



Electricity Supply Board Aghada Generating Station

Report Title:	2024 Efficiency Audit Report and Opportunities for energy efficiencies improvement / recovery.
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Attachment:	n/a

General

ESB Aghada is located in the Cork harbour, Eircode P25 XE94.

The site contains three identical open cycle gas turbines (OCGT), AT1, AT2, and AT4, each rated for 90MWe (nominal), with a thermal cycle efficiency of 31 % (nominal). They are fuelled by either Natural Gas or Liquid Gasoil (distillate).

AD2, a Combined Cycle Gas Turbine generating unit (CCGT), rated at 432MWe was handed over to the station in early 2010. This unit was constructed as a base load plant with a Thermal efficiency in excess of 58%.

The site also comprises a 19MW (38MWh) Battery Energy Storage Solution (BESS1) which is operational under ESB Renewables Operations. BESS 1 functions by charging batteries using electricity imported from the national electricity grid. When the stored energy is required, it can be released to provide grid system services such as stabilising the frequency of the electricity network or provide energy during periods of electricity shortages. A further 150MW (300MWh) Battery Energy Storage Solution (BESS2) has been constructed.

Maintaining Unit Performance & Energy Consumption

Each unit's performance and energy consumption are measured against pre-set operating targets. Variations or degradation in the energy conversion process will arise with operation over time. Temporary losses can be recovered and restored while other degradation is not recoverable. Temporary losses can arise due to increased use of energy in the 'house load' element of the process. Hence the electrical energy used, or 'house load', is optimised by having the most efficient plant in service at any time. Other temporary losses can arise due to loss of energy from the process (e.g., water or steam leaks) and fouling of components leading to inadequate heat transfer or (e.g., inadequate heat transfer within the process such as for example fouling of the sea water cooled condenser) or fouling of filters and compressors requiring extra effort to operate. As plant ages, there will be degradation resulting in increased energy consumption, that cannot be recovered.

Plant reliability and optimised performance is achieved by undertaking corrective and preventive work, either during short term plant shutdowns or longer plant overhauls, usually on an annual basis.

The station assigns an operating efficiency target to each unit each year. A 100% outturn infers that the fuel allowance is being converted to electrical energy in an optimal way.

Open Cycle Gas Turbines (AT1, AT2 & AT4)

Open Cycle gas turbine running is heavily influenced by variability in wind, availability of interconnectors and starting reliability of larger plant. Work was completed on site to reduce the start-up time and increase the loading rates of these units in an effort to make the units more attractive to the TSO and to better support the DS3 marketplace, all of which is designed to facilitate penetration of wind and other renewables.

The 2024 run hours on the units are summarised as follows:

2024 data	AT1	AT2	AT4
Operating Efficiency (Gen) %	97.26% average		
Run Hours	176.7	68.3	262
Hot Starts	31	10	54

As these units only operate intermittently, for short periods, the energy flows are dependent on starting reliability and component condition. Short term maintenance shutdowns are used to ensure that the starting reliability, and equipment reliability of each Combustion Turbine is maintained.

Running of these units can be biased based upon foreseen maintenance outage plans.

Air filtration is maintained at F7 levels to ensure air compressors remain clean. Despite this, year on year the station has ensured that annual offline compressor washes of each open cycle turbine are completed. This improves the operating performance of the units.

Combined Cycle Gas Turbine (AD2)

AD2 is an Alstom KA-26-1 Single Shaft Combined Cycle Gas Turbine based upon the GT26B2.2 technology gas turbine. At full output of 432MWe, the thermal cycle efficiency of the unit can be expected to be in excess of 58%.

As with the open cycle GTs, the site is committed to enhancing the flexibility of the CCGT to facilitate renewables on the Grid. In 2021 the site installed technology to further reduce the minimum stable load of AD2 whilst remaining emissions compliant and maintaining high part load efficiency. This enables the unit to operate in any range between 449 to 88MW net at reference conditions. It is noted however that the optimal efficiency performance is at maximum generation, therefore the ratio of dispatchable hours at lower loads may affect overall operating efficiency.

2024 data	AD2
Operating Efficiency (Exp) %	99.03
GWHrs Exported GWh	952
Run Hours	2601
Starts	38

- AD2 accumulated 38 Starts and 2,601 Run hours in 2024. This is a reduction in Run Hours compared to 2023 as AD2 was on outage for approx.. 28 weeks. There was an increase in Starts due to AD2 no longer being 'Constrained On'.
- Operating Efficiency out turn for 2024 was up at 99.03% compared to 97.96% in 2023. Most likely due to new or clean parts in Gas Turbine after outage & more high load running.
- The start-up house load target set by the station influences operating efficiency figures. House load is the energy consumed by the plant which cannot be exported to the Grid. Typically, AD2 has a house load of ~ 5.5MWs. On start-up, prior to synchronising to the Grid, fuel and electrical house load are being consumed. If house load is excessive, operating efficiency will drop. House load continues to be monitored, and refinements made to start-up and shutdown practices.
- Air intake filtration is maintained at H class filtration. So called HEPA filters help to keep the compressor clean. E11s (fine filters) and F7s (pre-filters) are installed. All Air Intake filtration was replaced as part of the 2024 outage & continue to be monitored for excessive fouling.
- The station policy for washing of the GT Compressor changed in light of improved air filtration. Routine On-line washing is conducted on a fortnightly basis in order to wash salts from the compressor inlet section. These salts pass the air filters in solution & crystallises on the clean site at the engine inlet. Off-line compressor washing is available - but only conducted by exception.
- Performance (corrected power output and compressor efficiency) are monitored using remote monitoring services provided by the turbine manufacturer with diagnostic reports generated and reviewed once per month.
- Parasitic losses from the process are monitored and acted upon. These include:
 - Anti-icing, a parasitic bleed of hot air from the gas turbine compressor to ensure that the intake remains clear of ice.
 - Water Steam Cycle make-up, indicative of excessive chemical blowdown from the drums and of leakage from the process is monitored.
 - Internal leakage or bypassing of the steam turbine through passing steam turbine bypass valves is acted upon as it arises.
 - Condenser vacuum is optimised for ST load to minimise excessive cooling of condensate and to minimise cooling water pump flow and associated auxiliary load.
 - Increased GT exhaust back pressure due to increased HRSG Differential Pressure (DP).