



Sustainable Energy. Anywhere

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Temporary Solar-Hybrid Power Solutions for the Off-grid Market

CEBC Breakfast briefing Energy Storage – March 9th 2014



Enerwhere is the world's leading provider of rental solar-hybrid power solutions to the off-grid market



OUR SERVICES

EQUIPMENT RENTAL & MAINTENANCE



- Solar-diesel hybrid
- Solar-battery hybrid
- Solar only

POWER PURCHASE AGREEMENT (PPA)



Power supply on a per kWh basis

APPLICATIONS

TEMPORARY ACCOMODATION



CONSTRUCTION



OIL & GAS



MINING



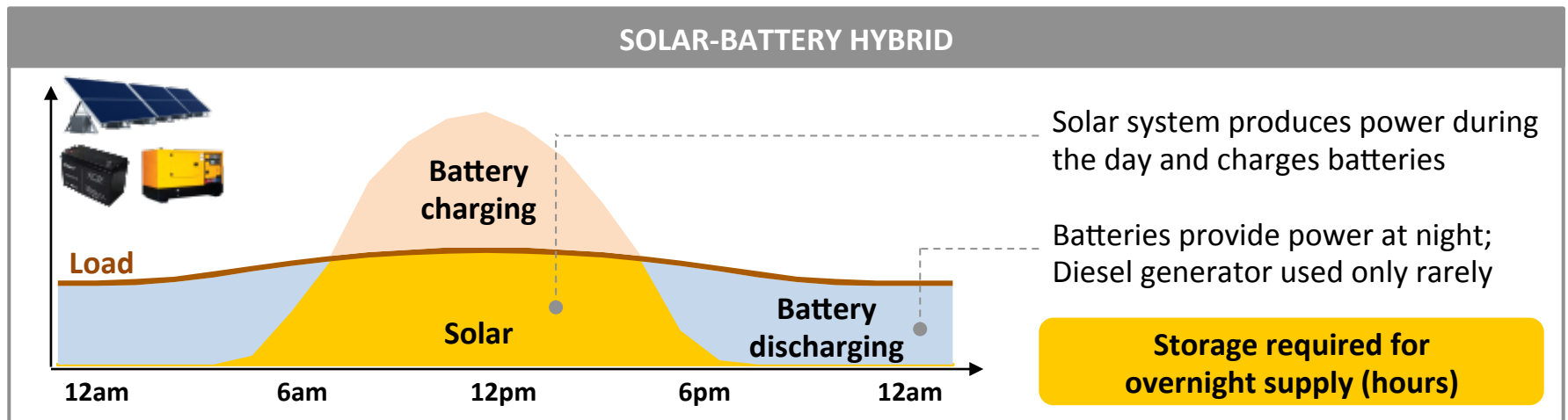
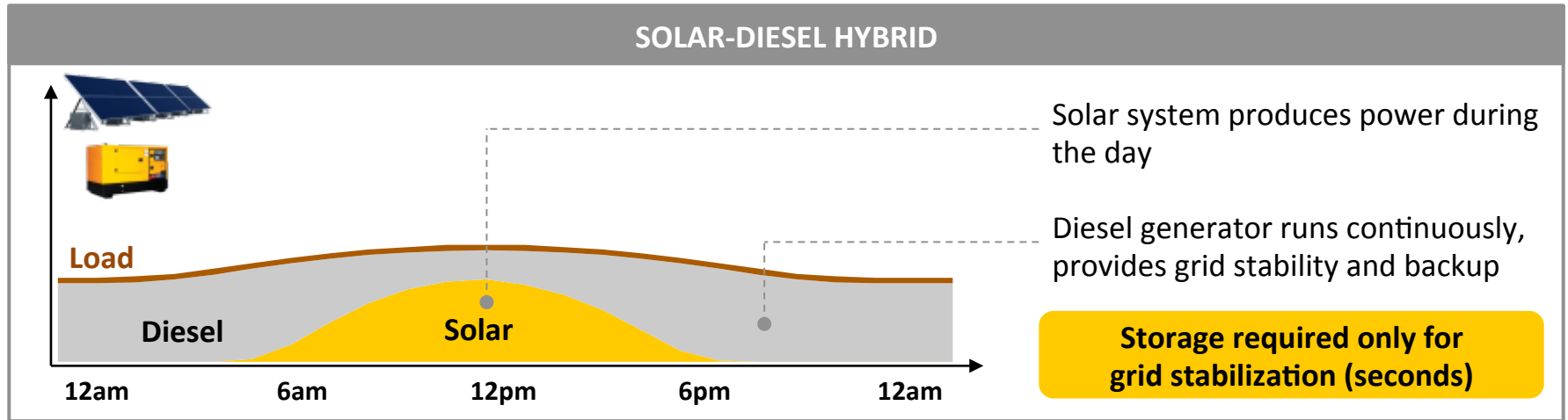
HOSPITALITY



