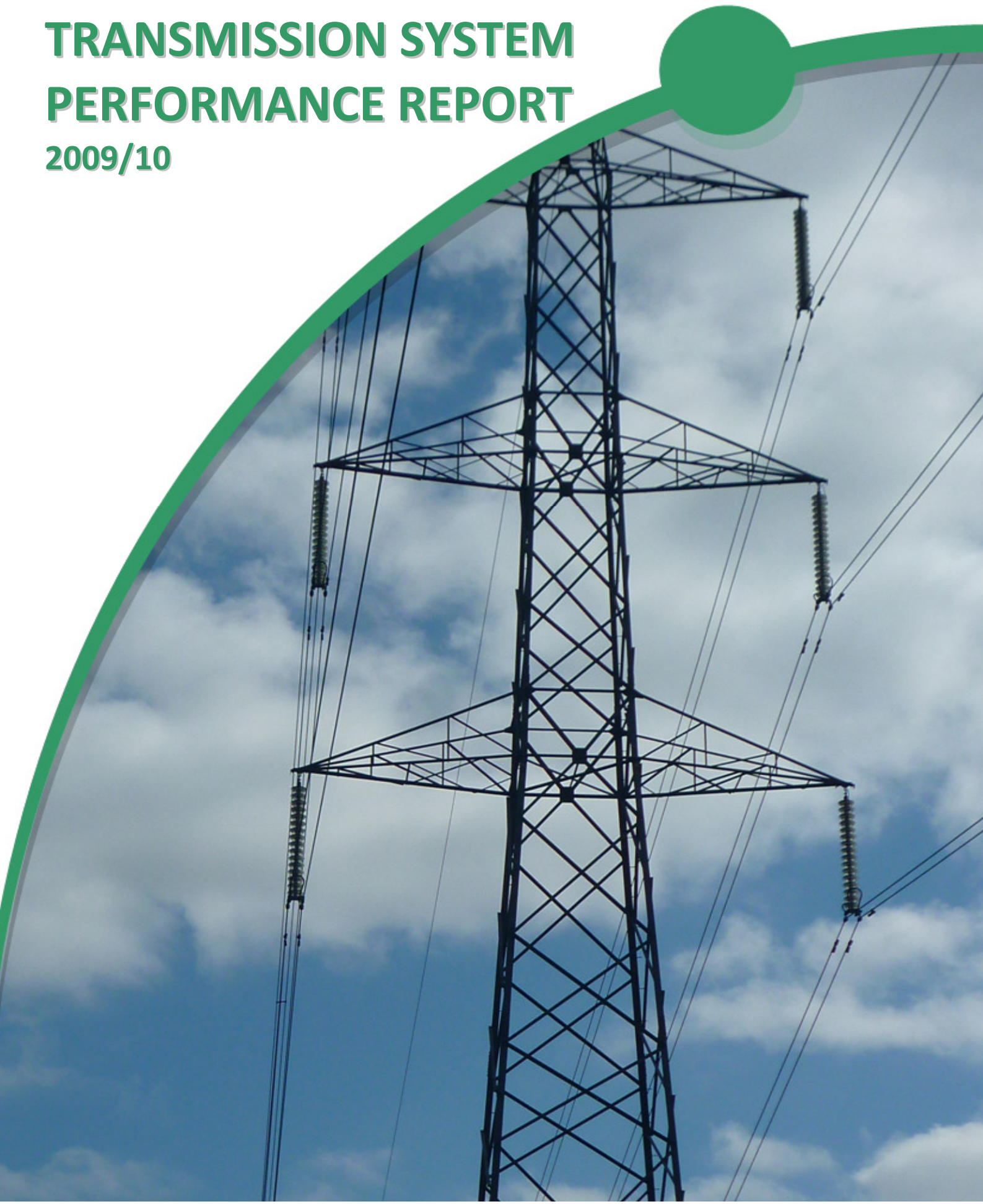
System Operator for Northern Ireland

TRANSMISSION SYSTEM PERFORMANCE REPORT

2009/10



SYSTEM OPERATOR FOR NORTHERN IRELAND LTD

TRANSMISSION SYSTEM PERFORMANCE REPORT

FOR THE YEAR 2009/10

1 OCTOBER 2009 – 30 SEPTEMBER 2010

Prepared November 2010

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EXECUTIVE SUMMARY

SONI has prepared the Transmission System Performance Report (TSPR) in accordance with Part 11 of Condition 20 of the Licence to Participate in the Transmission of Electricity. There is a requirement to produce the Report annually, two months after the completion of the financial year. This report covers the year 2009/10 (1st October 2009 - 30th September 2010).

One of the key measures of performance is availability, both of the overall Northern Ireland transmission system, and interconnection to the system. System availability is calculated as a percentage of actual circuit hours available in relation to total possible circuit hours available. Circuit outages that result from both planned and unplanned unavailability are taken into account.

The annual system availability was 97.67%, with a higher winter availability of 99.02%, reflecting the fact that planned work on circuits is minimised over the winter months. The annual system availability has slightly improved on the 2008/09 figure of 97.26%.

The performance of the interconnector and tie-lines continues to vary, with Moyle Interconnector HVDC link having an annual availability of 88.18%, the average percentage since commercial operation began in April 2002 being 97.63%. This lower figure was mainly as a result of a lengthy planned outage of the Moyle interconnector, to accommodate the connection of a windfarm in Scotland. The North-South 275kV Tie Line's availability was 97.31% with a 13 year average of 97.64%. The two 110kV Tie Lines had an annual availability of 99.94%, and the 13 year average being 98.10%. This higher figure was due to no planned outages on either line during the reporting period.

Another key measure of performance is system security, which is captured by reporting on any incidents resulting in loss of supplies to customers. In 2009/2010 there was one incident.

Quality of service is measured by the number of voltage and frequency excursions over the year, that fall outside statutory limits. There were no voltage excursions over the year. When we consider frequency excursions on the same basis as previous years, using 49.5Hz as a threshold, the number of incidents has increased from 4 last year to 7 in 2009/10. This increase was caused mainly by new CCGT generating plants commissioned in RoI. We have also reduced the threshold at which frequency incidents are recorded to 49.6Hz. This change has increased the number of events that are reportable. This provides additional information for the reader following the introduction of Harmonised Ancillary Services in February 2010. None of these incidents, however, resulted in a loss of load in Northern Ireland and statutory limits were not exceeded.

In March of 2010, there was a severe ice storm in Northern Ireland. As a consequence of this severe storm, there were 138 individual faults on the transmission system over a period of 15 hours; an unprecedented number for Northern Ireland. None of these transmission faults resulted in the loss of load in Northern Ireland. Overall, the transmission system has performed very well over the 2009/10 period, with only one incident resulting in a loss of load; a mal-operation of the protection equipment on the Coolkeeragh - Magherafelt 275kV double circuit.

With the exception of the Moyle Interconnector HVDC link all system availabilities have generally improved as compared to last year's report.

1 INTRODUCTION

This Transmission System Performance Report (TSPR) has been prepared by the System Operator for Northern Ireland Ltd. (SONI) in accordance with the requirements of Part 11 of Condition 20 of the 'Licence to Participate in the Transmission of Electricity'.

SONI is responsible for the safe, secure, efficient and reliable operation of the Northern Ireland transmission network. The transmission network is operated at 275kV and 110kV. Its primary purpose is to transport power via overhead lines and cables from generators and interconnectors to Distribution Bulk Supply Points. The power is then transformed to lower voltages (33, 11 and 6.6kV) and distributed to customers.

This report provides information on system availability, interconnector and tie-line availability, system security and quality of service on the 275/110kV transmission network for 2009/10.

Section 2 outlines both the month by month system availability and unavailability, and also provides a historic comparison of annual system availability.

Section 3 shows the historic availability and monthly unavailability for interconnection with GB and the NI-RoI Tie Lines.

Section 4 provides details of incidents that resulted in the loss of supplies, and compares the number of incidents and unsupplied energy over a historic ten year period.

Section 5 highlights quality of service and measures this with reference to both system voltage and frequency, and records when either criteria exceeds its statutory limits. For each frequency excursion, there is a data table and corresponding graph included in this report. The data table is in section 5.1 and the graphs are in Appendix A.

Reporting is carried out in accordance with the definitions and principles of the National Fault and Interruption Reporting Scheme (NAFIRS), (Engineering Recommendation G43/2). The effects of national / regional emergencies and disputes are excluded.

This report covers the period 2009/10 (1st October 2009 - 30th September2010).

2 SYSTEM AVAILABILITY

2.1 CALCULATION METHODOLOGY

System Performance is monitored by reporting monthly variations in system availability, winter peak and average annual system availability, together with planned and unplanned system availability.

Availability is reduced whenever a circuit is taken out of operation, either for planned purposes e.g. maintenance work, or as the result of a fault, caused, e.g., by lightning strikes, high winds, equipment failure etc.

SONI is required under its licence to operate the transmission system in accordance with the Transmission and Distribution System Security and Planning Standards and the Grid Code.

Planned work is necessary to facilitate new user connections, network development and the maintenance of network assets necessary to deliver acceptable levels of system security and reliability.

The outages of transmission circuits either planned outages or faults resulting in forced outages have the net effect of reducing system availability to less than 100%. System availability is defined by the formula:

$$\text{System Availability} = \frac{\text{The sum of all circuit hours actually available x 100\%}}{\text{(Total No. of circuits) x (Total No. of hours in one year)}}$$

A circuit is defined as the overhead line, cable, transformer or any combination of these that connects two system bus bars together or connects the system to a User's busbar. Network bus bars are located in transmission substations; the bus bars, circuits and network configuration are described in the current SONI Transmission Seven Year Statement.

There are approximately 150 transmission (275kV and 110kV) circuits in the Northern Ireland transmission system, covering a total length of circa 2130km in the form of transmission overhead lines and cable circuits.

Planned unavailability - is defined as outages that are required to maintain transmission network assets. These are planned in excess of seven days prior to the outage. This also includes outages to facilitate user connections (generators etc.) and also general network maintenance that benefits all users.

Unplanned unavailability - is due to an outage which occurs as a result of breakdown, i.e. outages required and taken immediately upon request or planned at less than seven days notice.

2.2 RESULTS

2.2.1 ANNUAL SYSTEM AVAILABILITY

For 2009/10, the Average Annual Availability of the Northern Ireland Transmission System was 97.67%, a slight increase on 97.26% in the 2008/09 report.

2.2.2 SUMMER AND WINTER AVAILABILITY

The Winter Peak System Availability (average system availability for the period of November 2009 to February 2010) has also improved to 99.02% from 98.44% in the 2008/09 report.

The Summer System Availability (average system availability for the period of May 2010 to August 2010) also shows a slight improvement to 97.29% from 96.30% in the 2008/09 report.

2.2.3 MONTHLY VARIATION

Figure 2.1 below shows the month by month variation in system availability in respect of the transmission network in Northern Ireland.

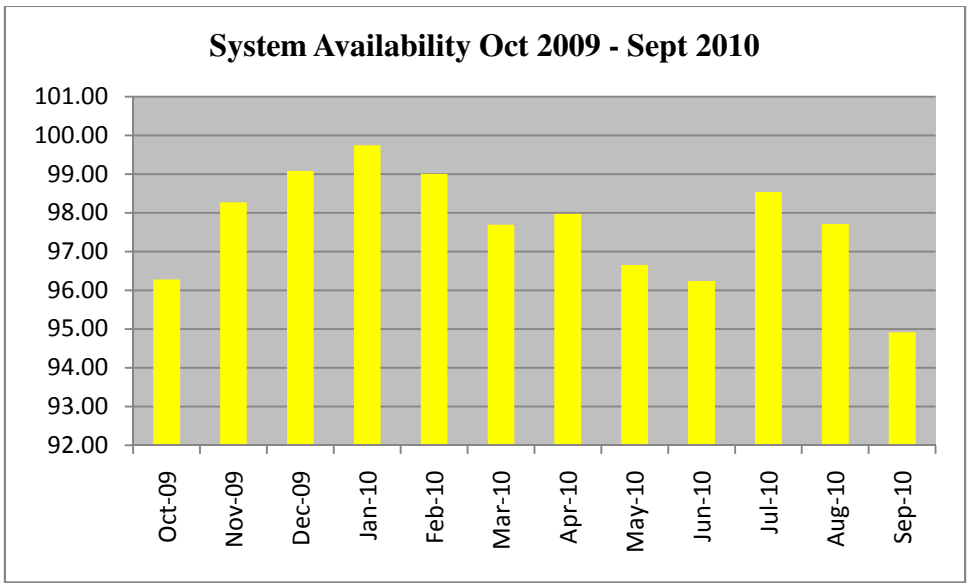


Figure 2.1: System Availability October 2009- September 2010

	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10
Total Availability	96.28	98.27	99.08	99.74	99.00	97.69	97.97	96.65	96.24	98.54	97.71	94.92

Overall, the availability of the system is high, particularly over the winter months, with an average of 99.02% for November 2009 – February 2010. The higher availability over the winter months is because planned outages are usually scheduled to take place over the summer months when network loading is generally lower. From May to August the availability is 97.29%; approximately 2% lower than winter.

2.2.4 SYSTEM UNAVAILABILITY

Figure 2.2 below shows the month by month variation in planned, unplanned and total system unavailability.

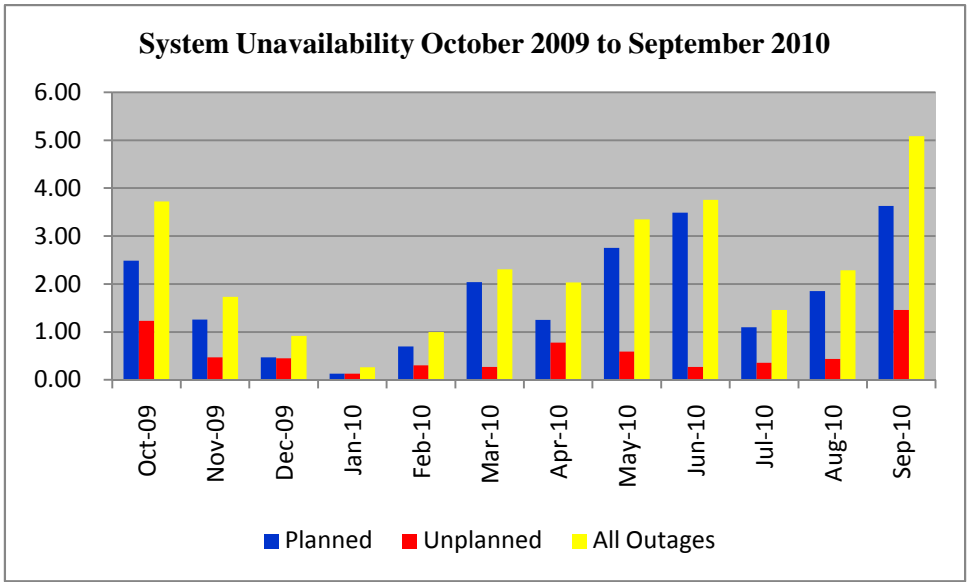


Figure 2.2: System Unavailability October 2009- September 2010

	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10
Planned	2.49	1.26	0.47	0.13	0.70	2.04	1.25	2.76	3.49	1.10	1.85	3.63
Unplanned	1.23	0.47	0.45	0.13	0.30	0.27	0.78	0.59	0.27	0.36	0.44	1.45
Total Unavailability	3.72	1.73	0.92	0.26	1.00	2.31	2.03	3.35	3.76	1.46	2.29	5.08

Total unavailability varies between 0.26% and 5.08% throughout the year, with the highest occurrence being in September 2010

Figure 2.2 shows that the majority of planned outages were done outside the winter period of November 2009 – February 2010. The months of October 2009 and May, June and September 2010 show the 4 months that have a value in access of 3% in unavailability due to planned outages.

2.2.5 SYSTEM HISTORIC AVAILABILITY PERFORMANCE

Figure 2.3 below shows the historic variation in system availability from 1997/98 to 2008/09 in respect of the transmission network in Northern Ireland.

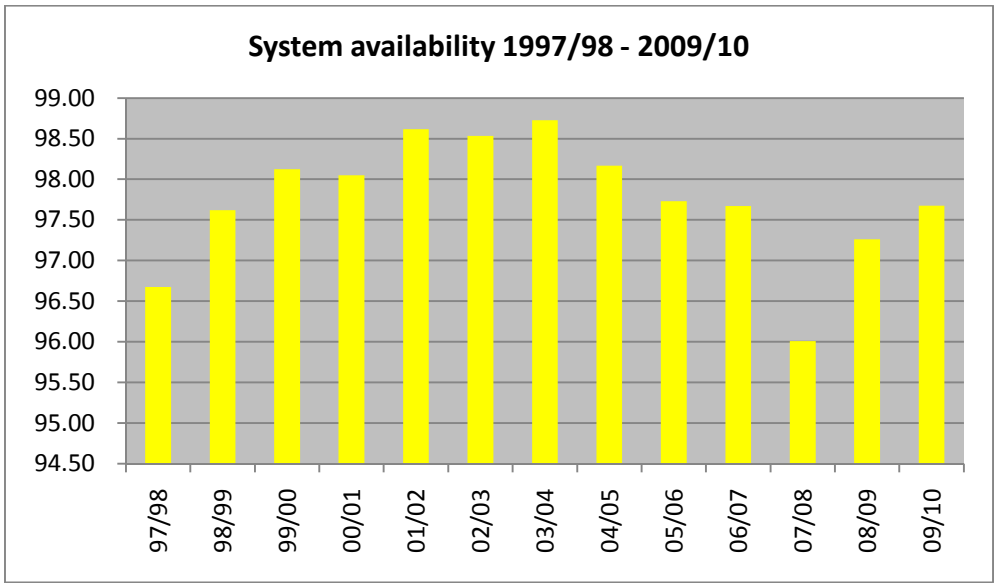


Figure 2.3: Historic System Availability 1997/98 – 2009/10

	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Total Availability	96.67	97.62	98.13	98.05	98.62	98.53	98.73	98.17	97.73	97.67	96.01	97.26	97.67

The previous Transmission System Performance report for 2008/09 realigned the data to cover the new financial year of 1st October to 30th September rather than 1st April to 31st March. This modification only slightly changed the historic availability figures, whilst the general trends have remained virtually unchanged.

The percentage figure of system availability for 2009/10 shows a further improvement on the previous year, but remains less than the system high figure of 98.73% in 2003/04. The annual average over the period of the above graph is 97.76%. The figure of 97.67% for 2009/10 therefore is virtually on a par with this average.

2.2.6 SYSTEM HISTORIC UNAVAILABILITY PERFORMANCE

Figure 2.4 below shows the breakdown of the system unavailability from 1997/98 to 2008/09.

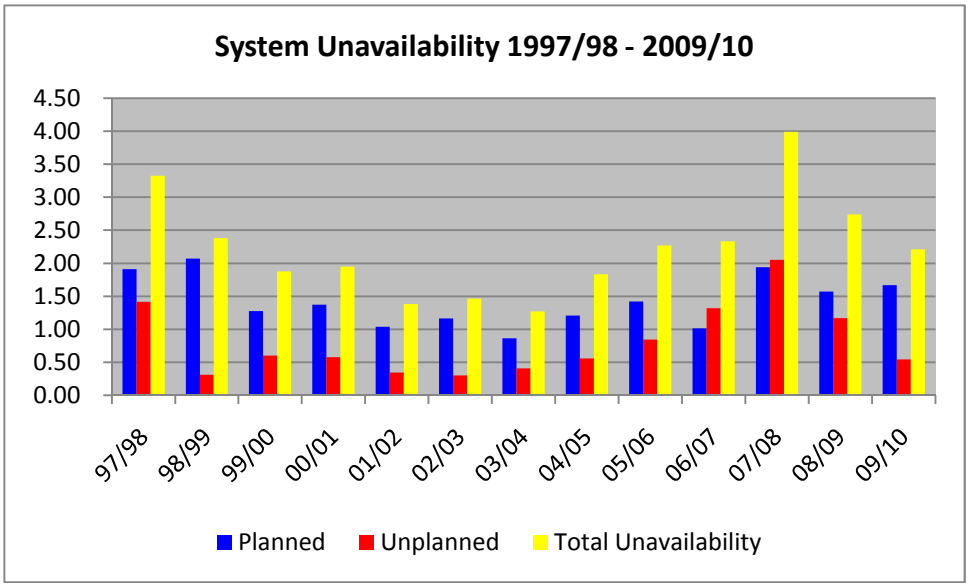


Figure 2.4: Historic System Unavailability 1997/98 – 2009/10

	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Planned	1.91	2.07	1.27	1.37	1.04	1.16	0.86	1.21	1.42	1.01	1.94	1.57	1.76
Unplanned	1.42	0.31	0.60	0.58	0.34	0.30	0.41	0.56	0.85	1.32	2.05	1.17	0.57
Total Unavailability	3.33	2.38	1.87	1.95	1.38	1.47	1.27	1.83	2.27	2.33	3.99	2.74	2.33

As figure 2.4 demonstrates, the annual system unavailability figure for 2009/10 shows an improvement over the 2008/09 figure. Although there was a slight increase in the percentage figure for planned outages, there was a more significant improvement in the figure for unplanned outages. The overall figure for total unavailability was reduced by 0.53%.

From the above graph the overall annual average percentage for system unavailability is 2.23%. The unavailability percentage for 2009/10 is on a par with the overall figure.

3 INTERCONNECTOR and TIE-LINE AVAILABILITY

3.1 INTERCONNECTION WITH GB

The Moyle interconnector, NI-GB, commenced commercial operation in 2002 and is constructed as a dual monopole HVDC link with two coaxial undersea cables from Ballycronan More, Islandmagee to Auchencrosh, Ayrshire, Scotland. The 500MW link is operated by SONI, and the performance of this link falls under the scope of this report.

3.1.1 MOYLE INTERCONNECTOR HISTORIC AVAILABILITY

The 2009/10 Annual Availability of the Moyle Interconnector was significantly reduced to 88.18%.

