover are not energy generation specialists. Beyond that many companies are not well informed on existing economical energy generation alternatives or don't understand how they technically work to provide appreciable financial advantages to businesses and boost their operational business ROI. This technical paper informs you and enables taking the decision.

The problem

While large-scale diesel generators are a convenient way to generate electricity in remote locations, diesel fuel has recently become increasingly expensive as fossil fuel prices are likely to increase further in the coming years. Moreover the emissions from generators engines are both a local health hazard and a global environmental risk. Fossil fuel power users are looking for a way to reduce diesel power costs and emissions with a cost-effective, clean and convenient alternative for a sustainable business operation.

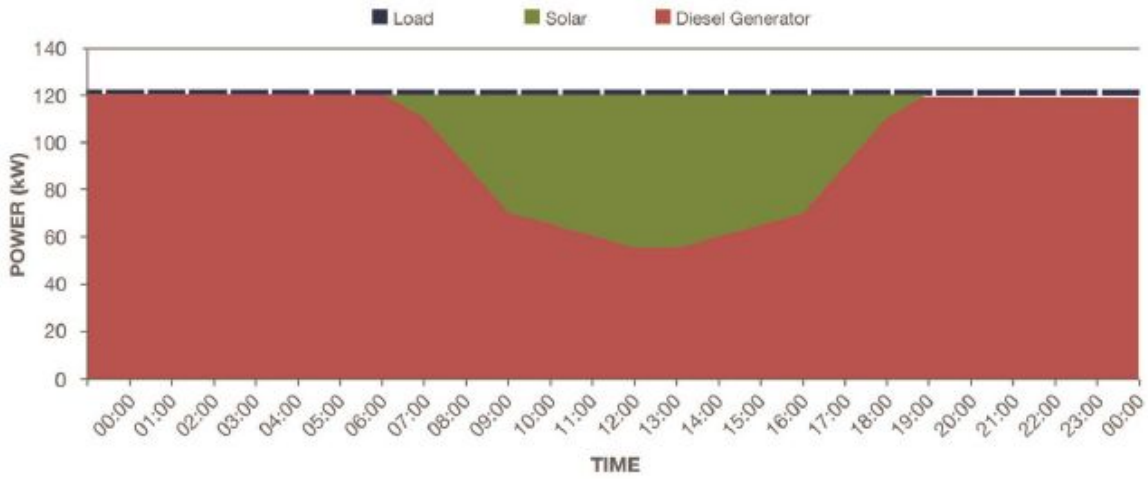
The solution



Hybrid Solar Energy System is a solar photovoltaic (PV) power system designed for seamless integration with new or existing fossil fuel with diesel generators with the objective of maximizing the use of free solar energy therefore reducing the consumption of fossil fuel. Fossil fuels may be diesel, heavy fuel oil (HFO) and liquid natural gas (LNG) depending on generator design.

Benefiting businesses are big consumers of fossil fuels: remote mines, power generation stations, mini-grids for isolated ares and islands, hospitality resorts, rural agro-industries, irrigation schemes, and son on and so forth.

At the core of the hybrid solar system is a synchronizer that gets information on the instant demand of power loads and on instant available solar energy to automatically command the start/stop of fuel generators. Most of the time a short term battery bank charged by solar energy will prevent frequent starts/stops of the fuel generator when there are short drops of solar energy production due to sky coverage with clouds for instance. A larger battery bank may be envisaged to use its stored solar energy during night hours but the cost/benefit ratio must be well established to avoid battery prohibitive costs. All this results in huge fuel savings for the business that will be in current practice between 25% and 50% depending on local insulation and system set up. Sometime the whole system is conceived to be fast-assembling containers easily to move from place to place (case of use based on short term rental).



As shown in the diagram, the solar energy produced during sunny hours of the day (dark green colored zone) will represents a bunch replacing the power from fossil fuel consumption (dark red colored zone) and the higher the solar energy production (solar penetration percentage) the larger the savings of fuel.

Load balancing

Let's take 120 KW of power load demand. Around noon the PV system will produce its maximum power with 120 KW and therefore the synchronizing controller will switch of the diesel generator. If the available solar energy drops to 80 KW the extremely sensitive synchronizer will have instantly switched on the diesel generator to supplement the 20 KW difference. As such, depending on the load and the sunshine level during the day (and on the available energy in the battery bank), the net load required from the diesel generator, therefore the fuel consumption, will be reduced. At the same time the fuel generator will continue to load-follow and ensure that load demands are covered all times.