MANUFACTURING



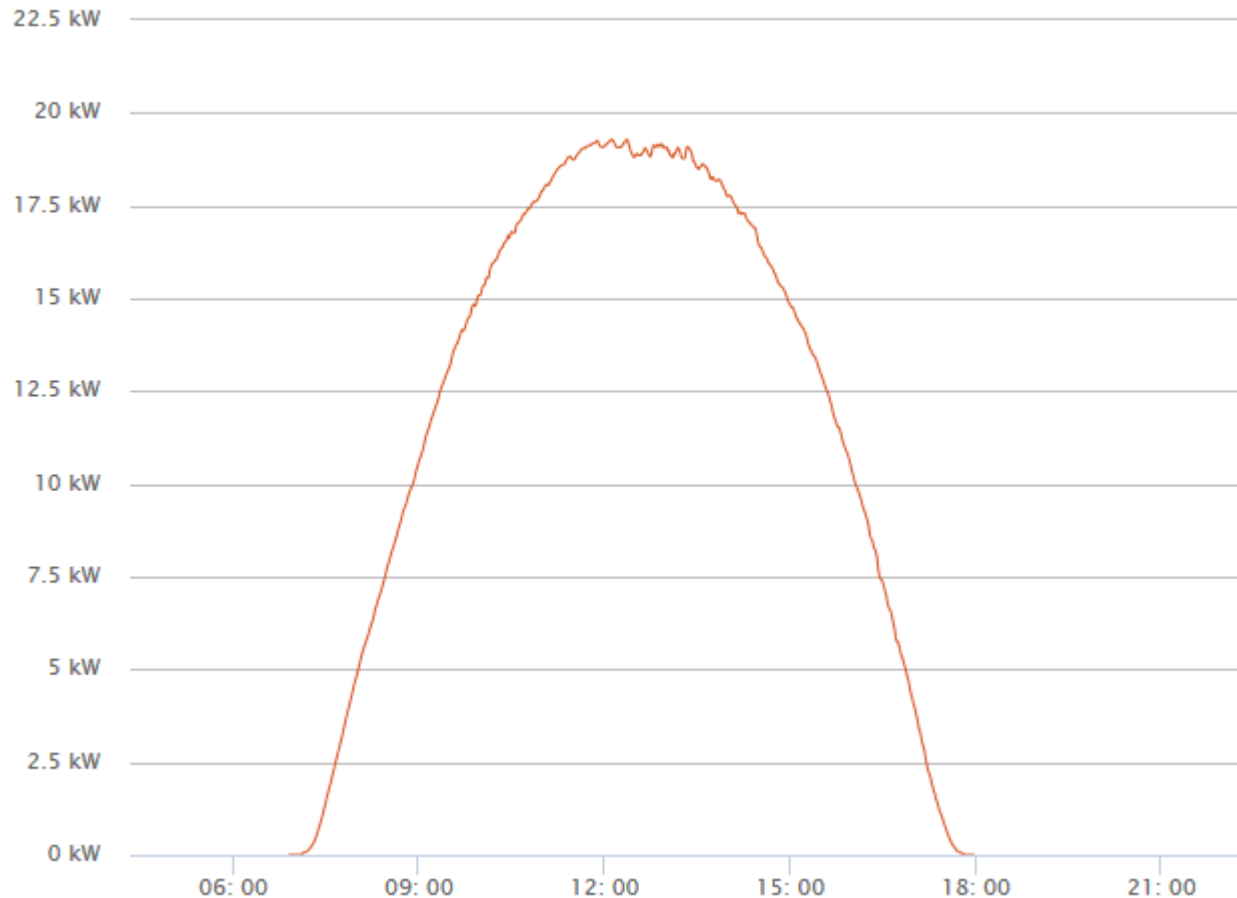
In off-grid solar systems there are two very different configurations, requiring different types of storage