Figure 3.1 below shows the historic annual variation in the Moyle Interconnector availability from 2002/03 – 2009/10. With the exception of 2009/10 the availability of the Moyle interconnector has remained high since its introduction in 2002, with 2007/08 remaining the highest on record.

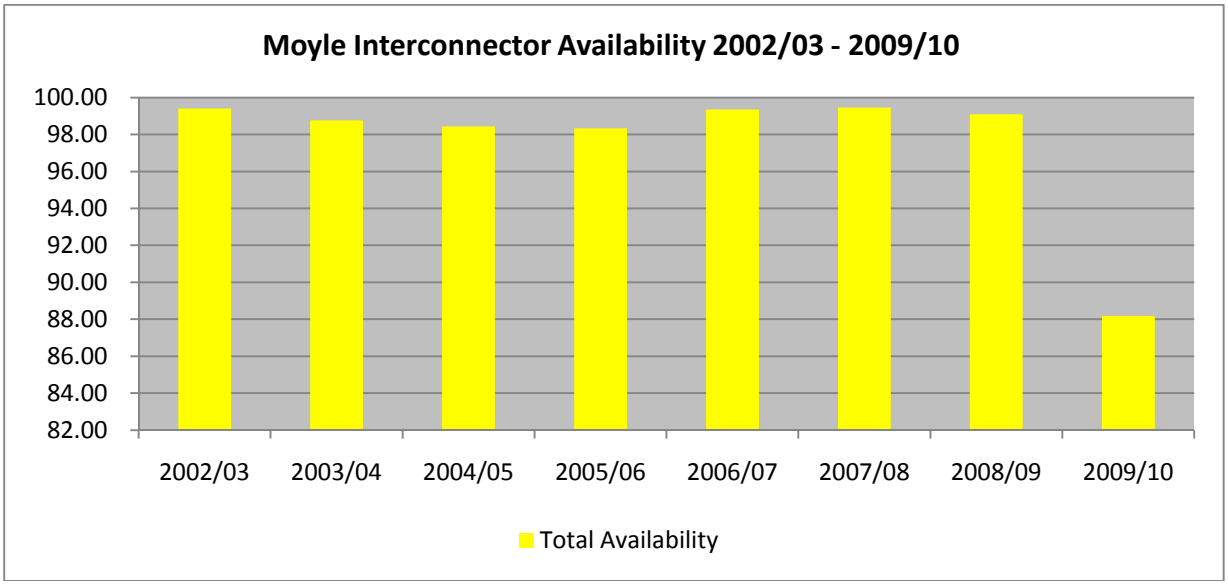


Figure 3.1: Historic Moyle Interconnector Availability 2002/03 – 2009/10

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Total Availability	99.40	98.77	98.43	98.34	99.35	99.46	99.09	88.18

The significant decrease in Moyle availability for 2009/10 was caused by two lengthy planned outages in October 2009 and June to July 2010. These planned outages allowed for routine maintenance and the connection of a windfarm in Scotland. The cable fault in September 2010 resulted in the increase in the unplanned outage figure. This fault continued beyond the timescales of this report.

3.1.2 MOYLE INTERCONNECTOR HISTORIC UNAVAILABILITY

The 2009/10 Annual Unavailability of the Moyle Interconnector was 11.82%

Figure 3.2 below shows the historic annual variation in the Moyle Interconnector unavailability from 2002/03 to 2009/10

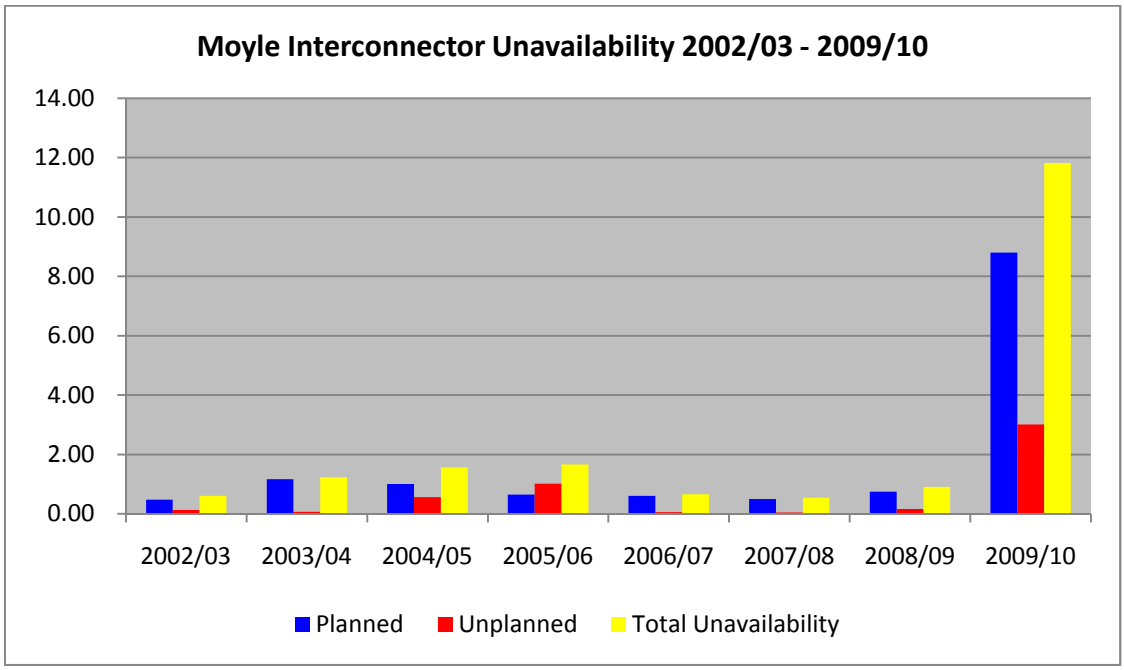


Figure 3.2: Historic Moyle Interconnector Unvailability 2002/03 – 2009/10

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Planned	0.47	1.16	1.00	0.65	0.60	0.50	0.74	8.80
Unplanned	0.13	0.07	0.57	1.02	0.05	0.05	0.17	3.01
Total Unavailability	0.60	1.23	1.57	1.66	0.65	0.54	0.91	11.82

Until 2009/10 the average unavailability performance of the interconnector was 2.37%.

Minimal outages have resulted in low unavailability figures. From 2006/07 the unavailability has been dominated by planned outages.

The significant increase in Moyle unavailability for 2009/10 was caused by two lengthy planned outages (October 09 and June – July 10) and one unplanned outage in September 2010.

The planned outages allowed for routine maintenance and the connection of a windfarm in Scotland. The cable fault on Moyle started on the 9th September 2010 and has continued beyond the dates of this report causing a significant increase in the unplanned outage percentage figure. These are clearly shown in figure 3.3 in Section 3.1.3.

3.1.3 MOYLE INTERCONNECTOR MONTHLY UNAVAILABILITY

Figure 3.3 below shows the month by month variation of unavailability of the interconnector. The graph indicates during which months that maintenance has been undertaken by Moyle.

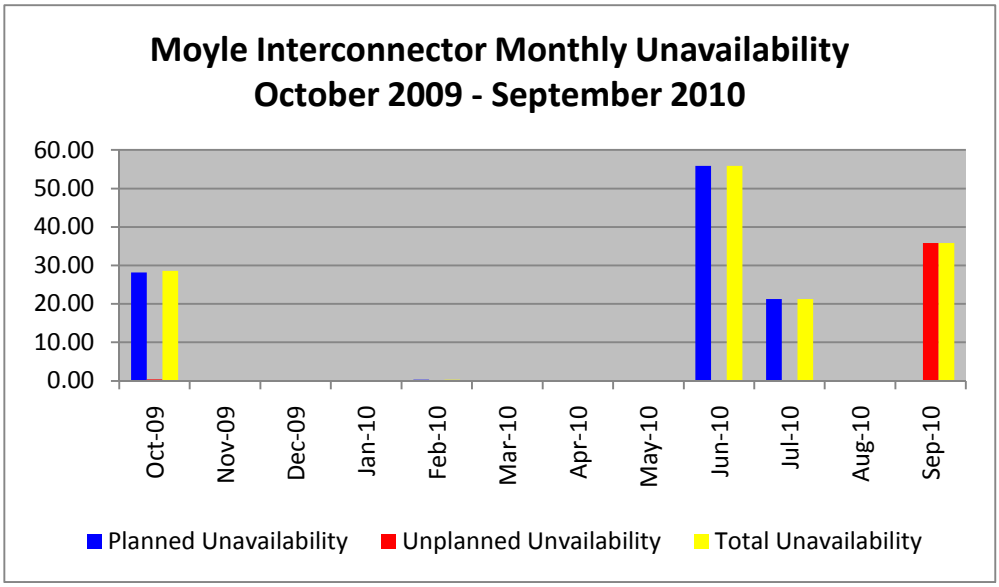


Figure 3.3: Moyle Interconnector Unavailability 2009/10

	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10
Planned	28.19	0.00	0.00	0.00	0.32	0.00	0.00	0.00	55.83	21.30	0.00	0.00
Unplanned	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.78
Total	28.55	0.00	0.00	0.00	0.32	0.00	0.00	0.00	55.83	21.30	0.00	35.78

Figure 3.3 above shows the 3 planned outages of 9 days in October 2009 and the outage which ran from 14th June 2010 through to 7th July 2010 (24 days). The significant decrease in Moyle availability for 2009/10 was caused by three lengthy planned outages in October 2009 and June to July 2010.

The unplanned outage starting on the 9th September 2010 was caused by a cable fault at Moyle which has run beyond the dates of this report.

3.2 TIE- LINES WITH ROI

3.2.1 275kV TIE LINE

The synchronous interconnection is via the double circuit 275kV North-South Tie Line between Tandragee and Louth. Since the introduction of the Single Electricity Market (SEM) the circuit is treated as a Tie Line.

Outages are planned between the connected parties to allow work to be undertaken in an efficient manner.

3.2.2 110kV TIE LINES

110kV connections with RoI are as follows:

- Strabane – Letterkenny 110kV circuit.
- Enniskillen – Corraclassy 110kV circuit

Until 2001, both circuits operated in a standby mode, but were then converted into permanent connections by the deployment of power flow controllers, rated at 125MW. The power flow controllers are normally adjusted to maintain a 0MW transfer, but can be set to any desired value to support either system during abnormal operating conditions. Since the introduction of SEM, the circuits are treated as Tie Lines.

The two circuits are automatically taken out of service during the outage of both 275kV circuits on the North-South Tie Line. This is to ensure that the all-Island network operates in a stable manner.

The Strabane – Letterkenny Tie Line is now also used to import excess wind from Donegal on a regular basis.

3.2.3 275kV NORTH-SOUTH TIE LINE ANNUAL AVAILABILITY

The annual availability of the 275kV North-South Tie Line was 97.31%. Figure 3.4 below shows the annual variation in the availability of the Tie Line from 1999/00 to 2009/10

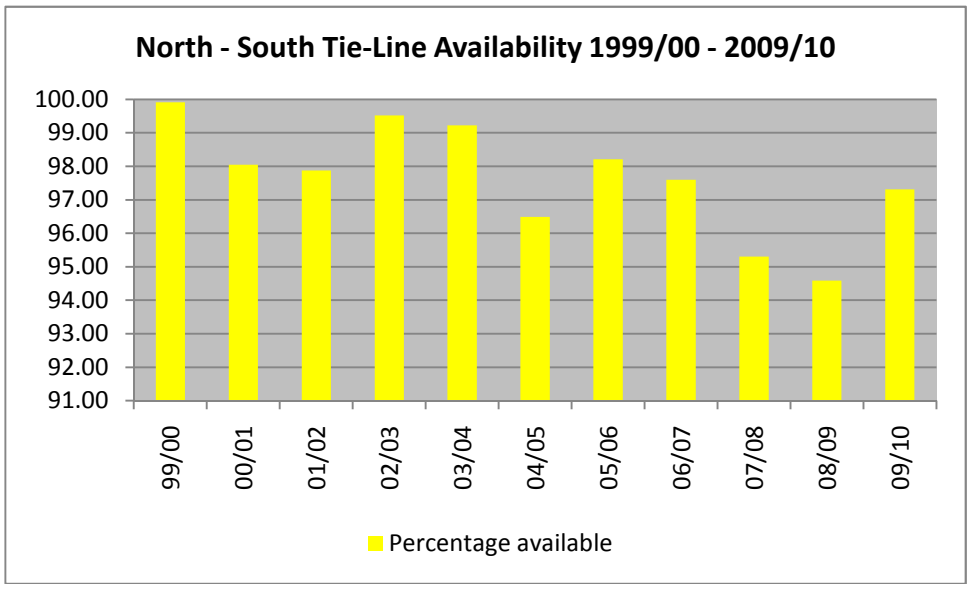


Figure 3.4: Historic North-South Tie Line Availability 1999/00 – 2009/10

	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Percentage available	99.91	98.04	97.87	99.51	99.22	96.49	98.21	97.60	95.31	94.58	97.31

The 2009/10 availability figure of 97.31% is a significant improvement on the record low figure of 2008/09 which was 94.58%. For the second successive year there were no unplanned outages on the North – South tie line. The overall annual percentage availability figure was 97.48% and the table above shows that the 2009/10 figure is on a par with this percentage.

3.2.4 275kV NORTH-SOUTH TIE LINE ANNUAL UNAVAILABILITY

Figure 3.5 below shows how the total unavailability for the years 1999/00 to 2009/10 is split between planned and unplanned outages.

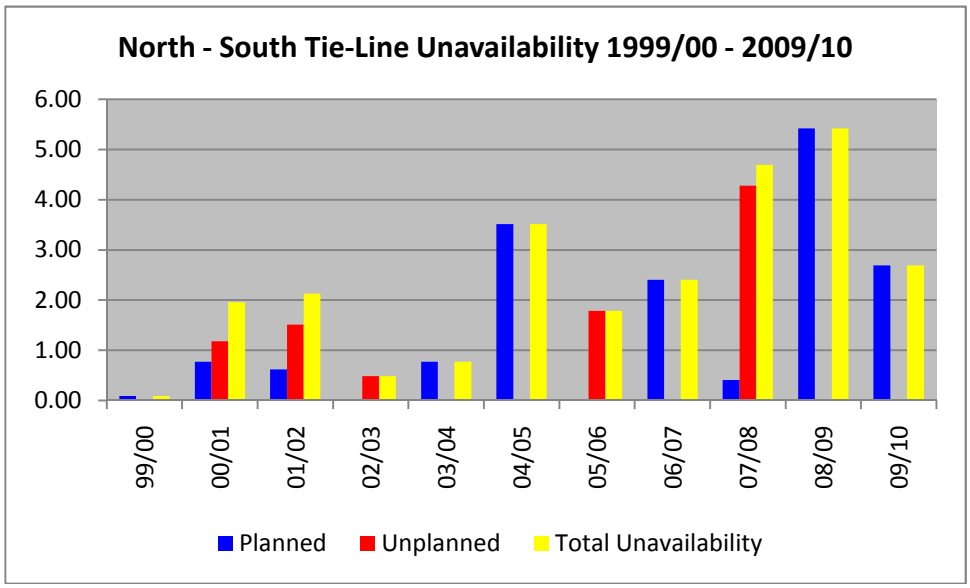


Figure 3.5: Historic North-South Tie Line Unavailability 1999/00 – 2009/10

	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Planned	0.09	0.77	0.62	0.00	0.78	3.51	0.00	2.40	0.41	5.42	2.69
Unplanned	0.00	1.18	1.51	0.49	0.00	0.00	1.79	0.00	4.28	0.00	0.00
Total	0.09	1.96	2.13	0.49	0.78	3.51	1.79	2.40	4.69	5.42	2.69

The level of unavailability for the North – South tie line for 2009/10 has dropped to less than half the figure of 2008/09. This has been a direct result of the reduction in planned outages during the year and the fact that for the second consecutive year there were no unplanned outages on the tie line.

3.2.5 275kV NORTH-SOUTH TIE LINE MONTHLY UNAVAILABILITY

Figure 3.6 below shows the month by month variation of unavailability of the North-South Tie Line.

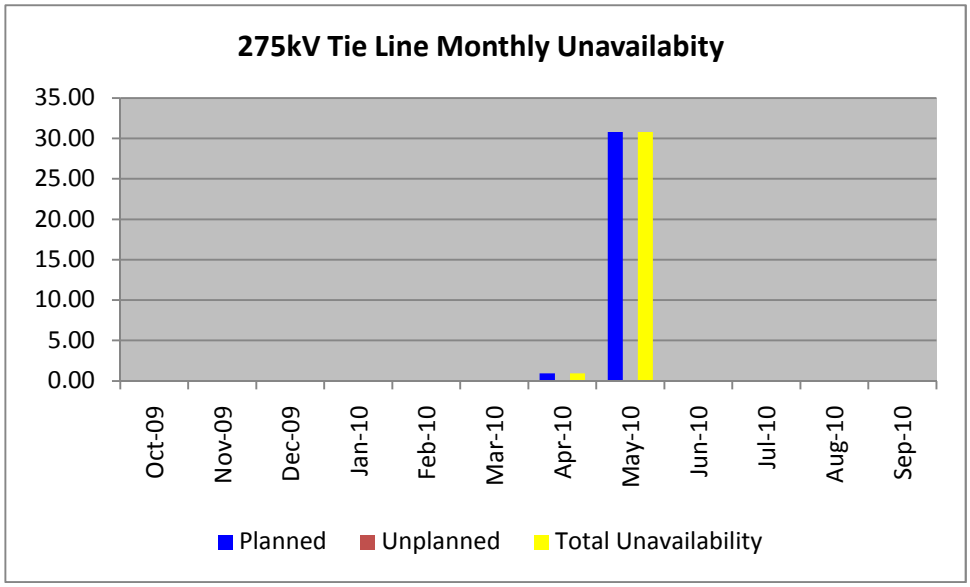


Figure 3.6: North-South Tie Line Monthly Unavailability 2009/10

	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10
Planned	0.00	0.00	0.00	0.00	0.00	0.00	0.93	30.80	0.00	0.00	0.00	0.00
Unplanned	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.93	30.80	0.00	0.00	0.00	0.00

Figure 3.6 highlights that the total percentage unavailability on the 275kV Tie Line for the period October 2009 – September 2010 was due entirely to a planned outage during April and May 2010. The outage was for a period of 7 days.

3.2.6 110kV TIE LINES ANNUAL AVAILABILITY

The availability of the 110kV Tie Lines was 99.94% for the period October 2009 to September 2010. Figure 3.7 below shows the annual variation in the availability of the Tie Lines from 1999/00 to 2009/10.

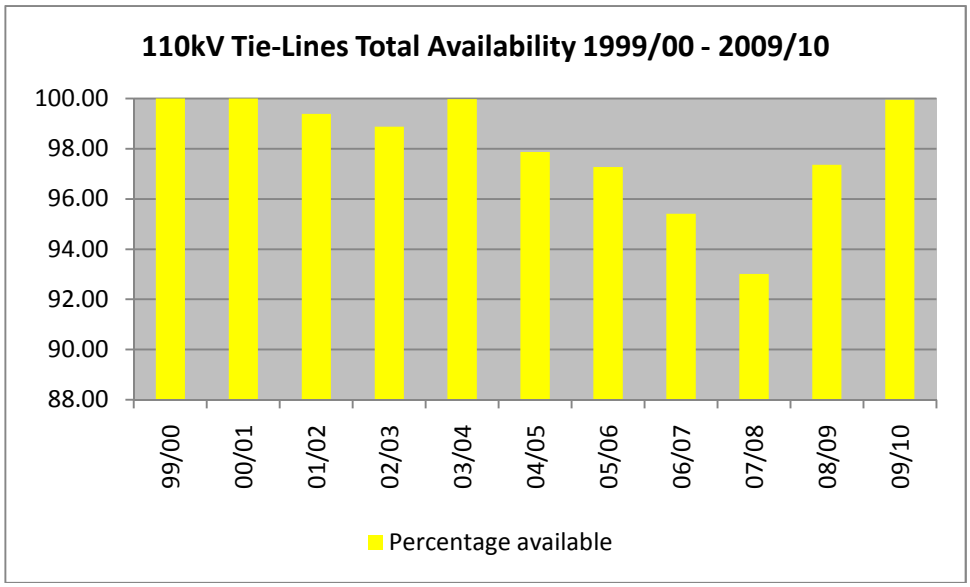


Figure 3.7: Historic 110kV Tie Line Availability 1999/00 – 2009/10

	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Percentage available	100.00	100.00	99.39	98.88	99.97	97.87	97.27	95.41	93.01	97.35	99.94

The year 2009/10 showed a significant increase of over 2.5% on the previous 2008/09 report. This improvement was brought about by the reduction in planned and unplanned outages during the period of this report. The average percentage availability for Figure 3.7 above is 98.1% and the figure of 99.94% for the period 2009/10 is also shows an improvement on this figure.

3.2.7 110kV TIE LINES ANNUAL UNAVAILABILITY

The unavailability of the 110kV Tie Lines was 0.06% for the period October 2009 to September 2010. Figure 3.8 below shows the annual variation in the unavailability of the Tie Lines from 1999/00 – 2009/10.