Synchronization

The hybrid synchronization controller is an intelligent real time system ensuring that the solar energy output and the fuel generator power generation (and the battery bank output) are working in tandem on an instant basis, priority to satisfy power load demands being given successively to solar power, then to the battery bank and to fuel generator in the last instance. This way the fuel consumption will be at its minimum.

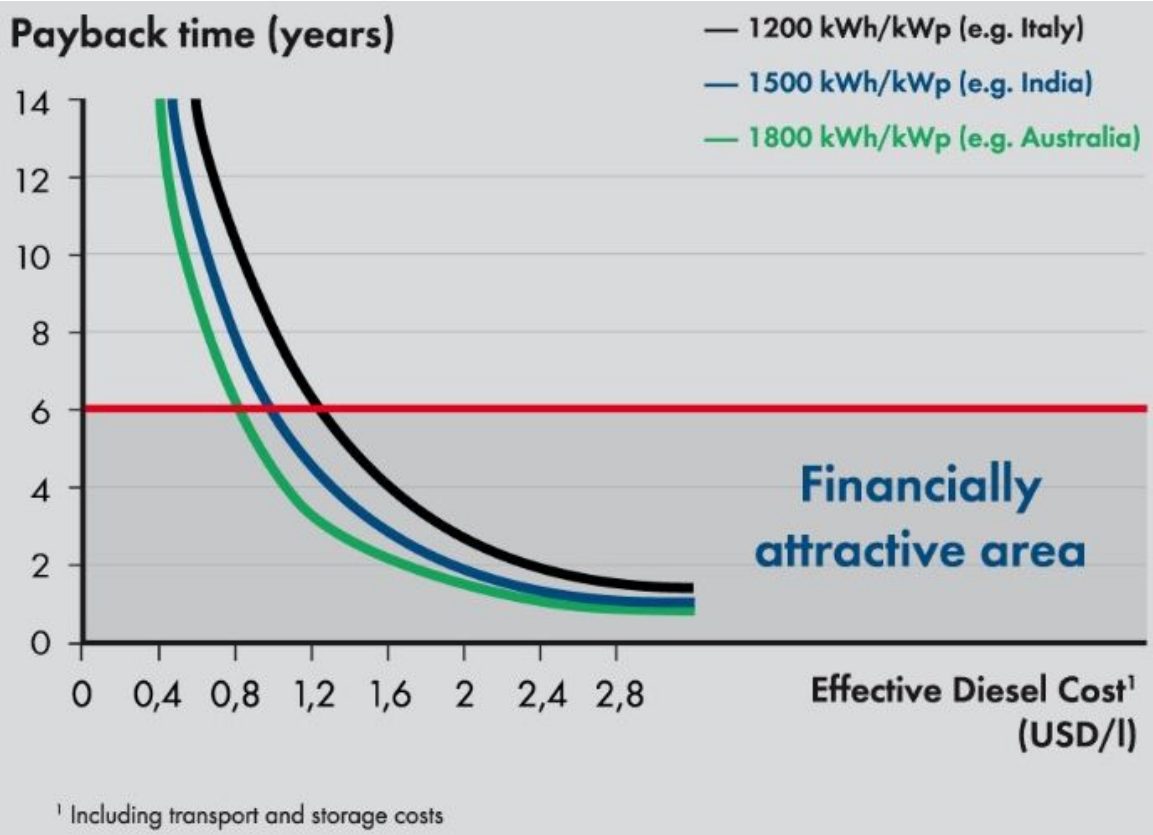
Generator efficiency

The solar PV hybrid system reduces fuel consumption while protecting the fuel generator from running at too low loading. This is because generator manufacturers recommend to run generators above 50% loading as below this level fuel consumption (that is liters per KWh generated) and wear-and-tear of the machine increase significantly and may nullify the desired fuel savings. High performance low load generators are available on the market if new fuel generators are due to be installed with a solar PV hybrid system.

Locking in solar energy cost

Solar energy consumed under a rental/lease contract and under a Power Purchase Agreement comes with the big advantage of locking in the solar energy price for the contract period. The lowered energy cost becomes much more predictable for business planning efficiency purposes.

On the side of solar hybrid system developer and investor offering energy-as-a-service, the payback period (i.e profitability) depends on the CAPEX but also on the fuel cost level and on local insulation expressed as power generation efficiency:



Helping the Planet

Apart from fossil fuel savings of 25-50%, hybrid energy systems enable to reduce carbon emissions from fuel generators which each MWh of solar energy consumed preventing about 0.7 tons of carbon dioxide from being emitted in the atmosphere.

More Information

For any additional information and questions please contact us.