On clear days, the solar generation curve is smooth and very predictable



Enerwhere plant on Saadiyat Island, 26 December 2014 Solar generation curve, inverter #8



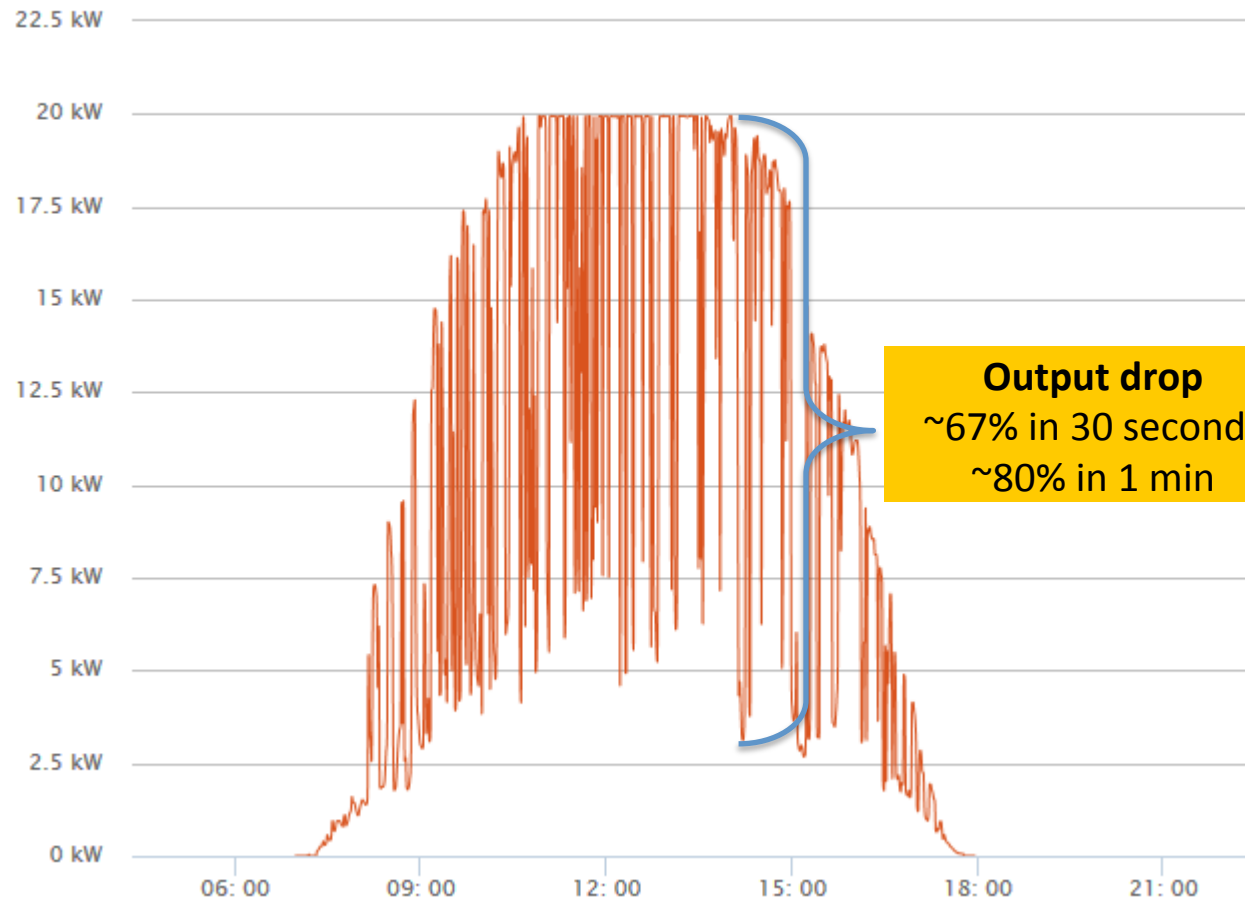
Comments

- The UAE has >320 clear days per year
- On those days, intra-day variation is minimal
- Solar availability in summer is >95% - probably better than conventional (thermal) plants

However, not all days are clear, so short-term storage can limit spinning reserve requirements



Enerwhere plant on Saadiyat Island, 25 December 2014 Solar generation curve, inverter #8