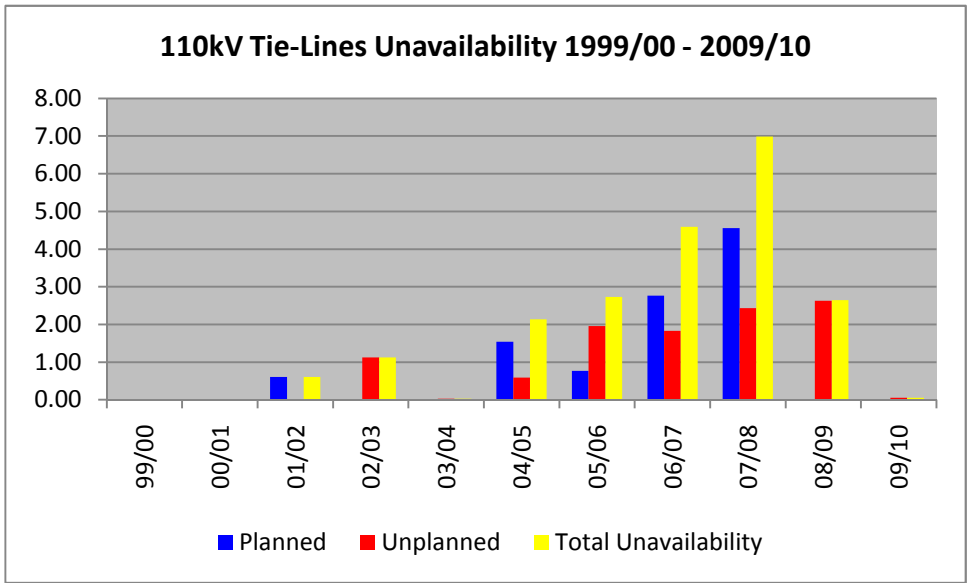


Figure 3.8: Historic 110kV Tie Line Unavailability 1999/00 – 2009/10

	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Planned	0.00	0.00	0.61	0.00	0.00	1.54	0.77	2.76	4.56	0.02	0.00
Unplanned	0.00	0.00	0.00	1.12	0.03	0.59	1.96	1.83	2.43	2.63	0.06
Total	0.00	0.00	0.61	1.12	0.03	2.13	2.73	4.59	6.99	2.65	0.06

As can be seen in figure 3.8 above, there is a significant reduction in annual percentage unavailability of the 110kV Tie Line. The reduction was brought about by the fact that during 2009/10 there were no planned outages on the tie-line and there was only minimal disruption caused by unplanned outages.

3.2.8 110kV TIE LINES MONTHLY UNAVAILABILITY

Figure 3.9 below shows the month by month variation of unavailability of the 110kV Tie Lines.

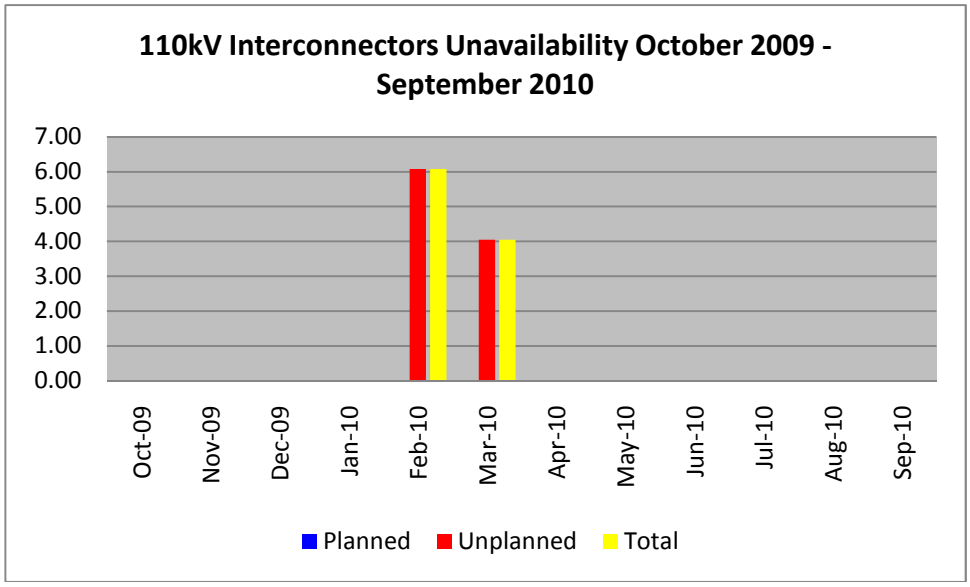


Figure 3.9: 110kV Tie Line Unavailability 2009/10

	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10
Planned	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unplanned	0.00	0.00	0.00	0.00	6.08	4.05	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	6.08	4.05	0.00	0.00	0.00	0.00	0.00	0.00

Figure 3.9 above shows the extent of outages on the 110kV Tie Lines during October 2009 to September 2010. There were only two unplanned outages during this period. The Enniskillen to Corclassy line faulted out in March, whilst the Strabane to Letterkenny line faulted during February.

4 SYSTEM SECURITY

All Transmission System related events that occurred in Northern Ireland that resulted in a loss of supplies are reported individually, giving information concerning the nature and cause of the incident and location, duration and an estimate of energy unsupplied.

An incident is defined as any system event that results in a single or multiple loss of supply.

4.1 NUMBER OF INCIDENTS AND ESTIMATED UNSUPPLIED ENERGY

Within the Northern Ireland system there was only one event that resulted in a loss of supply. This number is a reduction on the 4 incidents that occurred in 2008/09.

The unsupplied energy from the Northern Ireland system during 2009/10 was estimated to be 172.9MWh, which is considerably higher than the value for 2008/9. However, the higher value was caused solely by the major protection fault for Londonderry City as detailed in Section 4.2 below.

4.2 INCIDENTS FOR OCTOBER 2009 - SEPTEMBER 2010

Table 4.1 below lists the sole incident that is required to be included in this report.

Incident Date, Time and Location	MW Lost	Mins	MWh Unsupplied	Customers affected
21/11/2009 Londonderry City 275kV Coolkeeragh - Magherafelt B Line Fault And the concurrent protection mal-operation resulting and trip of Coolkeeragh - Magherafelt A circuit resulting in the trip of the Coolkeeragh CCGT	78	133	172.9	44187

Table 4.1: Transmission System Incidents 2009/10

SONI/NIE carried out an investigation into this incident and made recommendations to prevent a recurrence. Recommendations include protection modifications, earthing checks and a review of operating sequences of Special Protection Schemes on the Coolkeeragh to Magherafelt line. The incident was reported to DETI on 23rd November 2009.

The criterion for reporting incidents is specified in Schedule 4, paragraph 35, of the Electricity Supply Regulations (Northern Ireland) 1991. An incident shall be reported if there has been:

- Any single interruption of supply to one or more consumers of 20MW or more for a period of one minute or longer; or
- Any single interruption of supply to one or more consumers of 5MW or more for a period of one hour or longer; or

- Any single interruption of supply to 5,000 or more consumers for a period of one hour or longer.

4.2.1 SYSTEM SECURITY - INCIDENT ANALYSIS

Figure 4.1 below shows the number of incidents which occurred historically in Northern Ireland. The red bars on the graph below represent the number of incidents each year, whist the blue line is the average duration of each incident.

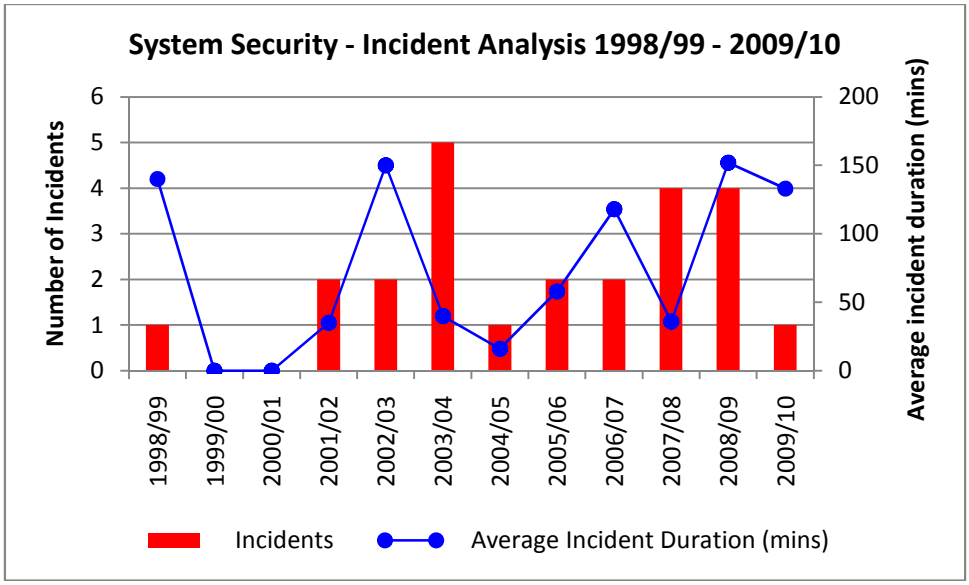


Figure 4.1: Historic System Security 1998/99 – 2009/10

As seen in Figure 4.1 above, the number of incidents has reduced to one, from the previous year's four. The average incident time remained high due to the fact that the minutes lost were caused by the single outage.

4.2.2 SYSTEM SECURITY - UNSUPPLIED ENERGY

Figure 4.2 below shows the historic amount of unsupplied energy to Northern Ireland customers. The red bars are the total for each year in MWh and the blue line is the average amount of unsupplied energy per incident.

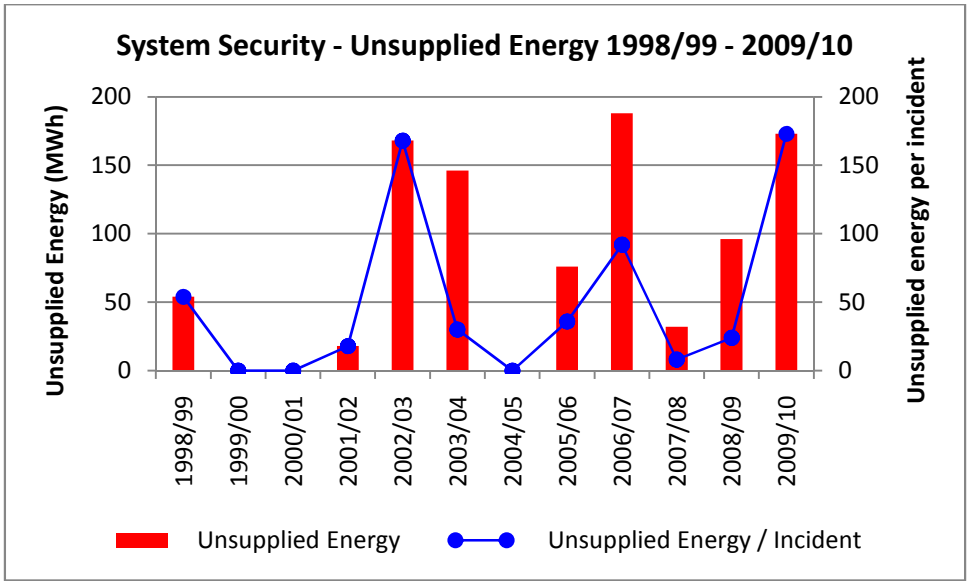


Figure 4.2: Historic Unsupplied Energy 1998/99 – 2009/10

The increase in unsupplied energy and unsupplied energy per incident has risen during 2009/10 was the result of the single incident on the 275kV Coolkeeragh - Magherafelt B Line.

5 QUALITY OF SERVICE

Quality of service is measured with reference to system voltage and frequency.

5.1 VOLTAGE

The Electricity Supply Regulations (Northern Ireland) 1991 permit variations of voltage not exceeding 10% for voltages of 110 kV and higher (Regulation 31.2B).

SONI must keep the voltage within these limits, apart from under abnormal conditions e.g. a system fault. The Northern Ireland Transmission & Distribution Security and Planning Standards state that the voltage should not vary by more than 6% following a single contingency event.

For the purpose of this report the 6% limit is used.

5.2 VOLTAGE EXCURSIONS

During 2009/10, there were no voltage excursions exceeding these limits and indeed there have not been any since 1998/99.

5.3 FREQUENCY

The Electricity Supply Regulation (Northern Ireland) 1991 permit variations in frequency not exceeding 2.5% above and below 50Hz, a range of 48.75Hz to 51.25Hz (Regulation 31.2A).

The SONI Grid Code (CC5.3) imposes a more arduous criterion to within 1% of 50Hz, a range of 49.5Hz to 50.5Hz. In previous reports the SONI Grid Code limits are used when reporting excursions.

For the purposes of this report SONI have decided that they will report on any frequency excursions that impact below a 49.6 Hz or greater than 50.5 Hz threshold. This will increase the number of reportable events providing more information. It was felt that this information would be useful in the light of the changing generation plant portfolio and the introduction of Harmonised Ancillary Services agreements with generators on 1 February 2010.

Table 5.1 provides detailed information for each frequency excursion including maximum rate of change of frequency, minimum frequency reached and time below 49.6 Hz.

As both the NI and RoI transmission networks are connected with 275kV and 110kV Tie Lines to form a synchronous network. Poor generation reliability in either jurisdiction will have a negative impact on its neighbour

The individual frequency event graphs appear in Appendix A in this report.

FREQUENCY EXCURSIONS

In accordance with SONI's decision to report on any frequency excursion in excess of 49.6 Hz, there were 20 reportable frequency excursions during 2009/10. Table 5.1 below details these excursions. If SONI had reported on the normal 49.5 Hz there would only have been 7 reportable incidents.

Cause of Incident	Date	Generator Capacity MW	MW Lost	Pre-incident Frequency Hz	Minimum Frequency - Entire Event Hz	Minimum Frequency - POR Hz	Maximum Rate of Change of Frequency		t< 49.6 Hz (secs)	System Load Note 2			Wind			N - S Tie-Line Flow (MW)	Moyle Interconnection Flow (MW) Note 1
							Max df/dt Hz/sec	Average df/dt Hz/sec		RoI	NI	Total	RoI	NI	Total		
Coolkeeragh Trip	09/11/2009	402	400	49.96	49.521	49.528	-0.19	-0.05	5.9	3289	1097	4386	315	68	383	1.96	207.2
Coolkeeragh Trip	21/11/2009	402	400	50.00	49.550	49.550	-0.2	-0.2	3.9	3524	1212	4736	925	237	1162	195.6	119.06
Dublin Bay DB1 Trip	17/12/2009	403	380	49.99	49.587	49.790	-0.16	-0.03	0.6	3954	1440	5394	192	49	241	11.82	449.4
Tynagh TYC Trip	10/02/2010	384	360	49.99	49.529	49.780	-0.19	-0.05	4.4	4074	1421	5495	43	8	51	-75.76	451.14
Aghada AD2 Trip	12/03/2010	432	380	49.98	49.343	49.640	-0.22	-0.08	10.9	3789	1340	5129	354	137	491	-99.78	452.14
Aghada AD2 Trip	16/03/2010	432	430	50.10	49.563	49.560	-0.27	-0.03	2.1	3758	1332	5090	816	177	993	67.96	280.26
Aghada AD2 Trip	19/03/2010	432	430	50.09	49.512	49.510	-0.28	-0.05	3.9	3604	1223	4827	111	32	143	-33.2	427.6
Coolkeeragh Trip	20/03/2010	402	400	49.97	49.499	49.500	-0.2	-0.02	8.3	2981	990	3971	278	69	347	33.62	212.2
Huntstown HN2 Trip	18/04/2010	400	375	49.98	49.358	49.400	-0.25	-0.09	9.9	2599	902	3501	38	0	38	29.42	113.12
Aghada AD2 Trip	27/04/2010	432	440	50.00	49.023	49.020	-0.3	-0.09	19.2	3429	1245	4674	827	210	1037	65.66	373.34
Huntstown HN2 Trip	01/05/2010	400	380	49.94	49.235	49.240	-0.24	-0.09	15.3	2844	955	3799	27	4	31	18.08	201.6
Whitegate WG1 Trip	17/06/2010	445	414	49.96	49.451	49.450	-0.29	-0.06	8	3571	1231	4802	46	4	50	-25.54	0
Whitegate WG1 Trip	19/06/2010	445	320	49.98	49.566	49.570	-0.23	-0.05	2.6	2890	949	3839	310	175	485	60.54	0
Whitegate WG1 Trip	01/07/2010	445	422	50.11	49.568	49.570	-0.27	-0.03	2.1	3175	1060	4235	444	66	510	128.6	0
Whitegate WG1 Trip	04/07/2010	445	440	49.97	49.158	49.160	-0.32	-0.12	19.2	2936	1025	3961	1034	289	1323	-12	0
Tynagh TYC Trip	11/07/2010	384	342	50.00	49.539	49.640	-0.15	-0.05	5.8	2839	897	3736	94	3	97	106.7	220.66
Whitegate WG1 Trip	04/08/2010	445	444	49.96	49.391	49.390	-0.31	-0.07	6.1	3169	1146	4315	549	177	726	88.7	389.4
Whitegate WG1 Trip	18/08/2010	445	418	50.09	49.561	49.560	-0.29	-0.03	2.3	3091	1093	4184	249	79	328	-60.16	388.72
Tynagh TYC Trip	10/09/2010	384	340	49.99	49.582	49.590	-0.09	-0.002	0.5	3392	1140	4532	503	138	641	-5.76	251
Whitegate WG1 Trip	26/09/2010	445	430	50.08	49.551	49.550	-0.27	-0.04	3	3137	1062	4199	149	18	167	98.24	213.12

Table 5.1: Frequency Excursions in NI in 2009/10

- **Note 1: NS and Interconnection flows, VE+ represents an import to Northern Ireland**
- **Note 2: The System Load figures are in generated metered sent out terms**

Event Definitions.

Time 0 seconds	-	Considered to be when the frequency falls through 49.8 Hz
Pre Incident frequency	-	Average system frequency between t - 60seconds and t -30 seconds
Minimum Frequency (Entire Event)	-	Minimum system frequency from t 0 to t + 6 minutes
Minimum Frequency (POR)	-	Minimum frequency during POR period from t + 5 seconds to t + 15 seconds
Maximum Rate of Change of Frequency	-	Maximum negative rate of change of frequency during the period t – 5 seconds to t + 30 seconds (This is calculated from a five point moving average with a sample rate of 100 milliseconds)
Average Rate of Change of Frequency	-	This is the rate of change of frequency observed between two points in time. The first point being when the frequency passes through 49.8 Hz and the second when the frequency nadir is observed between t + 5 seconds and t + 15 sceonds (See HAS agreement)

5.4.1 ANNUAL FREQUENCY EXCURSIONS

Figure 5.1 below shows the number of frequency excursions from 1998/99 to 2009/10. The significant increase to 20 incidents is due the decision to change the criteria for reporting frequency excursions to any incident under 49.6 Hz. To compare against previous years criteria of only including frequency excursions below 49.5Hz, there would have been 7 incidents in the 2009/10 period.

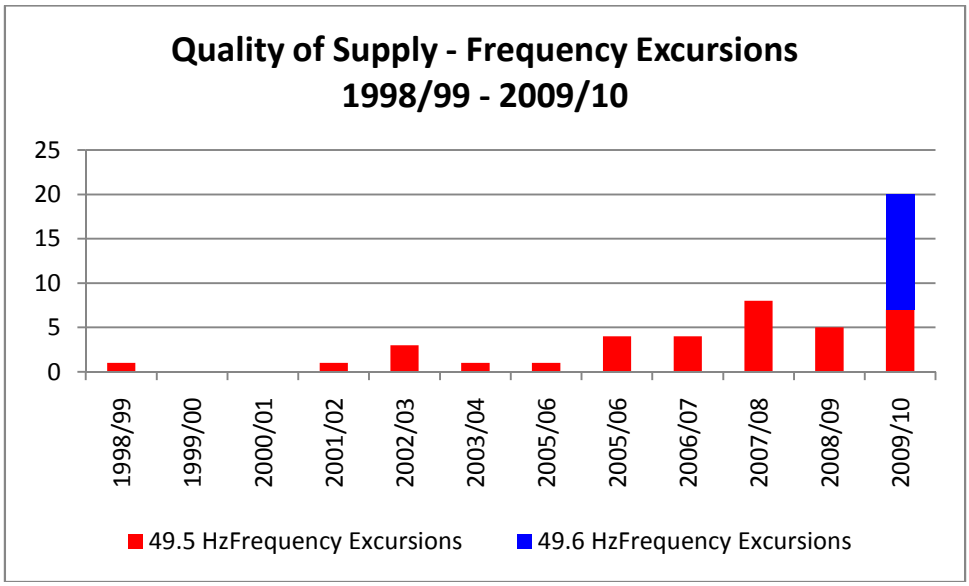


Figure 5.1: Historic Frequency Excursions 1998/99 – 2009/10

In recent years, a number of large combined cycle gas turbine (CCGT) units have been commissioned on the island of Ireland. These units tend to be base load, higher efficiency plant, generating for a high proportion of the time. As the all-island generating plant portfolio tends towards a smaller number of larger units, there is an increased possibility that frequency excursions will occur. However, during 2009/10 there were no incidents where the Electricity Supply Regulations (Northern Ireland) 1991 statutory limit of 2.5% was exceeded, and no customer disconnections occurred. It should be noted that, during 2009/10, two new CCGTs were commissioned in the Republic of Ireland - at Aghada and Whitegate. The required testing of these new machines led to a number of frequency excursions in Northern Ireland, as demonstrated in Table 5.1, with trips of both Aghada and Whitegate making up just over 50% of all incidents.

6 CONCLUSIONS

- There was a continued improvement in system availability during 2009/10 (97.67% as against 97.26% for 2008/09).

- The availability of the Moyle Interconnector with Great Britain was significantly reduced during 2009/10. The reduction was caused by 2 lengthy planned outages and the unplanned outage caused by the cable fault at Moyle.

- After 4 years of reduction in the 275kV North – South Tie Line availability, there was a significant improvement in 2009/10 availability to 97.31%.

- There was an improvement in 110kV Tie Lines availability during 2009/10 (99.94% as against 97.35% for 2008/09).

