

# Introduction to the IPowerE 2023 Operational Report

## **The Institution of Power Engineers**

Tel +44 (0)1234 214340 Email [enquiries@ipower.org](mailto:enquiries@ipower.org) [www.ipowere.org](http://www.ipowere.org)  
Registered office: Bedford Heights, Manton Lane, Bedford MK41 7PH

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# The IPowerE Operational Report



The IPowerE Operational Report has been in existence for 100 years. Originally known as the Working Costs Report it was first presented to members at a meeting held in 1923.

Since its first appearance the Working Costs Report - now the Operational Report - has over the years made available a vast amount of data contributed by engine users all over the world. This has proved of high practical value to the Contributors and the Power Industry worldwide.

## *THE REPORT*



*HYDRO*



*SOLAR*



*WIND*



*STORAGE*



*GT CCGT*



*RECIP ENGINES*



*SLOW SPEED*

Traditionally the operational report has covered reciprocating engines, gas turbines and combined cycle power plants. The changing world of power generation has resulted in the growth of Solar, Wind and Biomass generation as well as Hydropower. These are now being reviewed in addition to the traditional. In line with the Institution's new focus the Operational Report now includes renewable power sources Solar, Wind, Storage and Hydro power generation in addition to the traditional areas of technology.

Contributors provide data for the report covering engines and all forms of generating plant including reciprocating engines, gas turbines, combined cycle plants, conventional steam plant, hydro plants and renewables including solar, wind, and hydro plants.

All the Operational Report Contributors who submit a qualifying report are invited to nominate one member to take a one-year free membership for each power plant they reported. Each nominee will be asked to submit a membership application and qualify for member status. The report provides detailed analysis and tables of all the data submitted by Contributors.

**Table 1 - 1-Stroke Reciprocating Engines**

| Overall Summary - 1-Stroke Reciprocating Engines |                              |        |
|--|------------------------------|--------|
| Total Number of Engines                          | 1,124 Engines                |        |
| Total Capacity (MW)                              | 422,248 MW                   |        |
| Total Running Hours                              | 12,685,714,000 Running Hours |        |
| Total kWh  | 6,666,666,666 kWh            |        |
| Operating Hours per engine average               | 11,300,000                   |        |
| Running Hours per MW average                     | 27,187,500                   |        |
| Average  | Max                          | Min    |
| Capacity   | 35,000 MW                    | 100 MW |
| Running Hours                                    | 1,000,000                    | 10,000 |
| Max Capacity (MW)                                | 35,000                       | 100    |

**Table 2 - All 4-Stroke Reciprocating Engines**

| Overall Summary - All 4-Stroke Reciprocating Engines |                              |        |
|--|------------------------------|--------|
| Total Number of Engines                              | 1,124 Engines                |        |
| Total Capacity (MW)                                  | 422,248 MW                   |        |
| Total Running Hours                                  | 12,685,714,000 Running Hours |        |
| Total kWh  | 6,666,666,666 kWh            |        |
| Operating Hours per engine average                   | 11,300,000                   |        |
| Running Hours per MW average                         | 27,187,500                   |        |
| Average  | Max                          | Min    |
| Capacity   | 35,000 MW                    | 100 MW |
| Running Hours  | 1,000,000                    | 10,000 |
| Max Capacity (MW)                                    | 35,000                       | 100    |

**Table 3 - High-Speed 4-Stroke Engines**

| Overall Summary - High-Speed 4-Stroke Engines |                             |        |
|---|-----------------------------|--------|
| Total Number of Engines                       | 84,000 Engines              |        |
| Total Capacity (MW)                           | 111,111,111 MW              |        |
| Total Running Hours                           | 1,111,111,111 Running Hours |        |
| Total kWh                                     | 111,111,111,111 kWh         |        |
| Operating Hours per engine average            | 13,227,639                  |        |
| Running Hours per MW average                  | 15,617,167                  |        |
| Average                                       | Max                         | Min    |
| Capacity                                      | 1,327,639 MW                | 100 MW |
| Running Hours                                 | 1,111,111,111               | 10,000 |
| Max Capacity (MW)                             | 1,327,639                   | 100    |