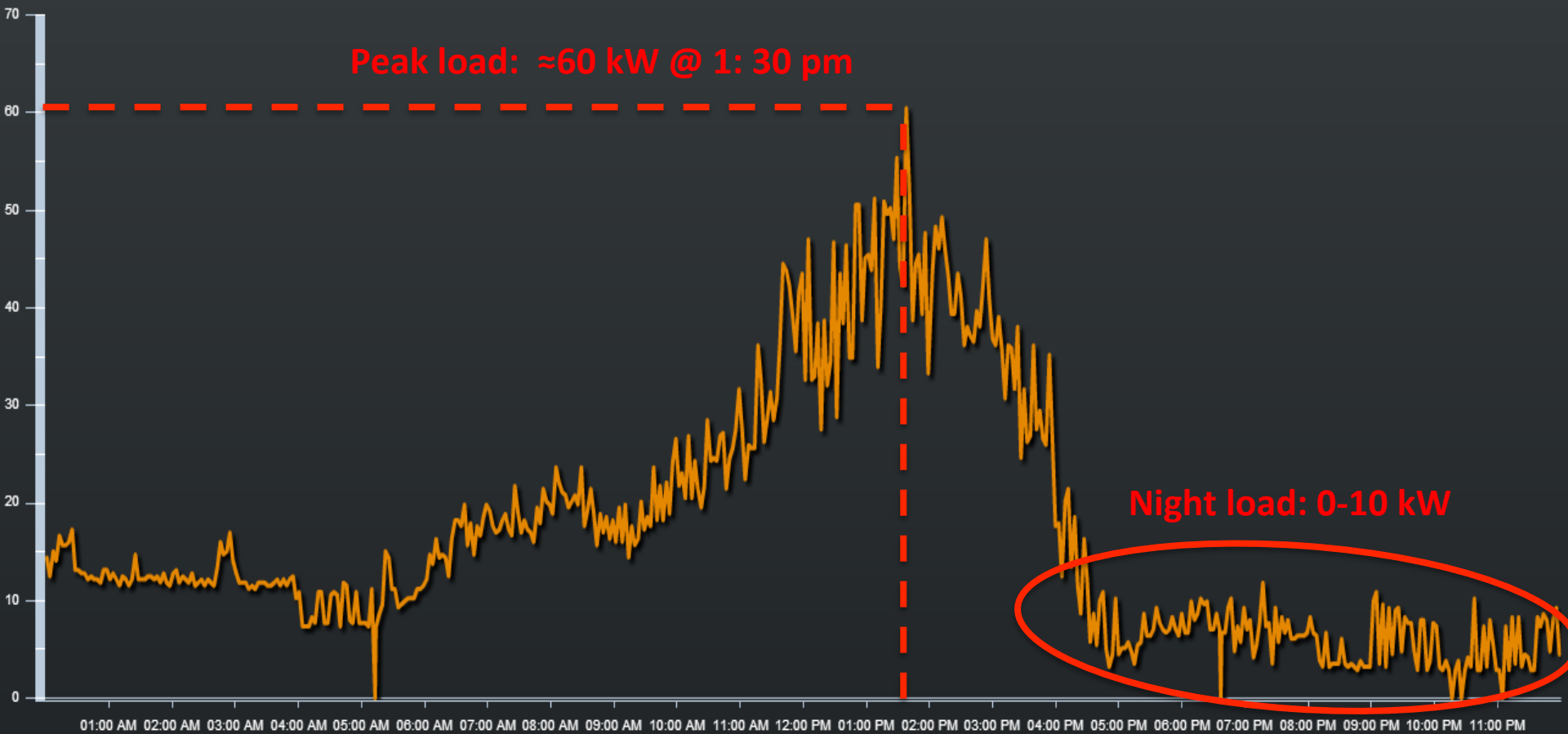
Comments

- Cloudy days are concentrated in the winter season
- Passing clouds can drop solar radiation dramatically in a short time
- Short-term storage dramatically lowers spinning reserve requirements

Many applications in the Middle East are air-conditioning & activity-driven, leading to dramatic load variations