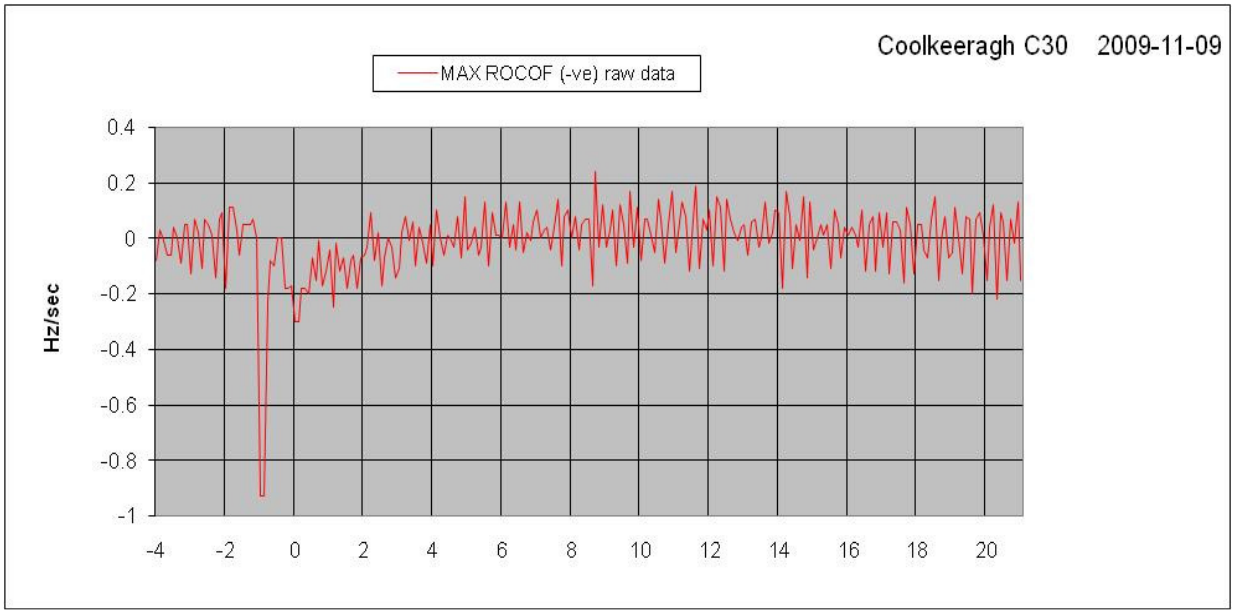
- There was only one incident that impinged on system security during the period of this report. The 275kV Coolkeeragh - Magherafelt B Line fault and subsequent protection mal-operation leading to the generation loss and customer load shedding in Londonderry.

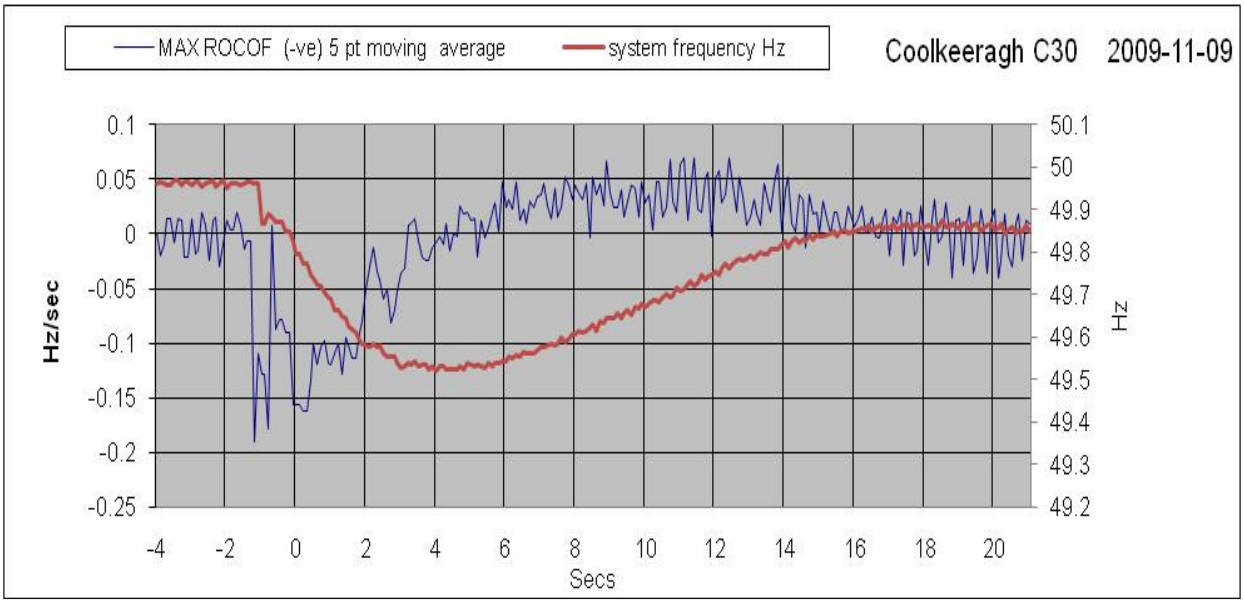
- There were no reported voltage excursions. SONI have decided to report on any frequency excursion less than 49.6 Hz. There were 20 incidents of which 5 fell below 49.5Hz.

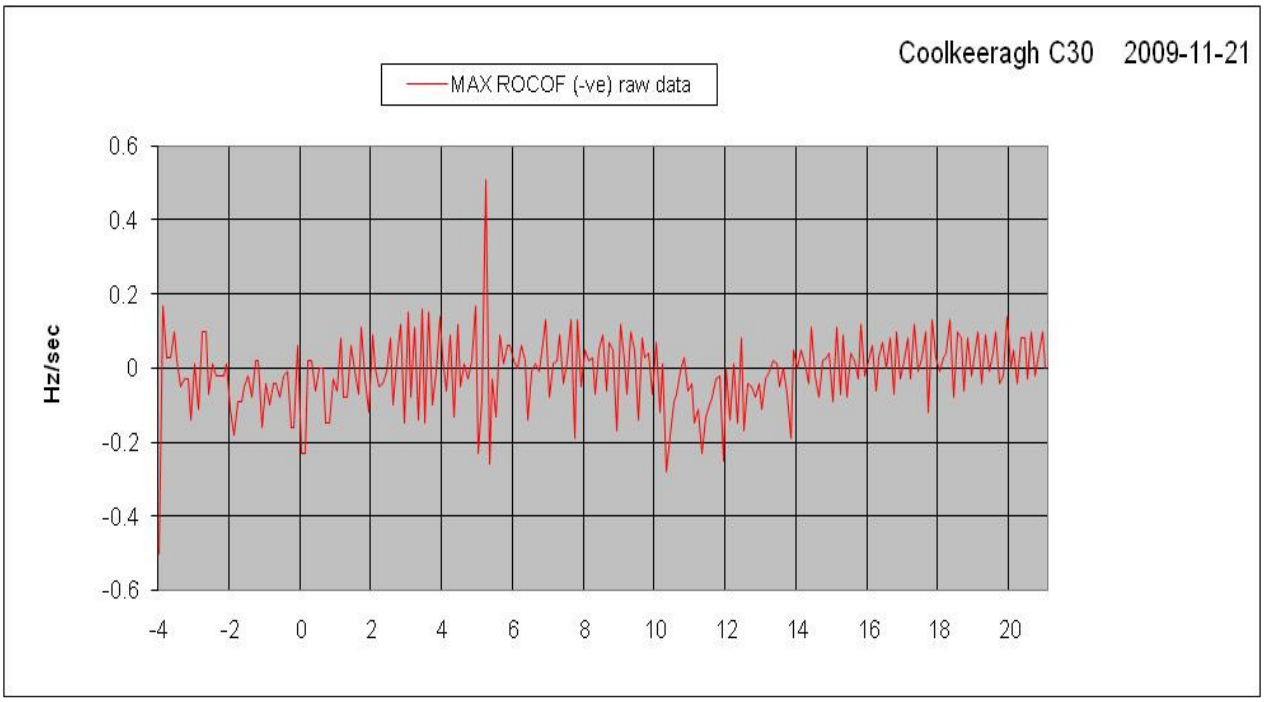
APPENDIX A FREQUENCY EXCURSION GRAPHS

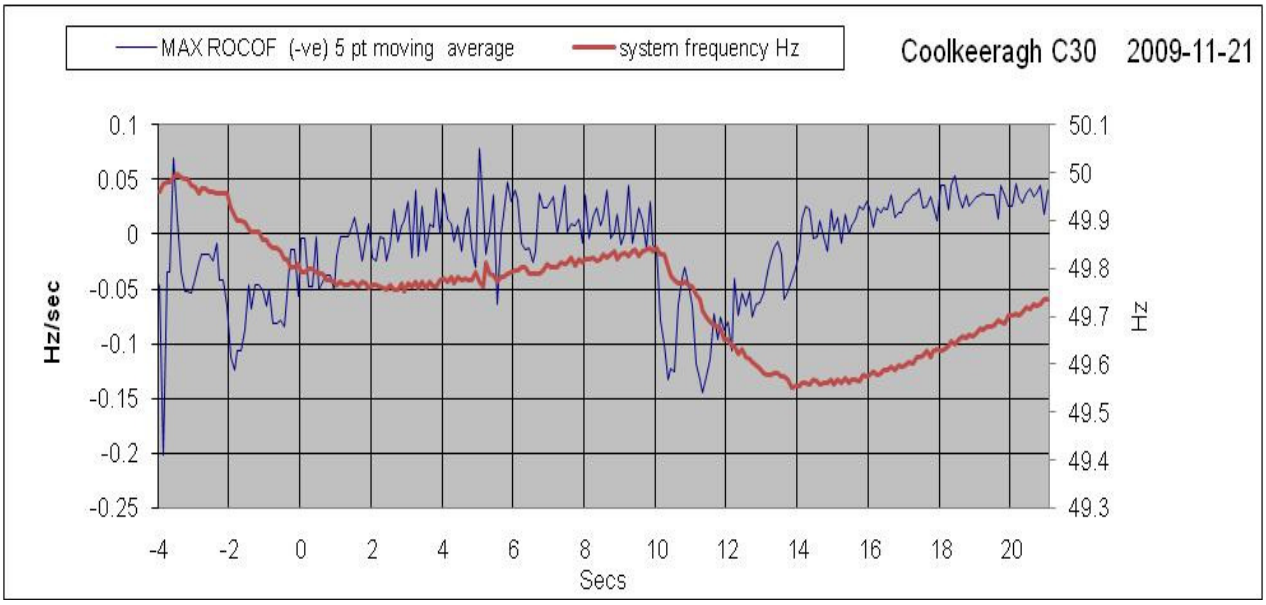
The following is a list of graphs contained in this section.

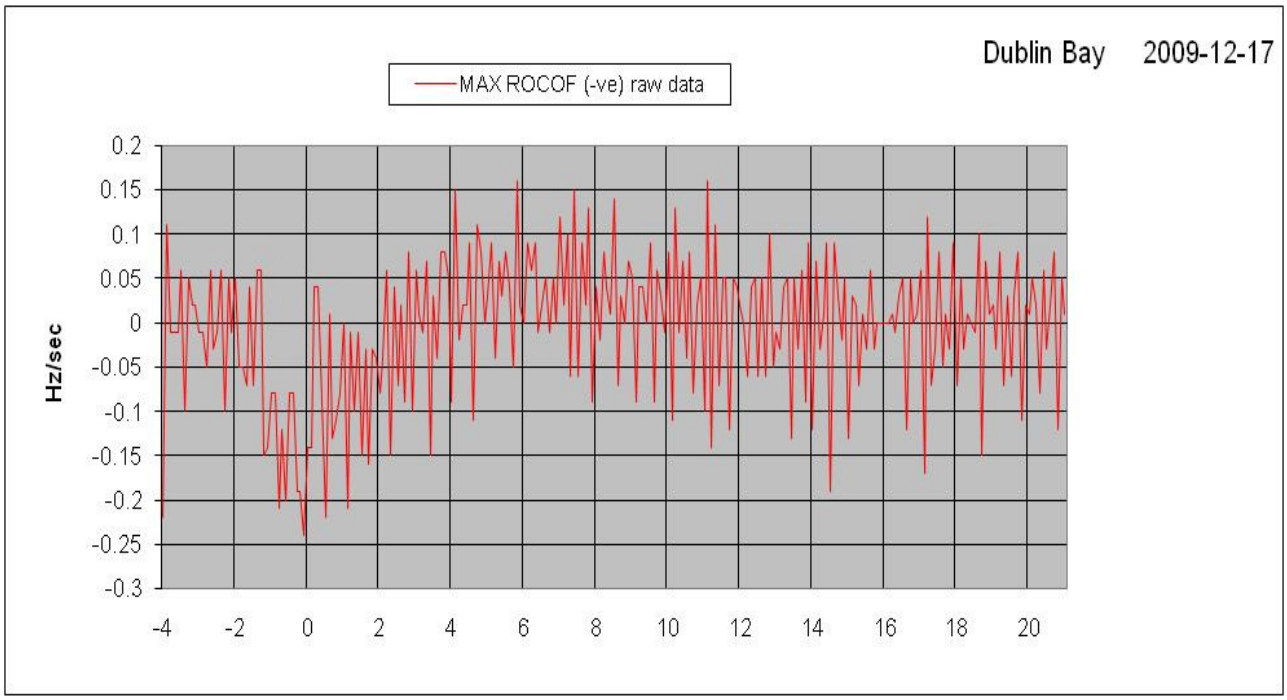
N.B. On all the following graphs the term ROCOF means Rate of Change of Frequency

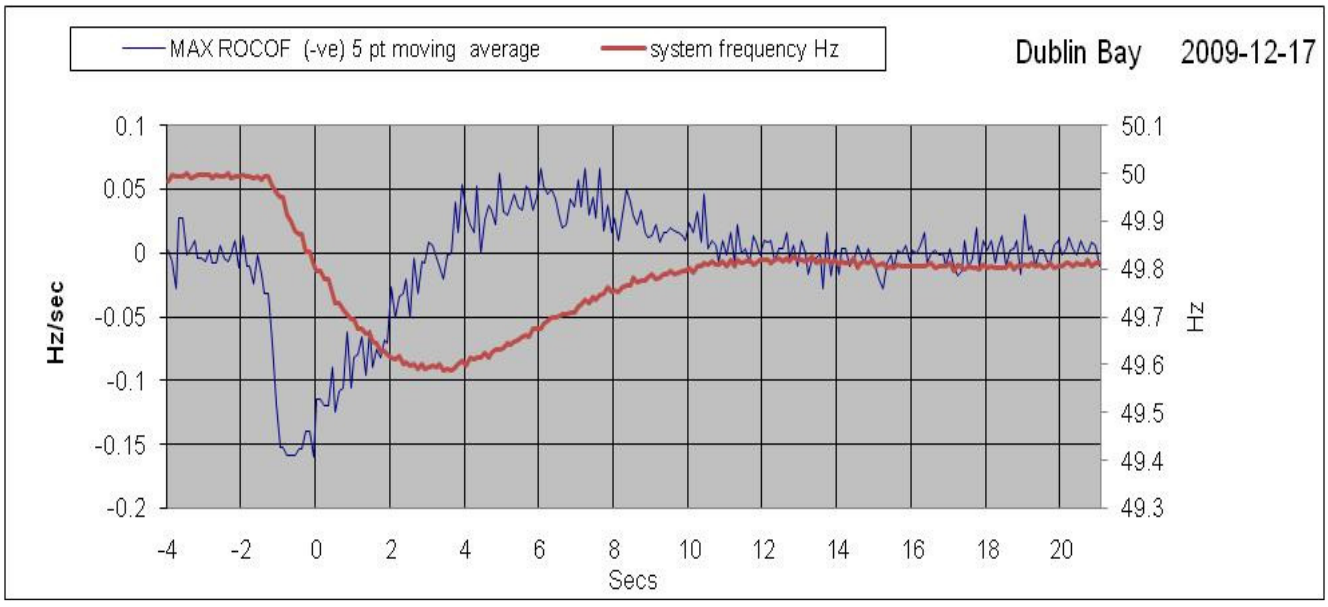

Coolkeeragh C30 2009-11-09
MAX ROCOF (-ve) raw data
Hz/sec
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-4 -2 0 2 4 6 8 10 12 14 16 18 20

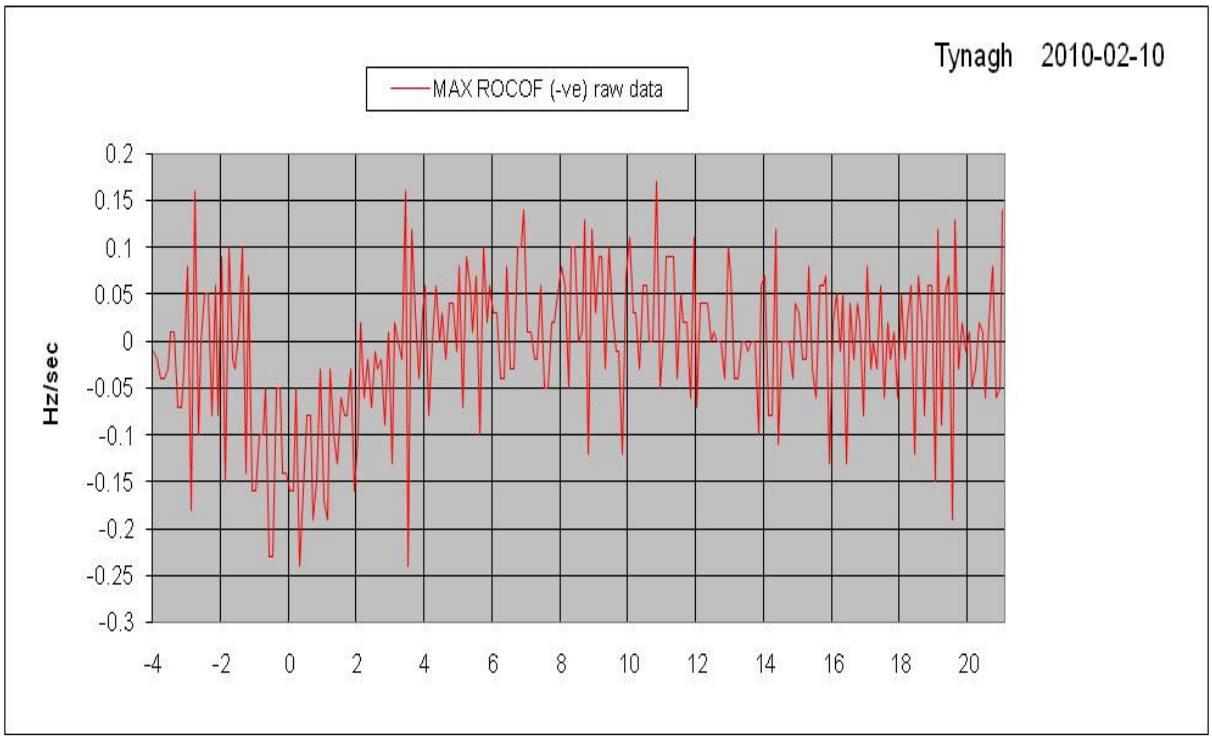

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Coolkeeragh C30 2009-11-09
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

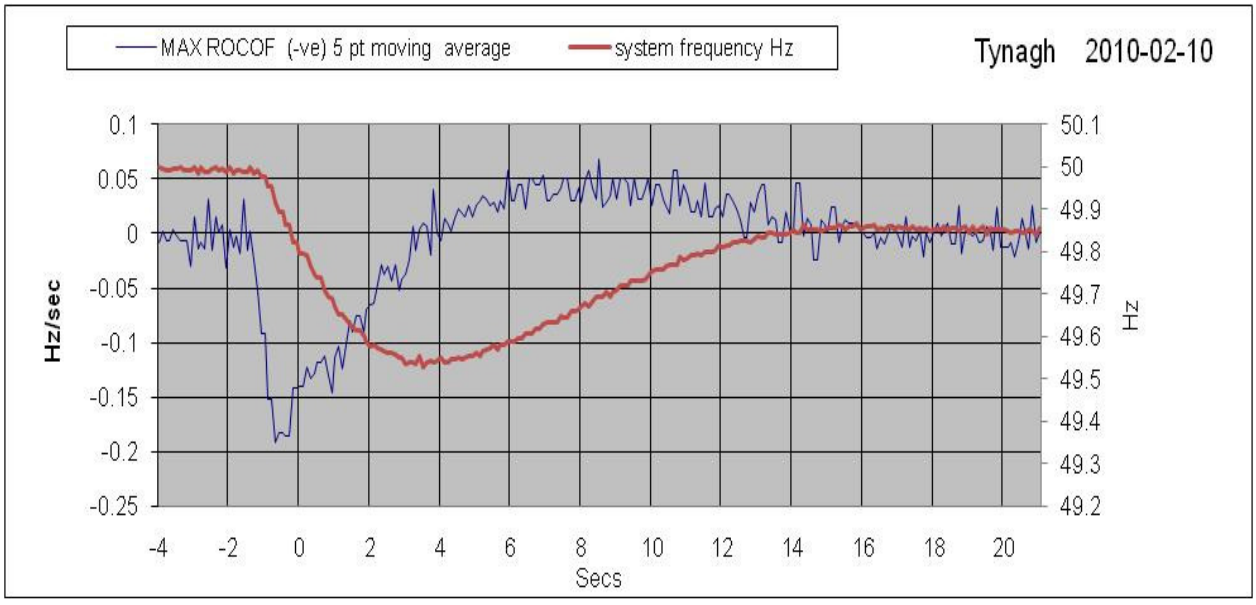

Coolkeeragh C30 2009-11-21
MAX ROCOF (-ve) raw data
Hz/sec
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-4 -2 0 2 4 6 8 10 12 14 16 18 20