**Table 4 - Open Cycle Gas Turbines**

| Overall Summary - Open Cycle Gas Turbines |                              |        |
|---|------------------------------|--------|
| Total Number of Engines                   | 17,000 Engines               |        |
| Total Capacity (MW)                       | 497,111,111 MW               |        |
| Total Running Hours                       | 49,711,111,111 Running Hours |        |
| Total kWh                                 | 49,711,111,111 kWh           |        |
| Operating Hours per engine average        | 2,924,179                    |        |
| Running Hours per MW average              | 2,924,179                    |        |
| Average                                   | Max                          | Min    |
| Capacity                                  | 29,241,790 MW                | 100 MW |
| Running Hours                             | 11,111,111,111               | 10,000 |
| Max Capacity (MW)                         | 29,241,790                   | 100    |

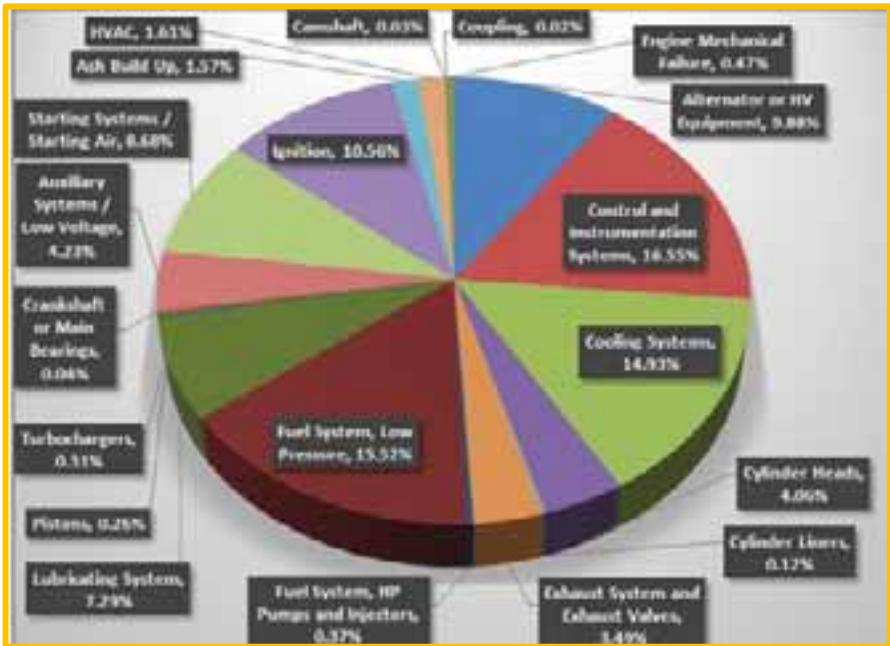
**Table 5 - Combined Cycle Gas Turbines**

| Overall Summary - Combined Cycle Gas Turbines |                              |        |
|---|------------------------------|--------|
| Total Number of Engines                       | 8,111,111 Engines            |        |
| Total Capacity (MW)                           | 49,711,111,111 MW            |        |
| Total Running Hours                           | 49,711,111,111 Running Hours |        |
| Total kWh                                     | 49,711,111,111 kWh           |        |
| Operating Hours per engine average            | 6,111,111                    |        |
| Running Hours per MW average                  | 6,111,111                    |        |
| Average                                       | Max                          | Min    |
| Capacity                                      | 6,111,111,111 MW             | 100 MW |
| Running Hours                                 | 11,111,111,111               | 10,000 |
| Max Capacity (MW)                             | 6,111,111,111                | 100    |

**THE ANALYSIS**

As well as running data and plant power generated there is the provision for Contributors to submit a forced outage report. This FO data is then analysed and a comparison made to identify the cause of plant unplanned outages. The diagram below shows one of these forced outage charts.

We would like to introduce submissions from the Nuclear Power Sector and would welcome any contributions for the next report.



## FORCED OUTAGE ANALYSIS

The Annual Operational Report is a unique compilation of data of value to organisations worldwide, including owners, operators, financial bodies, manufacturers and consulting engineers. The Report is one of a number of technical papers presented and published by IPowerE annually. Over recent years we have had 49 countries and territories represented in our reports representing over 600 sites and 3000 prime movers. Please help us to achieve our target by sending in your return and recommending to others.

For further information please contact the IPowerE office in Bedford, United Kingdom. To download the Invitation Letter, Guidance to Contributors and the Return Template please follow the link on the IPowerE Web Site [https://www.ipower.org/operational\\_report.html](https://www.ipower.org/operational_report.html)