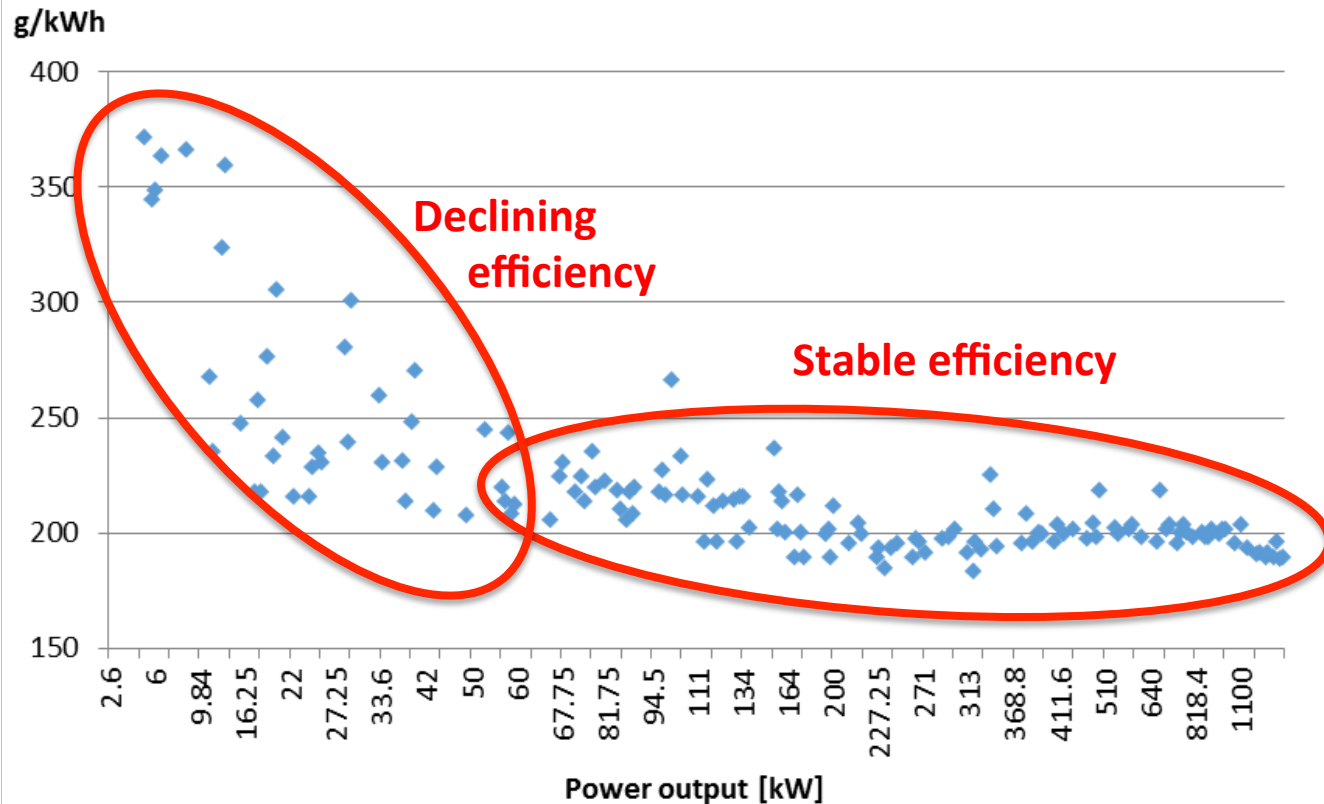
Construction site office Load in kW



For smaller loads (<50 kW load), solar + storage can already compete with diesel generators today



Diesel generator efficiency Fuel consumption in g/kWh



Comments

- Above 50 kW load, efficiency of standard diesel generators doesn't change much
- Below 50 kW load, standard diesel generator efficiency deteriorates rapidly
- Assuming a sufficiently long project duration, , battery storage starts to make sense <50 kW load

In summary, storage has benefits but requires a clear understanding of the application



Short-term storage



High Power

Short-term storage requires high power batteries, to deliver maximum power in a short time



Low cost per kW

The key metric for short-term storage is cost per kW peak output (e.g. for 30 seconds)



Inverter costs are key

Because the required battery capacity is small, inverter costs make up a large share of the total

Long-duration storage



High Energy

Long-duration storage requires high-energy batteries with enough power to last a long time (hours)



Low cost per kWh

Key performance metric for long-duration storage is cost per kWh per cycle



Battery costs & round-trip efficiency are key

Batteries and electrical losses make up the majority of costs



Thank you!



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