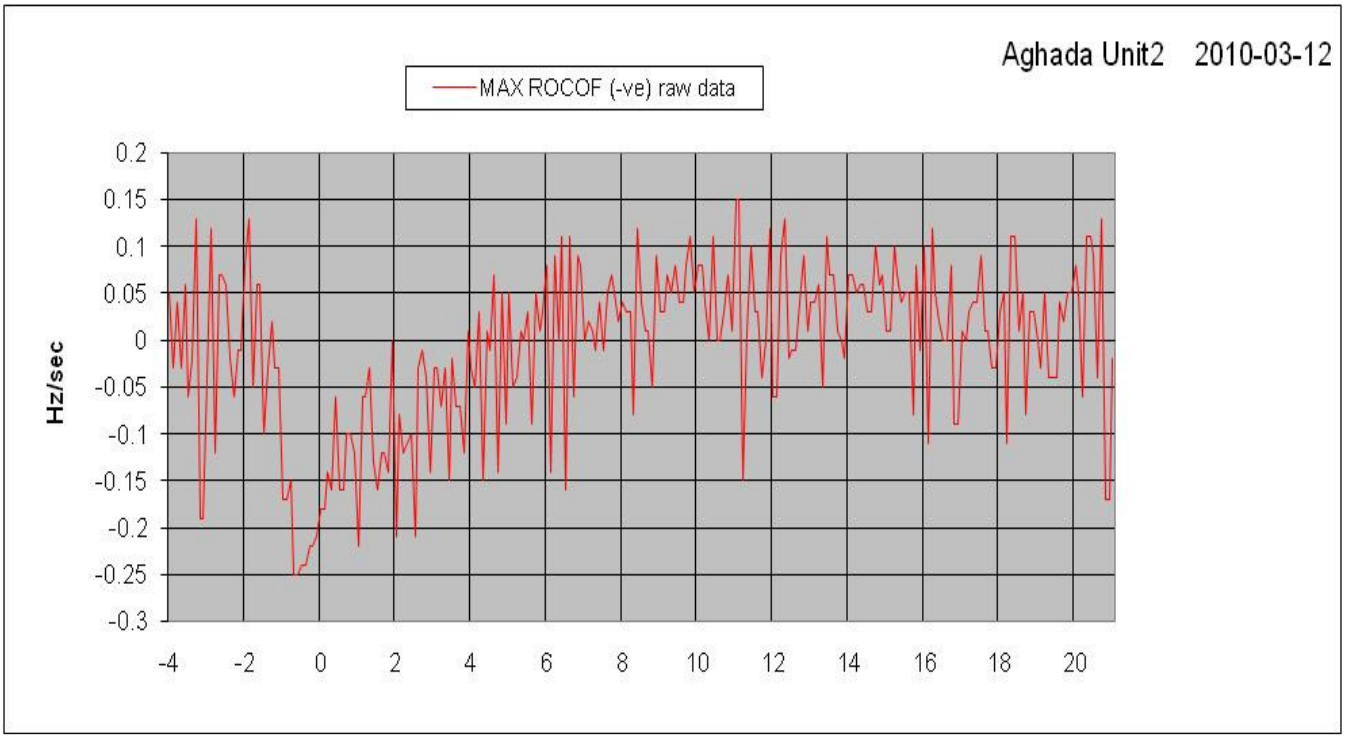

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Coolkeeragh C30 2009-11-21
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

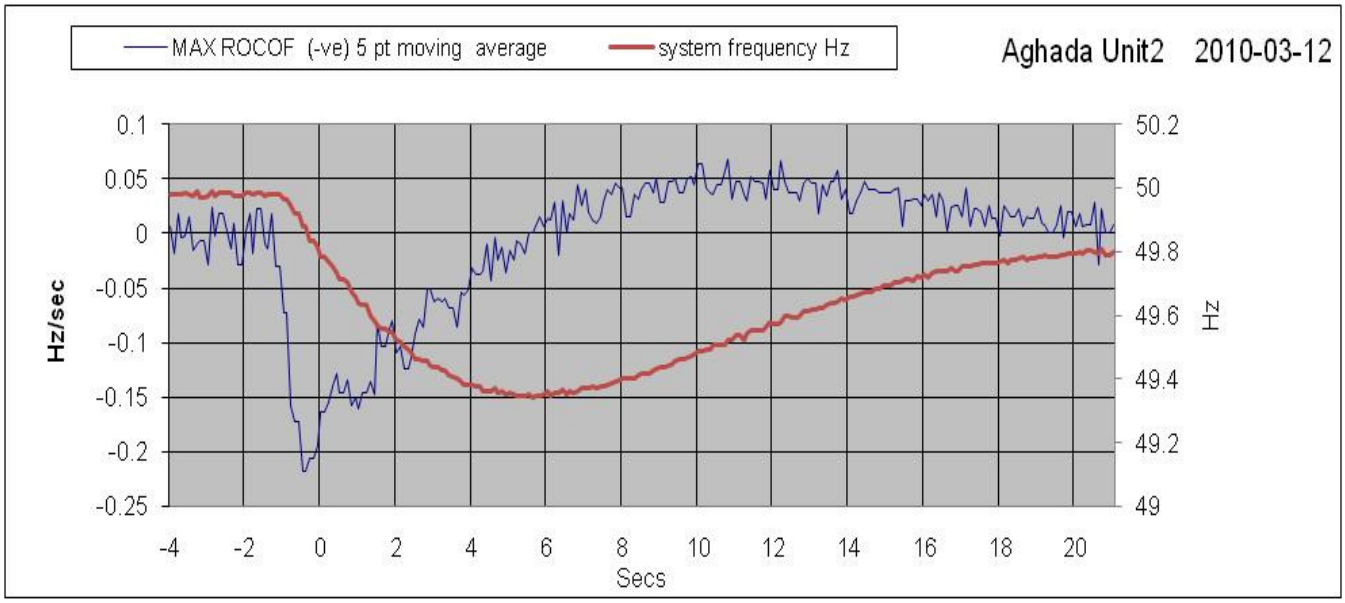

Dublin Bay 2009-12-17
MAX ROCOF (-ve) raw data
Hz/sec
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-4 -2 0 2 4 6 8 10 12 14 16 18 20

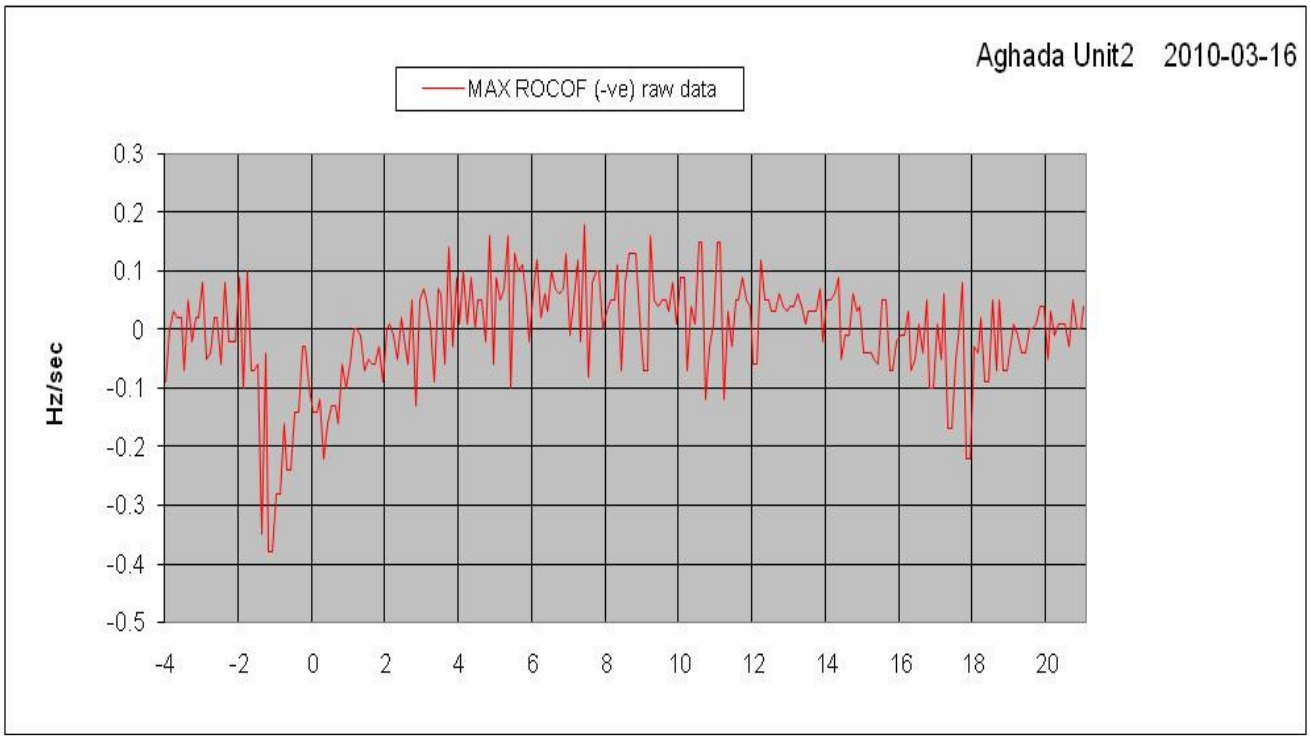

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Dublin Bay 2009-12-17
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

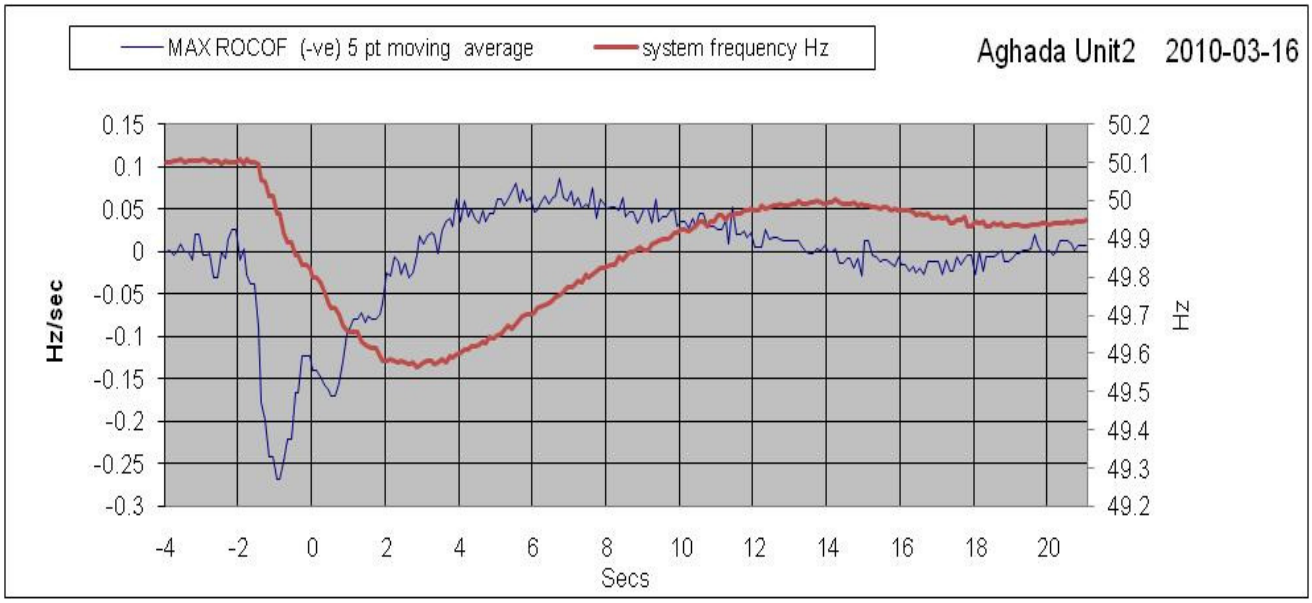

Tynagh 2010-02-10
MAX ROCOF (-ve) raw data
Hz/sec
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-4
-2
0
2
4
6
8
10
12
14
16
18
20

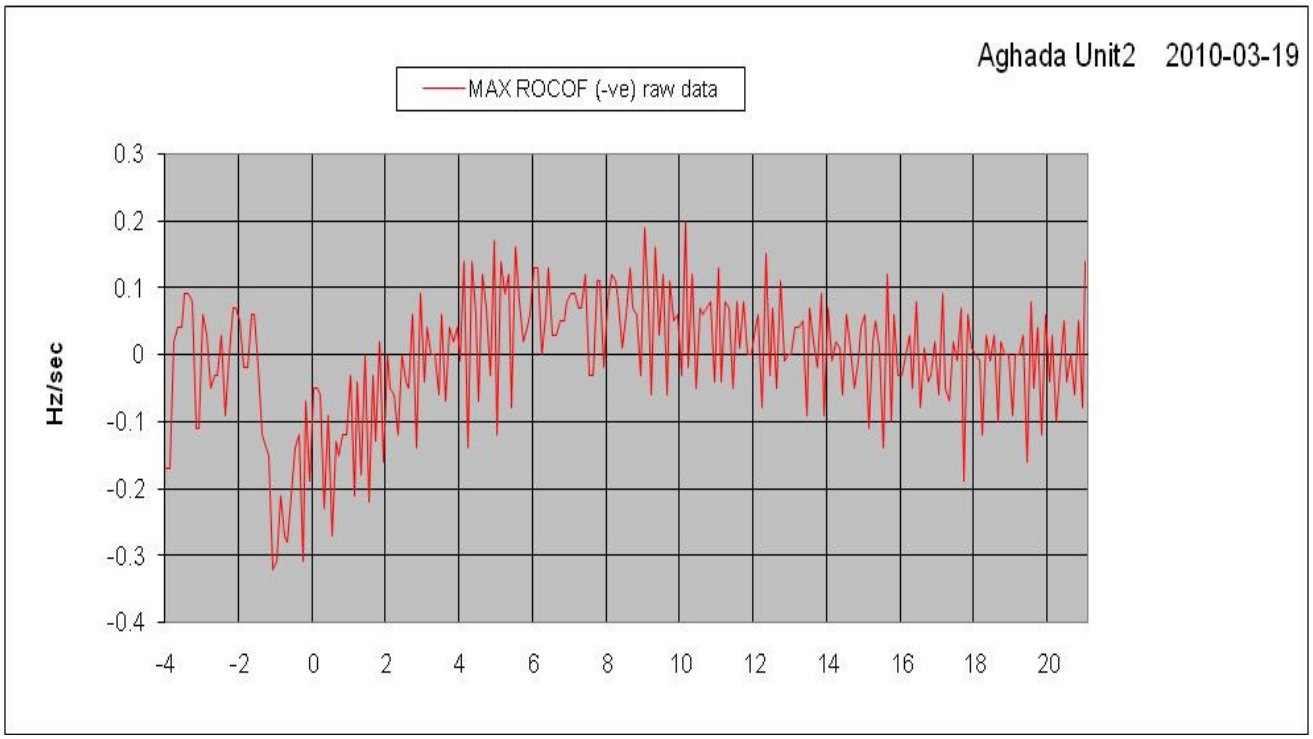

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Tynagh 2010-02-10
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
Hz
-4
-2
0
2
4
6
8
10
12
14
16
18
20
Secs

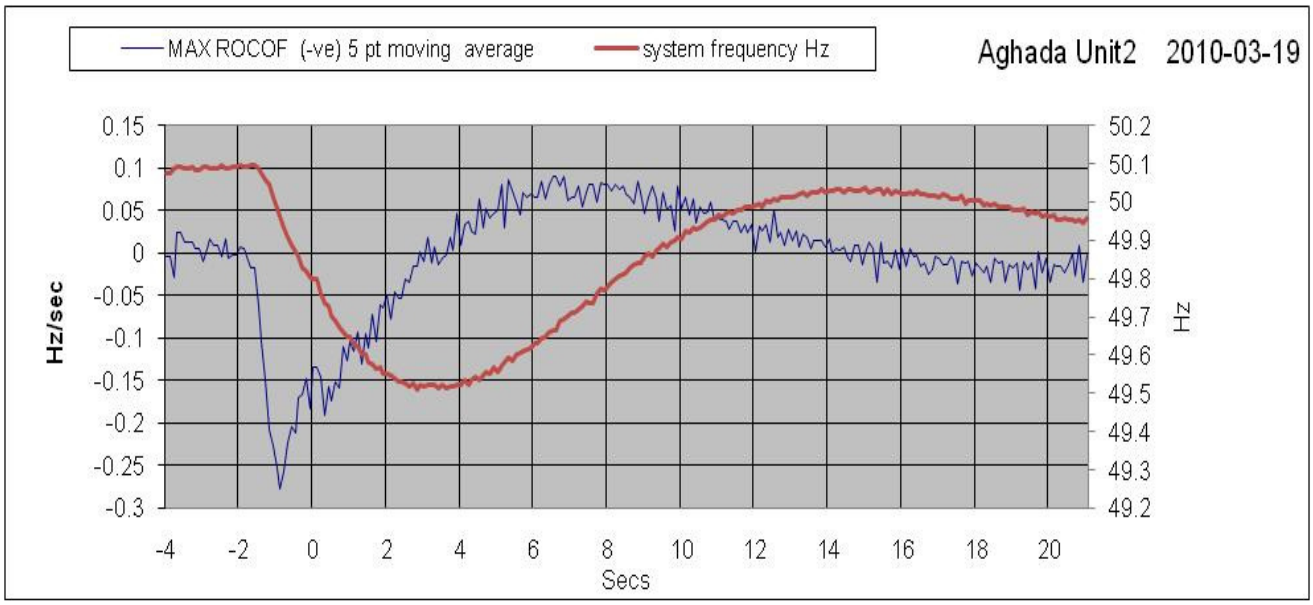

Aghada Unit2 2010-03-12
MAX ROCOF (-ve) raw data
Hz/sec
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-4
-2
0
2
4
6
8
10
12
14
16
18
20

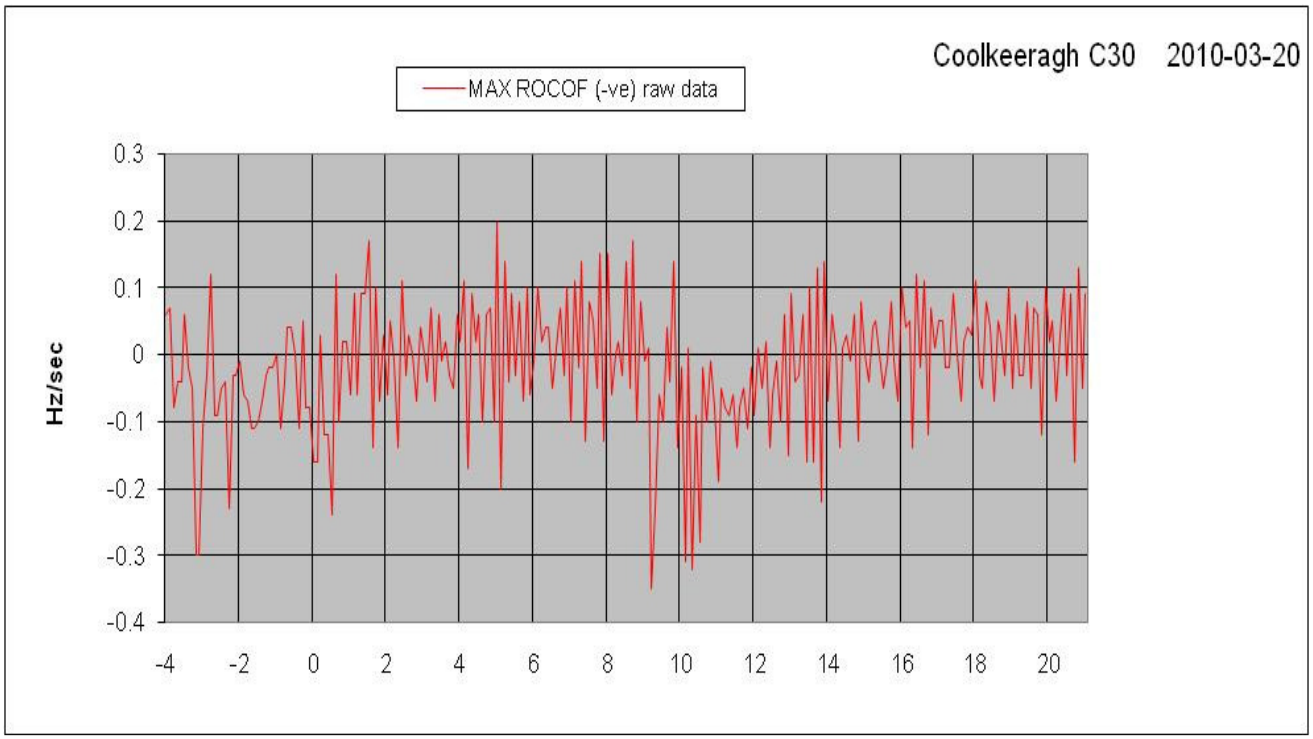

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Aghada Unit2 2010-03-12
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
50.2
50
49.8
49.6
49.4
49.2
49
Hz
-4
-2
0
2
4
6
8
10
12
14
16
18
20
Secs

