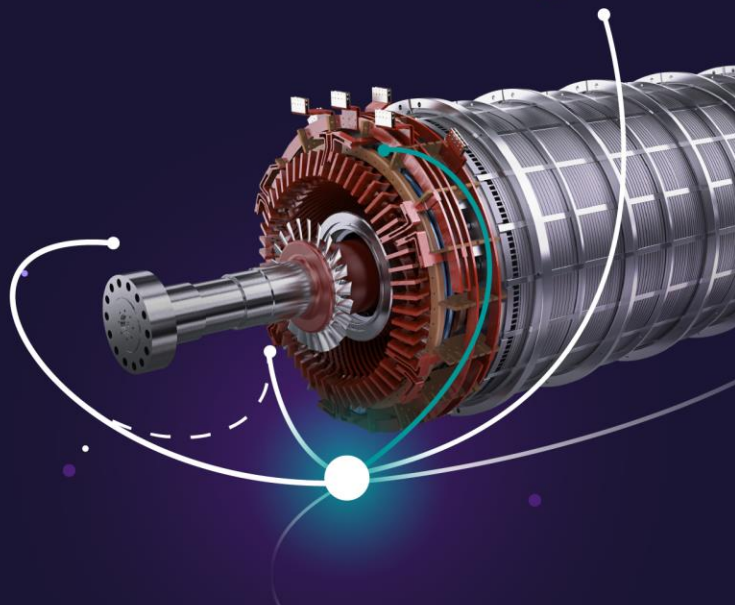


Black Start & Black Grid Restoration

“**Black Start** - is the process of restoring a power station without relying on the external transmission network, to recover from a total or partial shutdown.”

“**Black grid restoration** - is the procedure to re-energize the black grid (or grid portions), providing also energy for other power-plants so they can start-up”



Est. Lead time
8~20 months



Min. event type
Other



Fleet experience
> 10 units



Availability

- Interval Extension
- Outage Optimization



Reliability

- Operational Reliability
- Starting Reliability



Flexibility

- Operational Flexibility

Intended Benefits

Technical benefits:

- Availability to **start – up** the power plant without an external power source of supply,
- Capability to help to **restore power** to the grid in the event of a total or partial shutdown of the national grid,
- Provision of start up power to other power stations as the system restoration progresses,

Commercial benefits:

- Additional revenues received directly from the TSOs can help to
 - increase plant profitability
 - avoid plant closedown through additional functionality and revenue opportunities
- Mitigation of huge production losses by blackouts and equipment unavailability.

Initial Situation

Modern Energy Systems are being influenced by the reduction of nuclear and fossil power generation as well as the increase of renewable power generation.

This can cause stability problems in the HV-grid (Reduction of short circuit power / inertia and voltage dips stability) which might result in a blackout.

Power stations with black start capabilities are required.

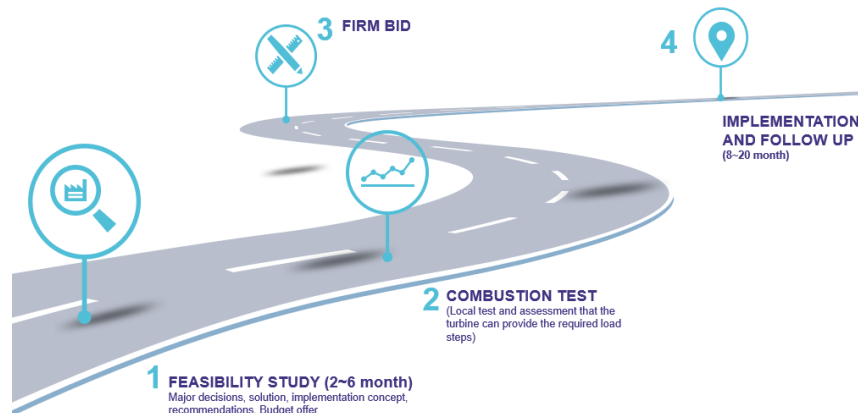
Solution

By using an independent power source to restore the plant auxiliary systems without an external source of supply like:

- Small Open Cycle turbines
- Gas Engine Generators
- Diesel Generators
- Batteries and Hybrid Solutions

With a feasibility study, perform an assessment on the main generator capabilities and grid requirements.

Integrate the new power source into the power plant and necessary modifications to the existing installation.



(Note - durations stated are estimates; actual may vary).