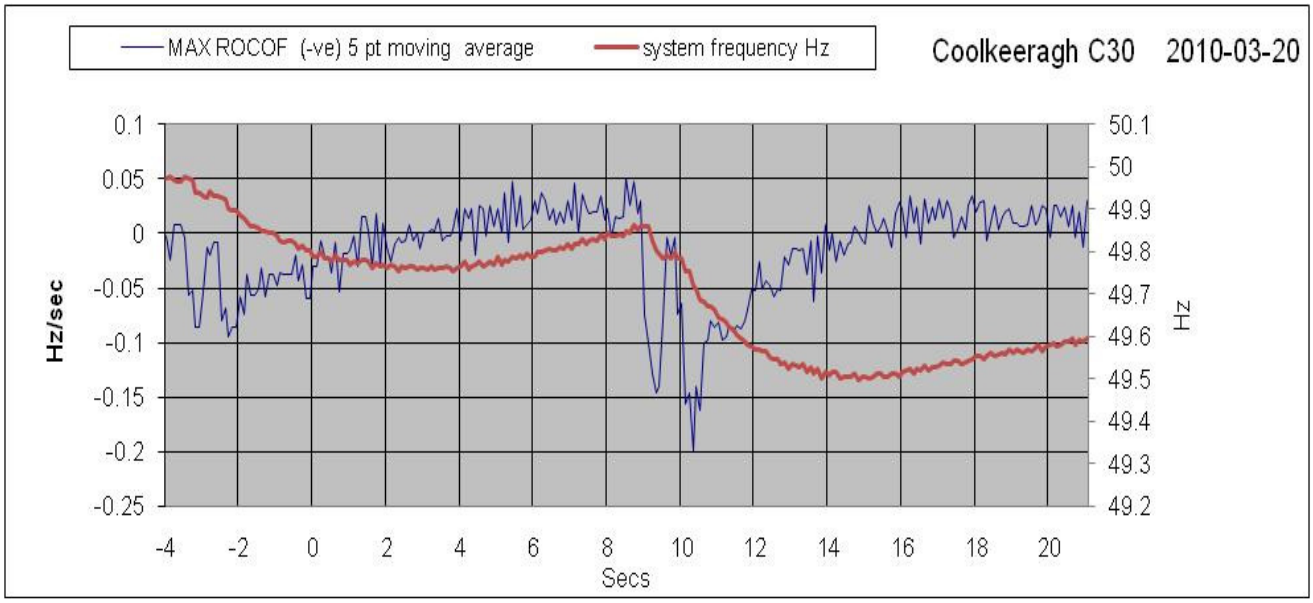

Aghada Unit2 2010-03-16
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-4
-2
0
2
4
6
8
10
12
14
16
18
20

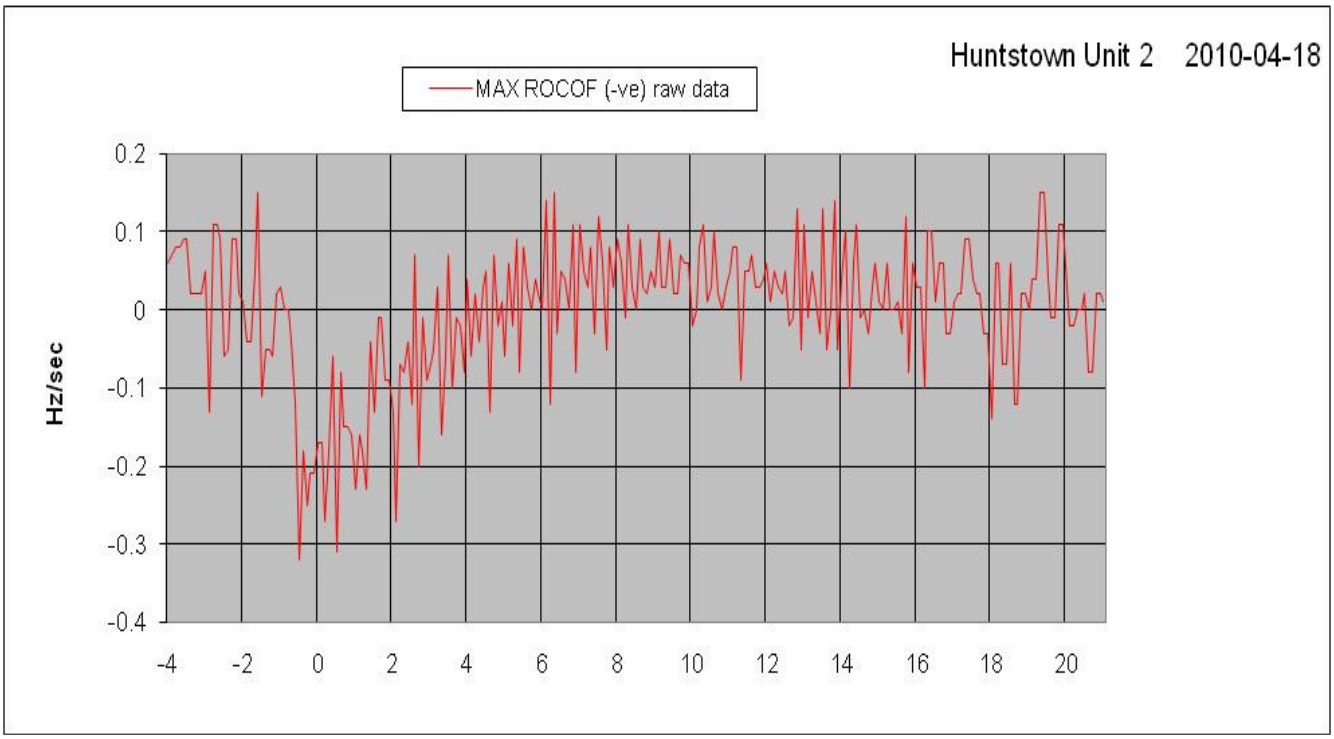

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Aghada Unit2 2010-03-16
Hz/sec
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
50.2
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
Hz
-4
-2
0
2
4
6
8
10
12
14
16
18
20
Secs

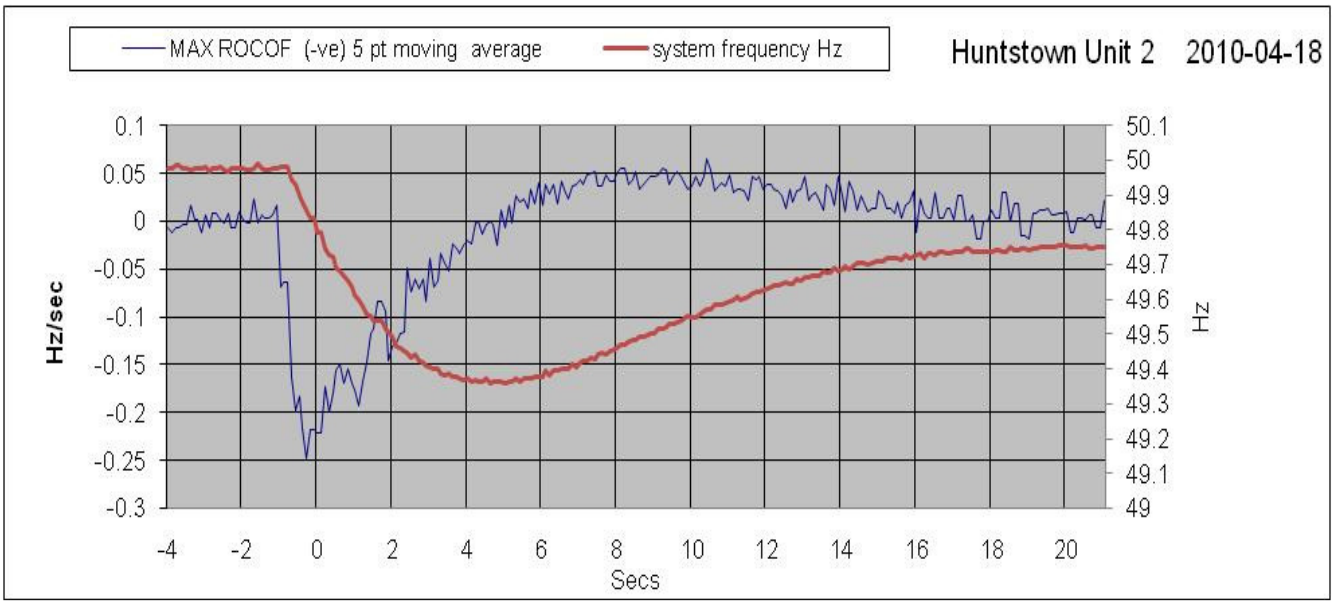

Aghada Unit2 2010-03-19
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4 -2 0 2 4 6 8 10 12 14 16 18 20

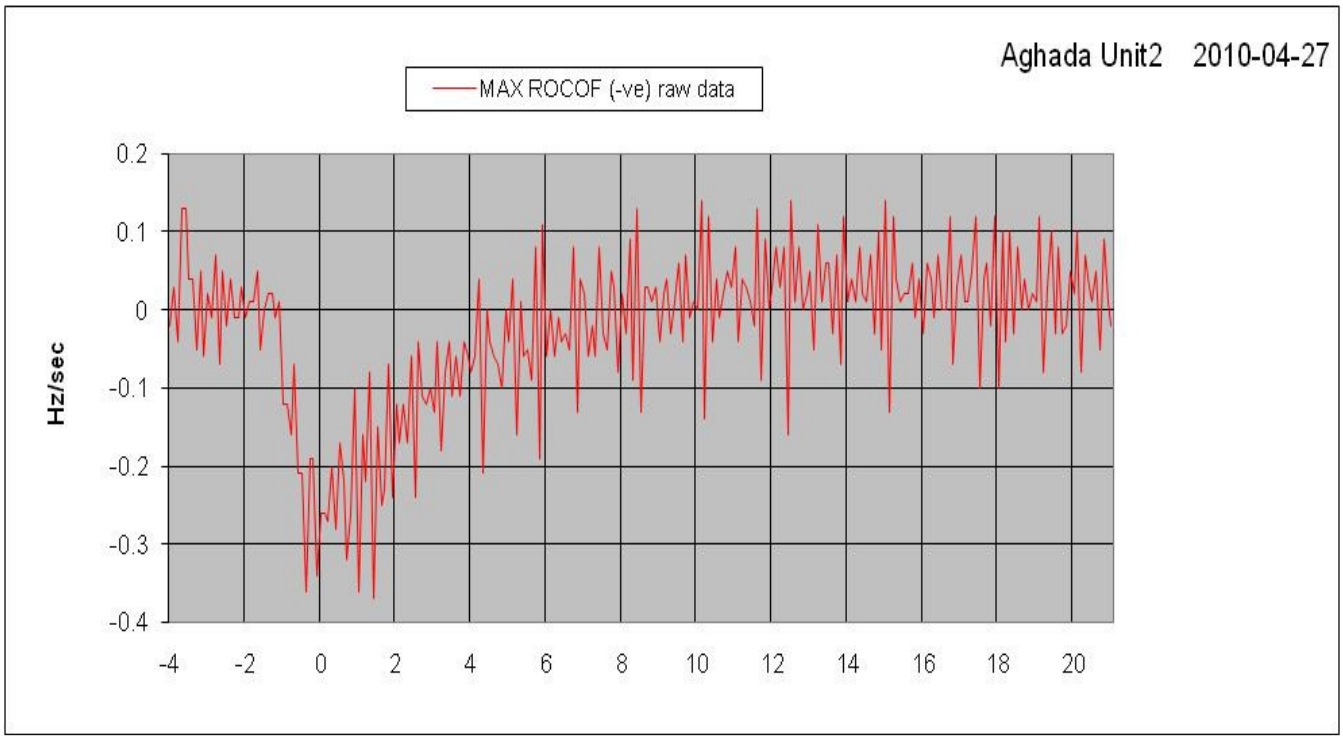

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Aghada Unit2 2010-03-19
Hz/sec
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
50.2
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

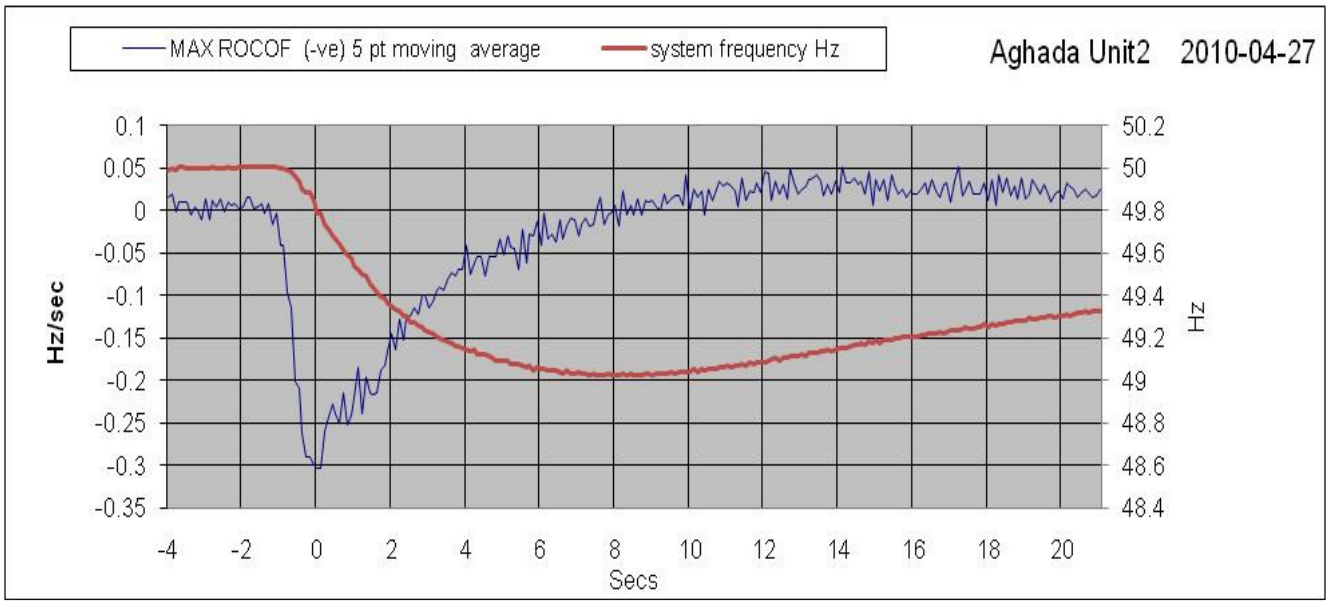

Coolkeeragh C30 2010-03-20
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4
-2
0
2
4
6
8
10
12
14
16
18
20

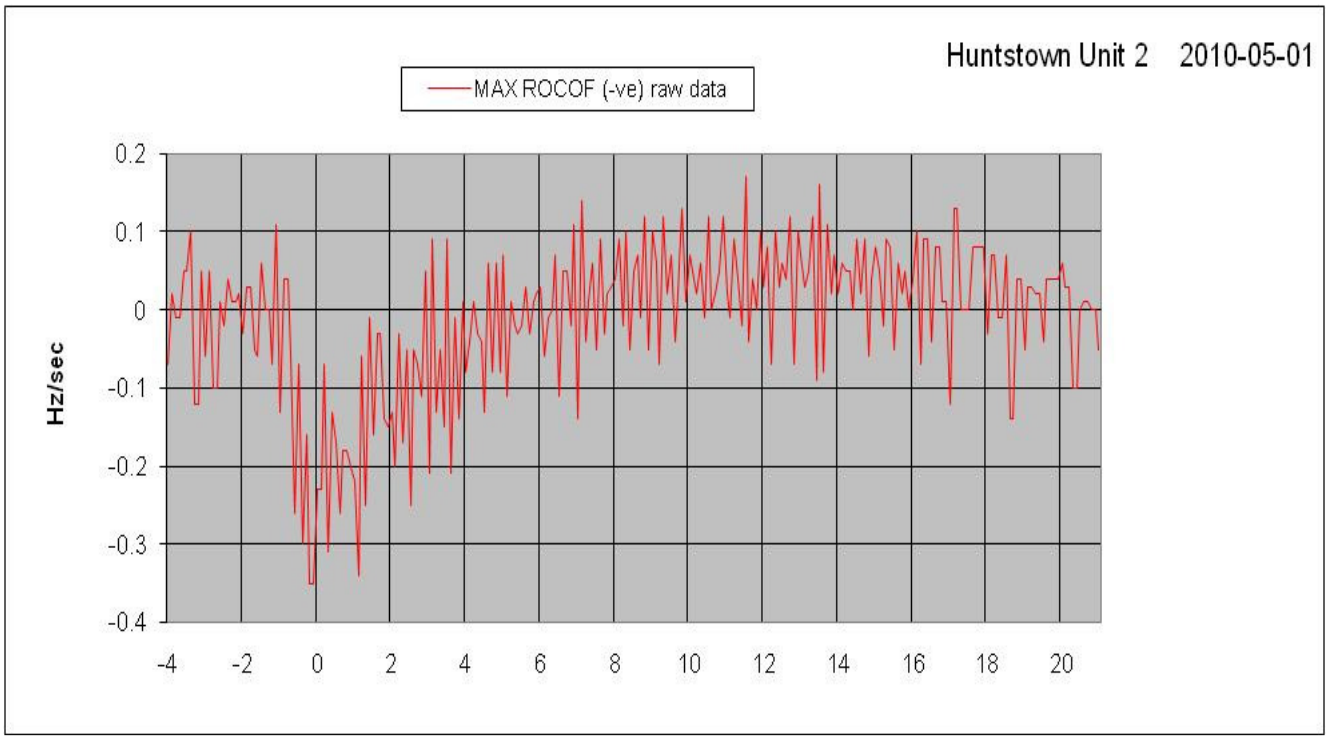

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Coolkeeragh C30 2010-03-20
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
Hz
-4
-2
0
2
4
6
8
10
12
14
16
18
20
Secs

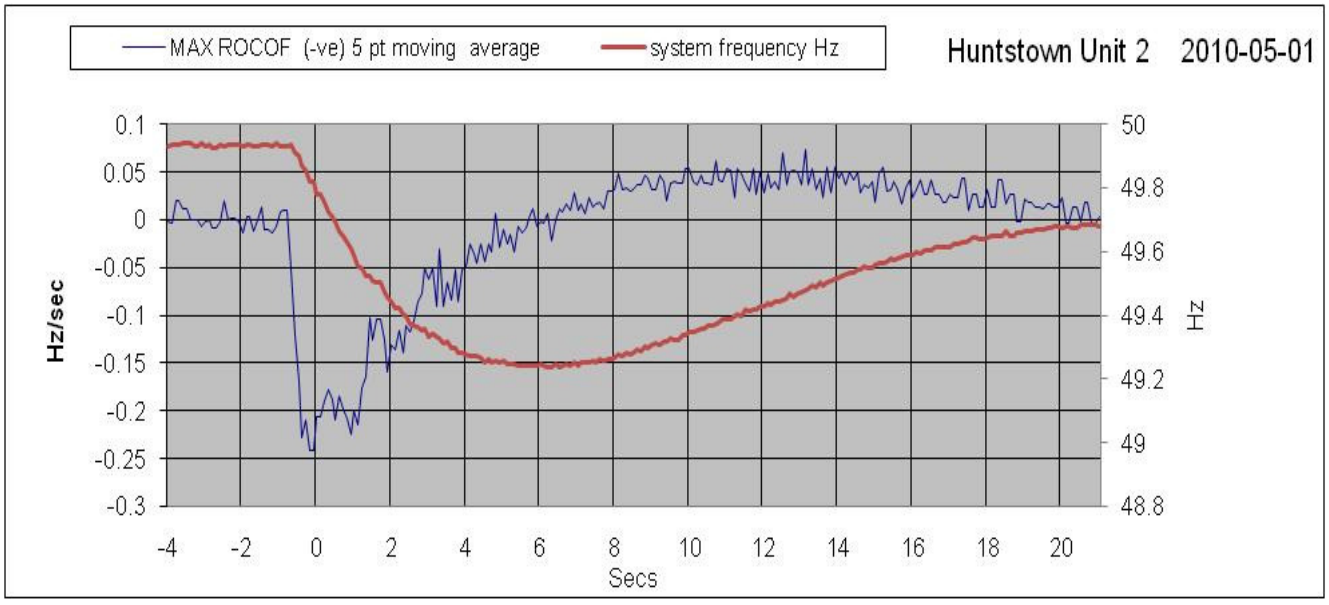

Huntstown Unit 2 2010-04-18
MAX ROCOF (-ve) raw data
Hz/sec
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4 -2 0 2 4 6 8 10 12 14 16 18 20

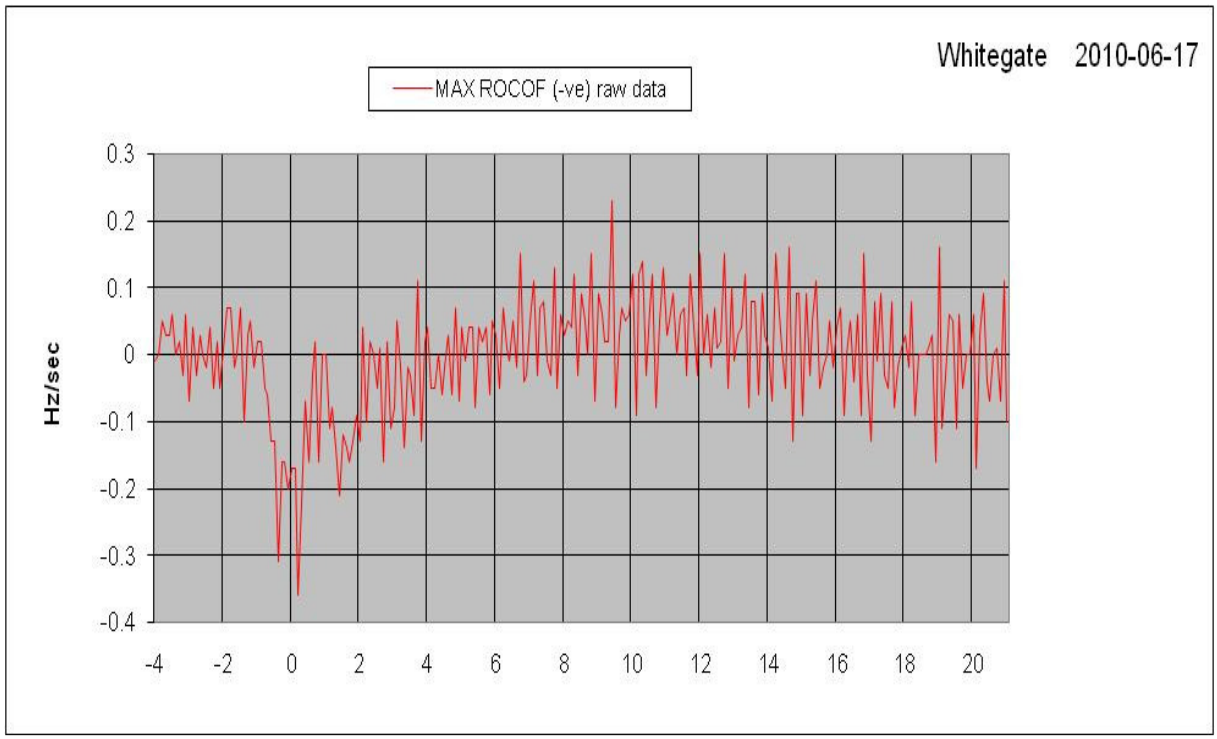

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Huntstown Unit 2 2010-04-18
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
49.1
49
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

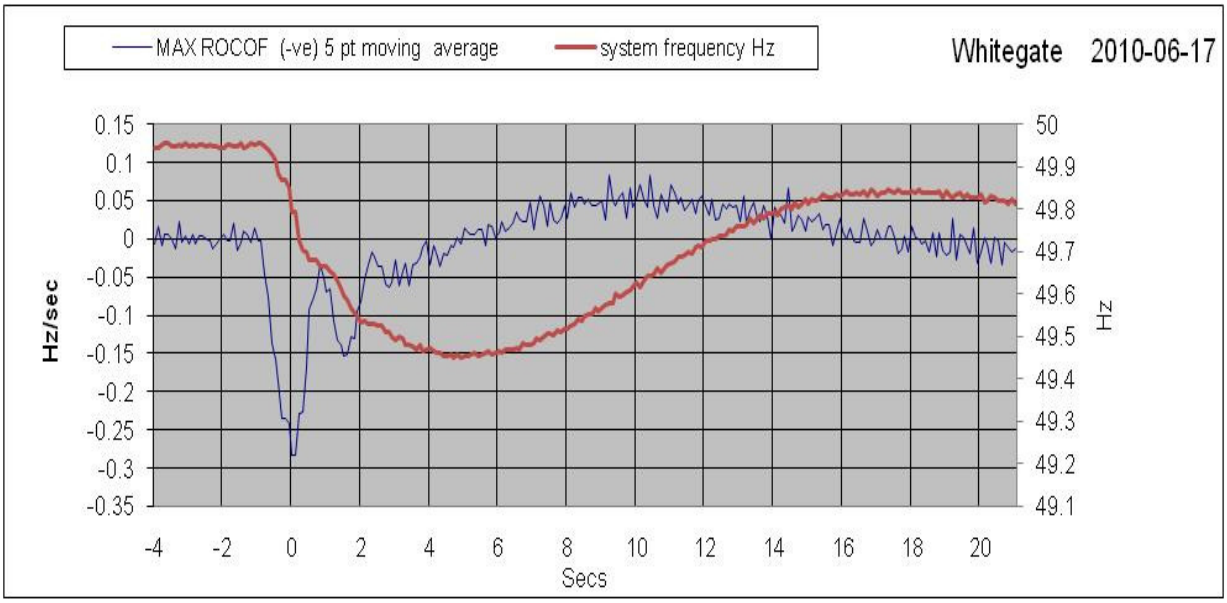

Aghada Unit2 2010-04-27
MAX ROCOF (-ve) raw data
Hz/sec
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4 -2 0 2 4 6 8 10 12 14 16 18 20

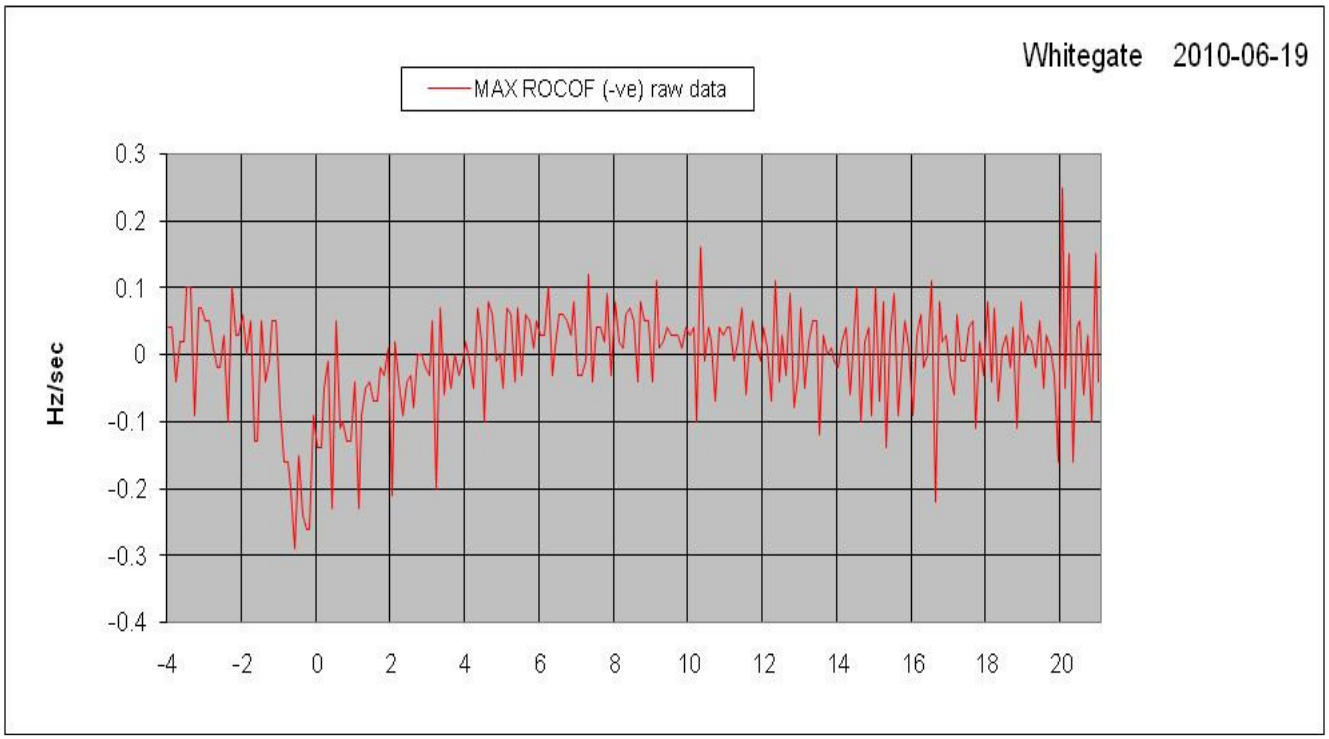

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Aghada Unit2 2010-04-27
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
50.2
50
49.8
49.6
49.4
49.2
49
48.8
48.6
48.4
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

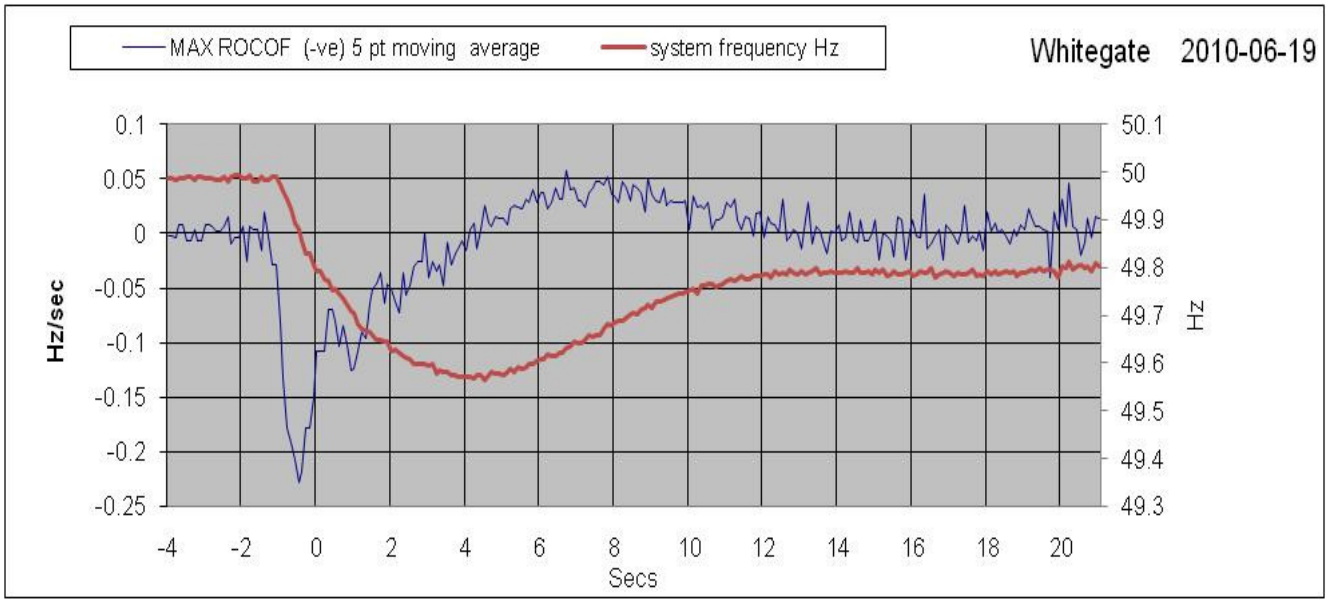

Huntstown Unit 2 2010-05-01
MAX ROCOF (-ve) raw data
Hz/sec
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4 -2 0 2 4 6 8 10 12 14 16 18 20

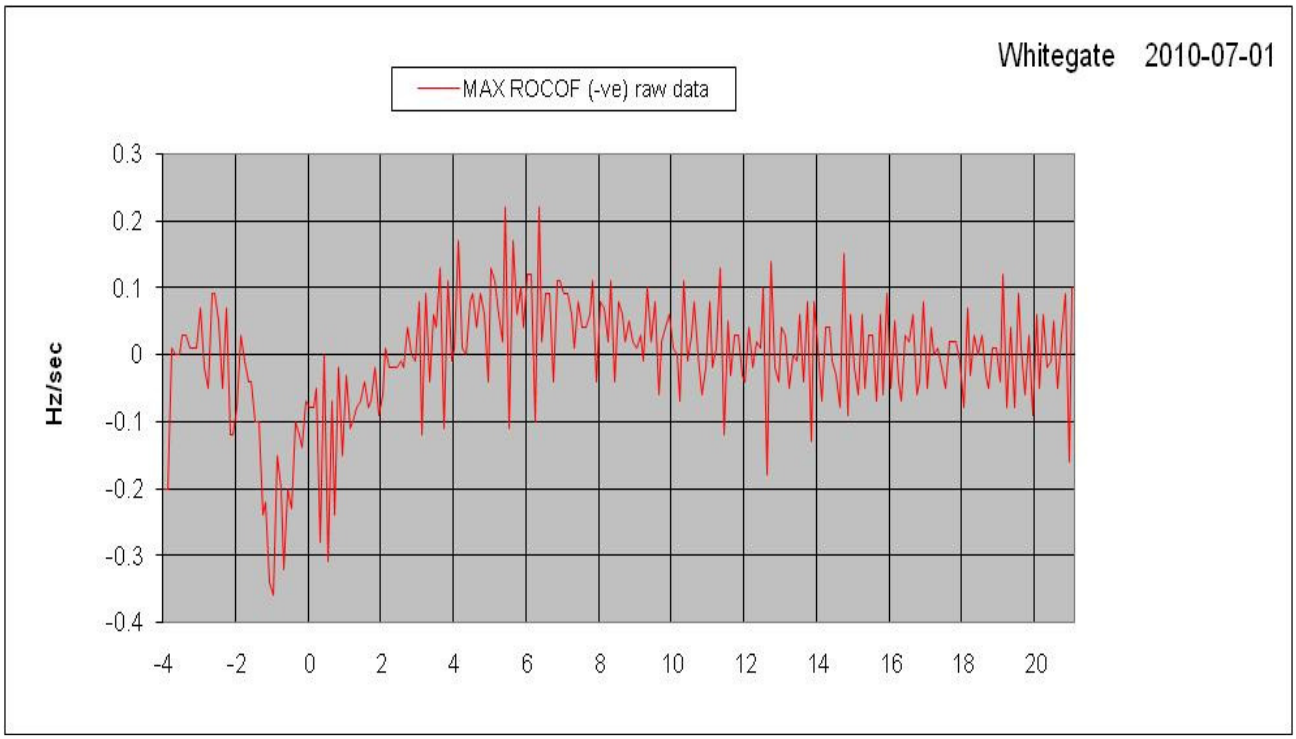

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Huntstown Unit 2 2010-05-01
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
50
49.8
49.6
49.4
49.2
49
48.8
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

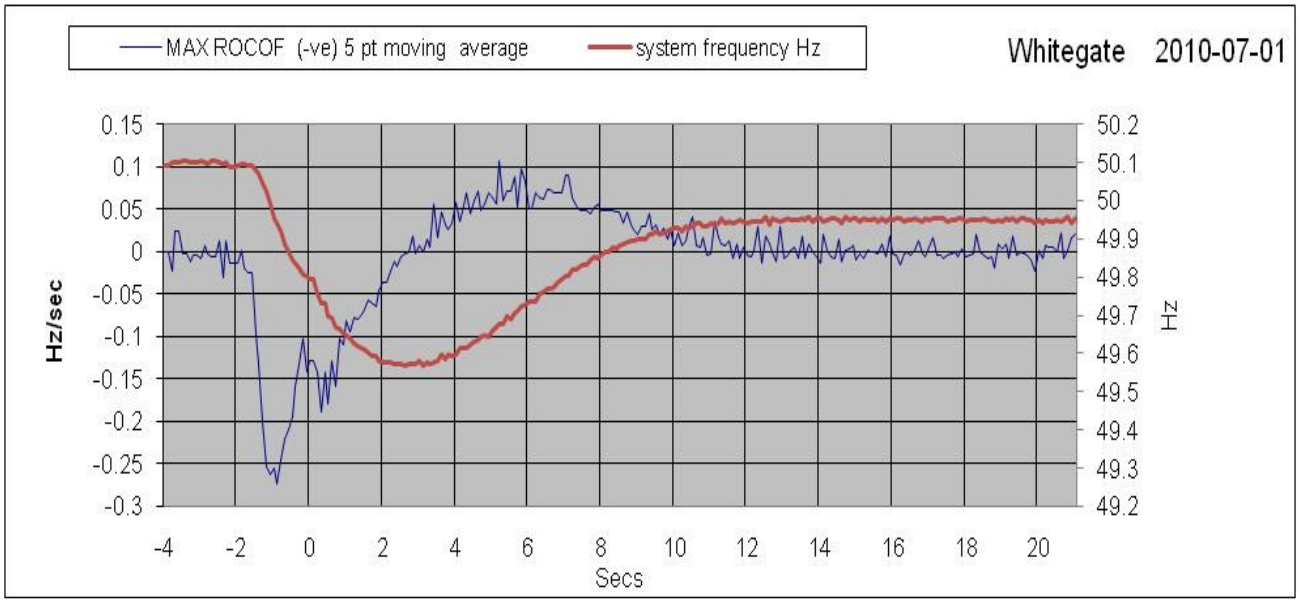

Whitegate 2010-06-17
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4 -2 0 2 4 6 8 10 12 14 16 18 20

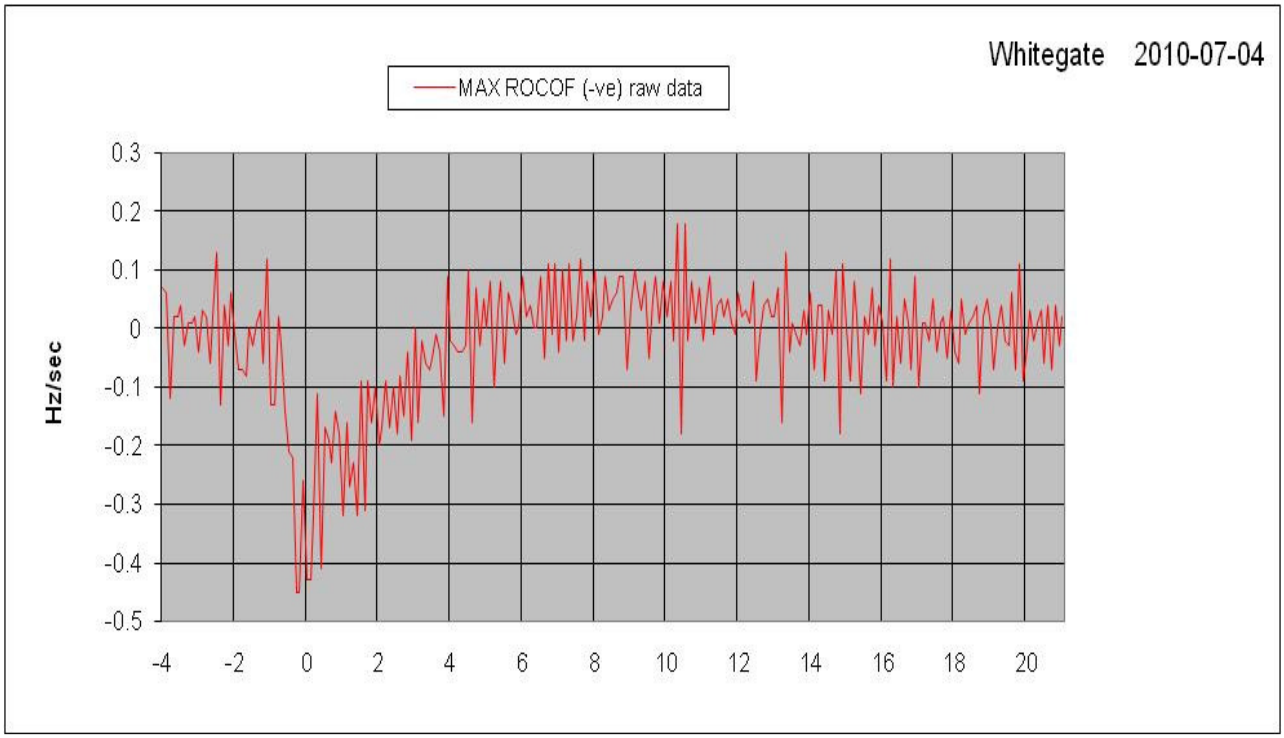

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Whitegate 2010-06-17
Hz/sec
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
49.1
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

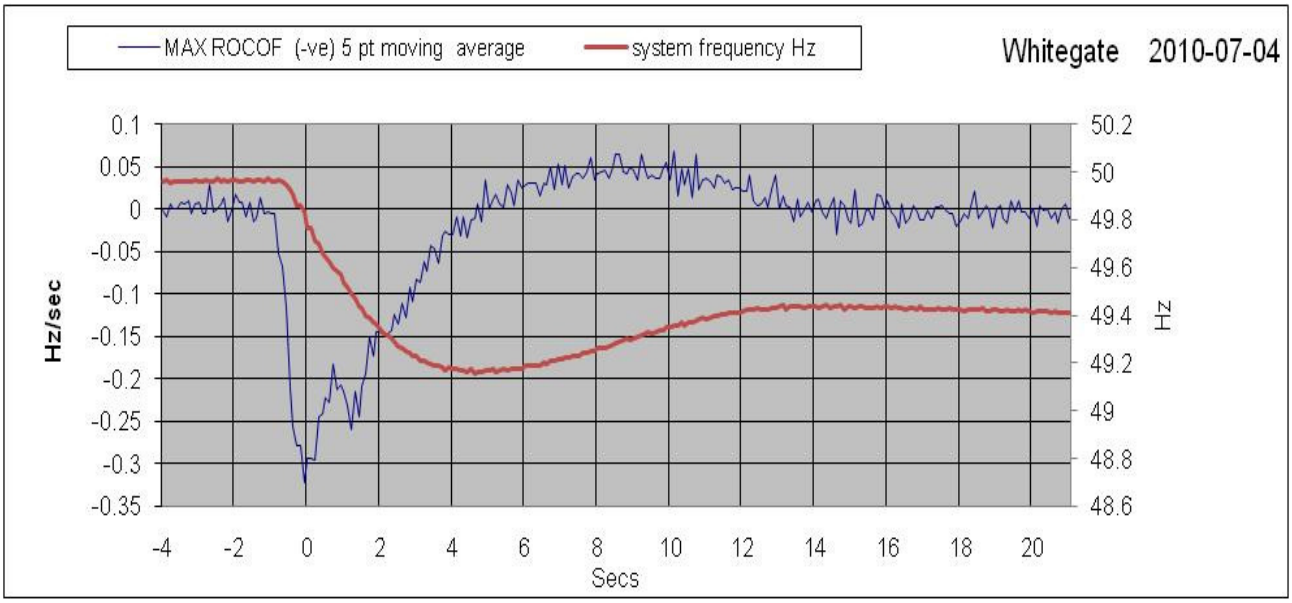

Whitegate 2010-06-19
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4 -2 0 2 4 6 8 10 12 14 16 18 20

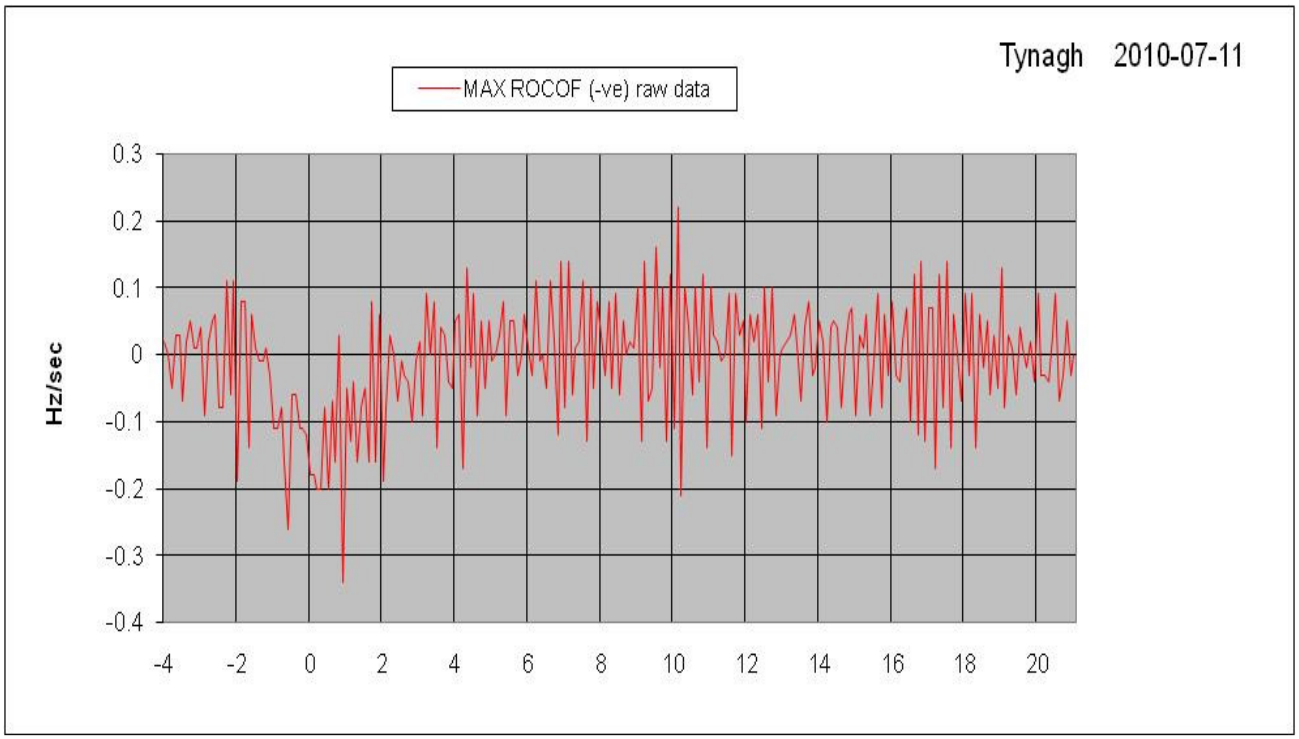

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Whitegate 2010-06-19
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

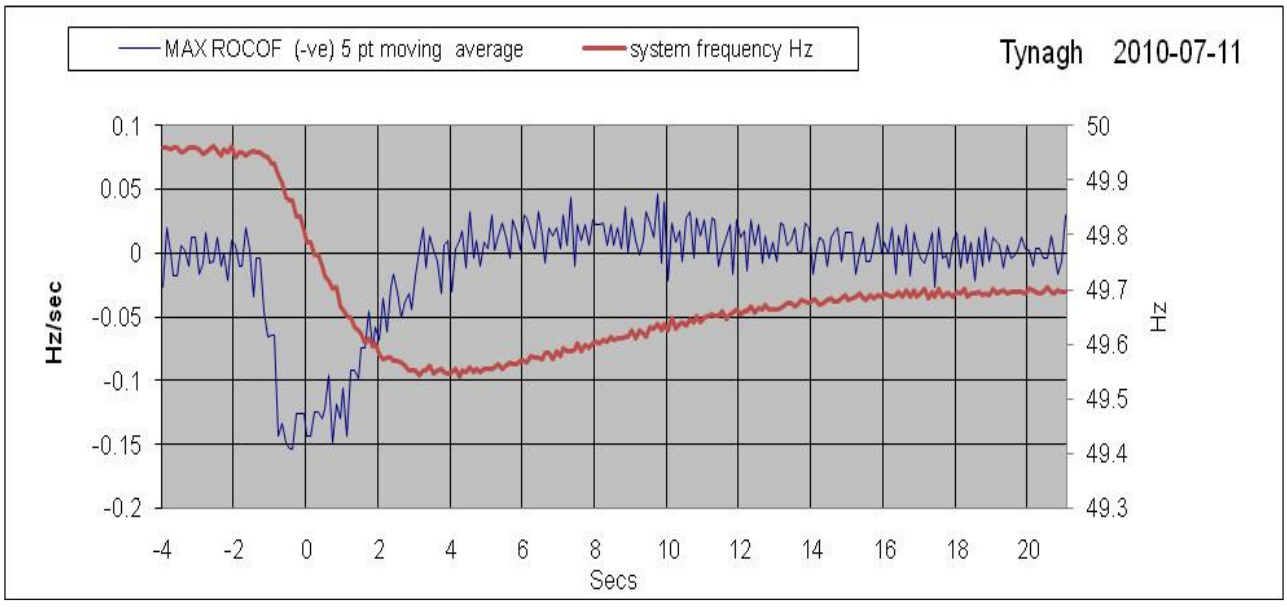

Whitegate 2010-07-01
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4 -2 0 2 4 6 8 10 12 14 16 18 20

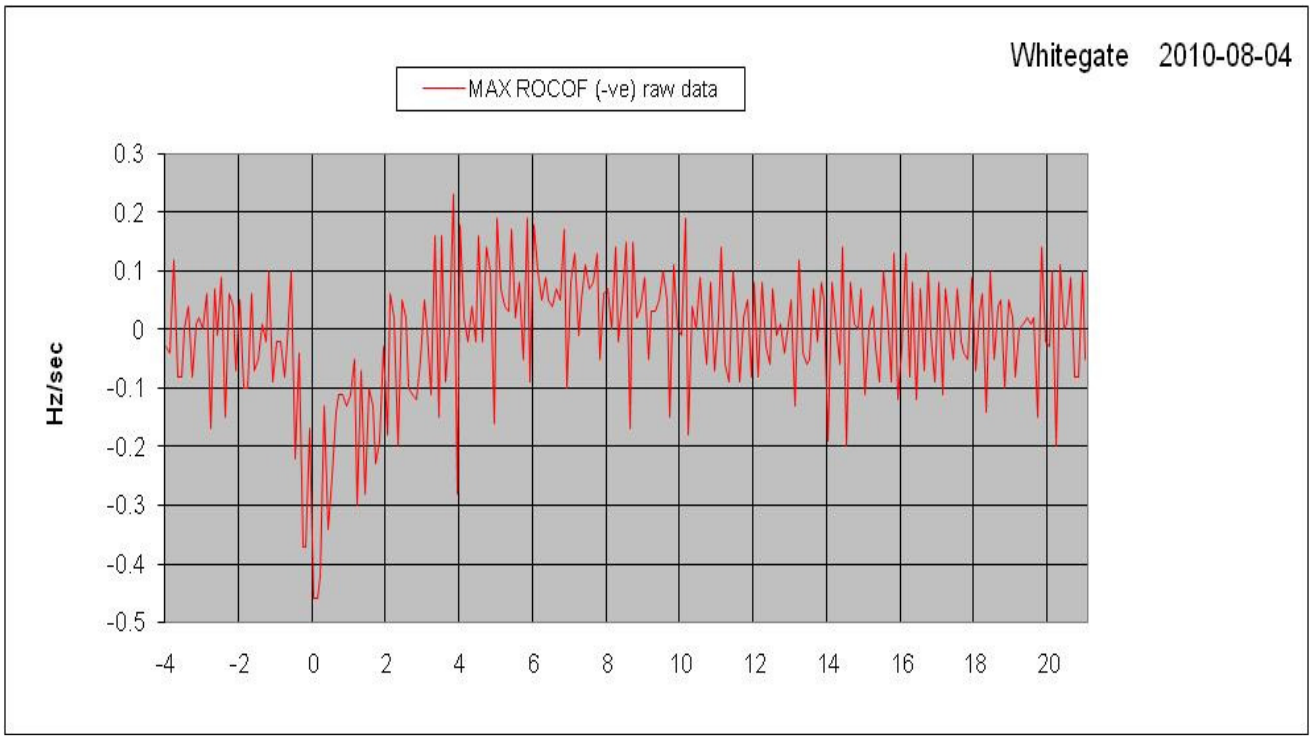

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Whitegate 2010-07-01
Hz/sec
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
50.2
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

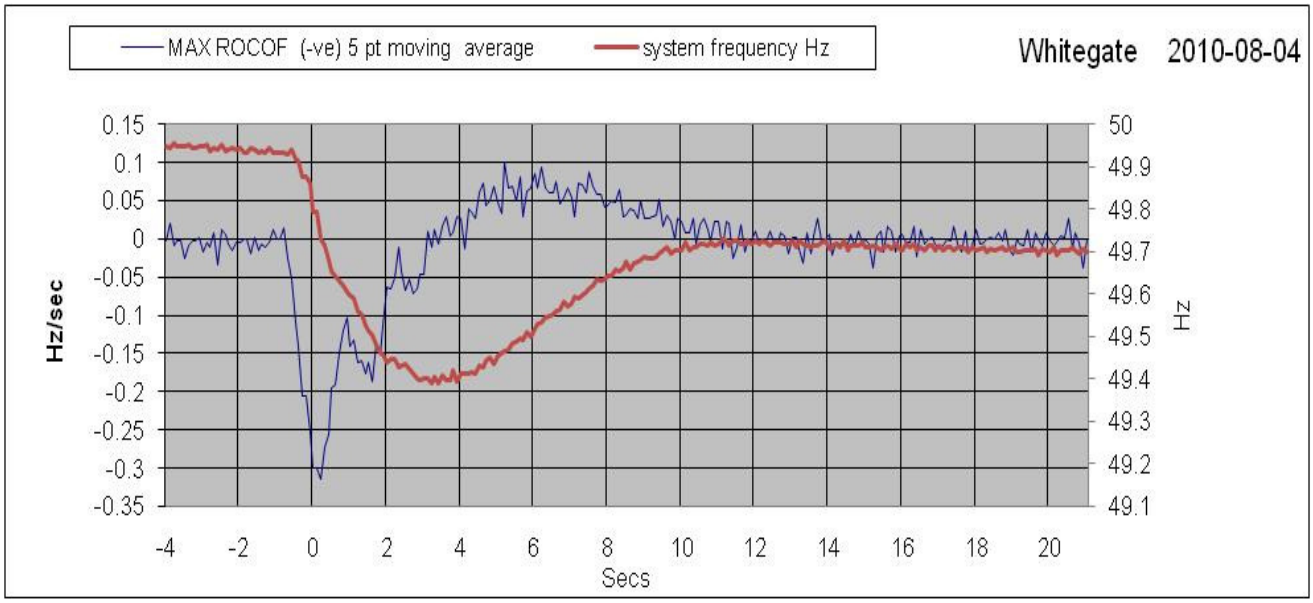

Whitegate 2010-07-04
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-4 -2 0 2 4 6 8 10 12 14 16 18 20

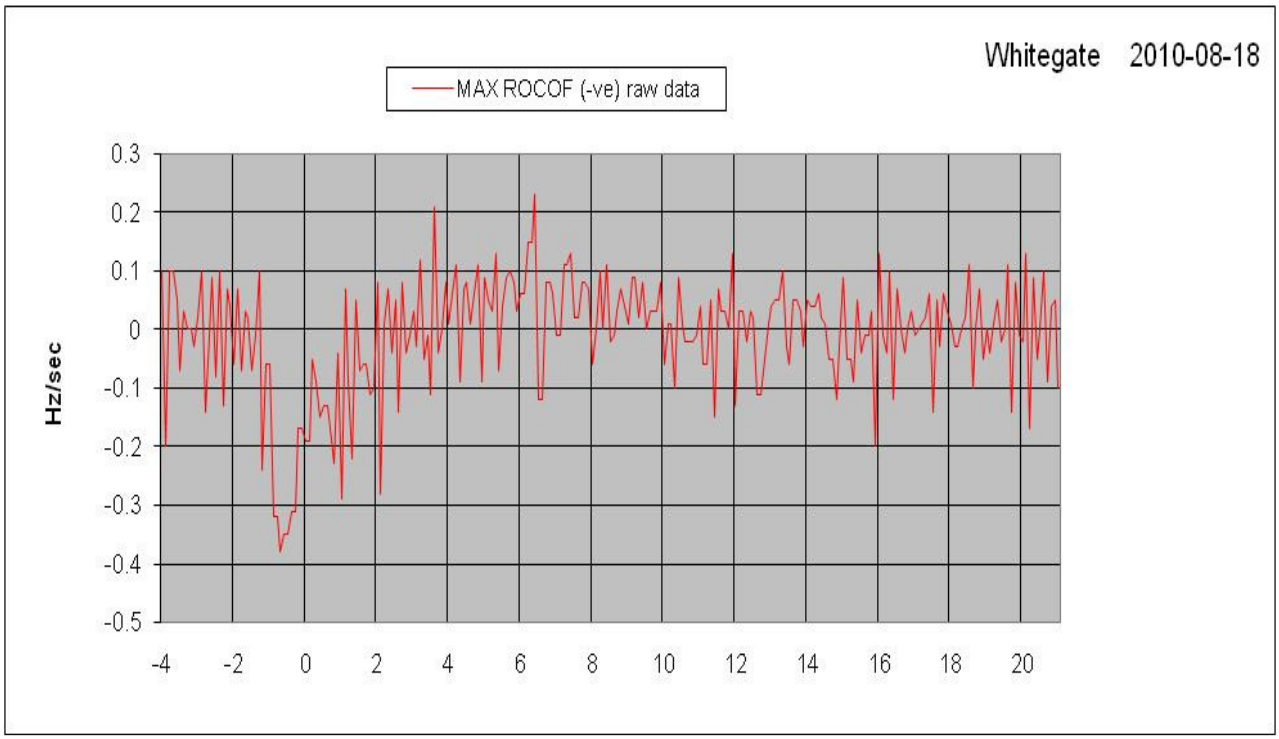

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Whitegate 2010-07-04
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
50.2
50
49.8
49.6
49.4
49.2
49
48.8
48.6
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs

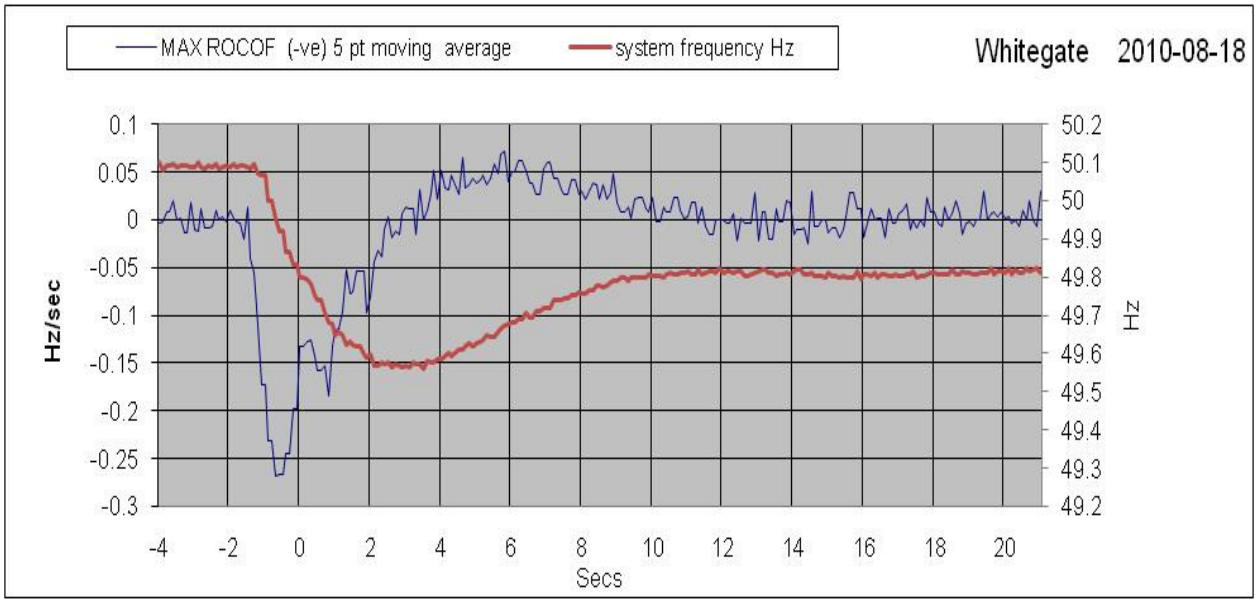

Tynagh 2010-07-11
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4
-2
0
2
4
6
8
10
12
14
16
18
20

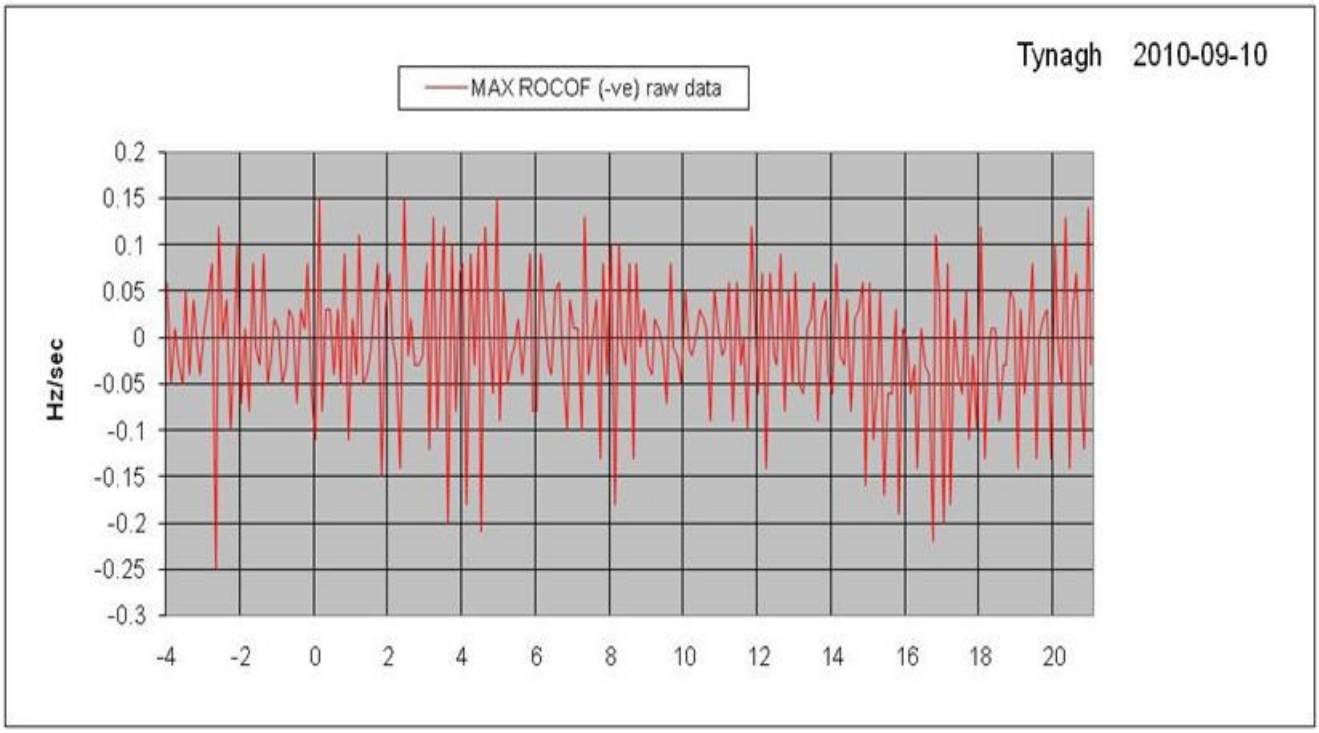

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Tynagh 2010-07-11
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
Hz
-4
-2
0
2
4
6
8
10
12
14
16
18
20
Secs

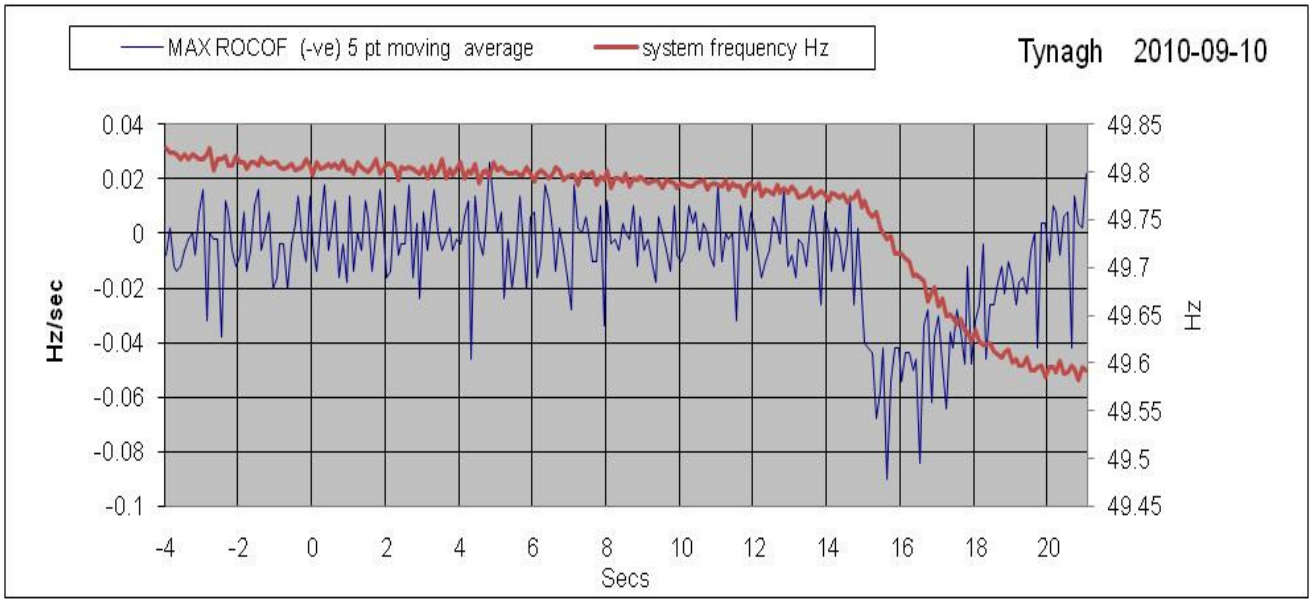

Whitegate 2010-08-04
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-4
-2
0
2
4
6
8
10
12
14
16
18
20

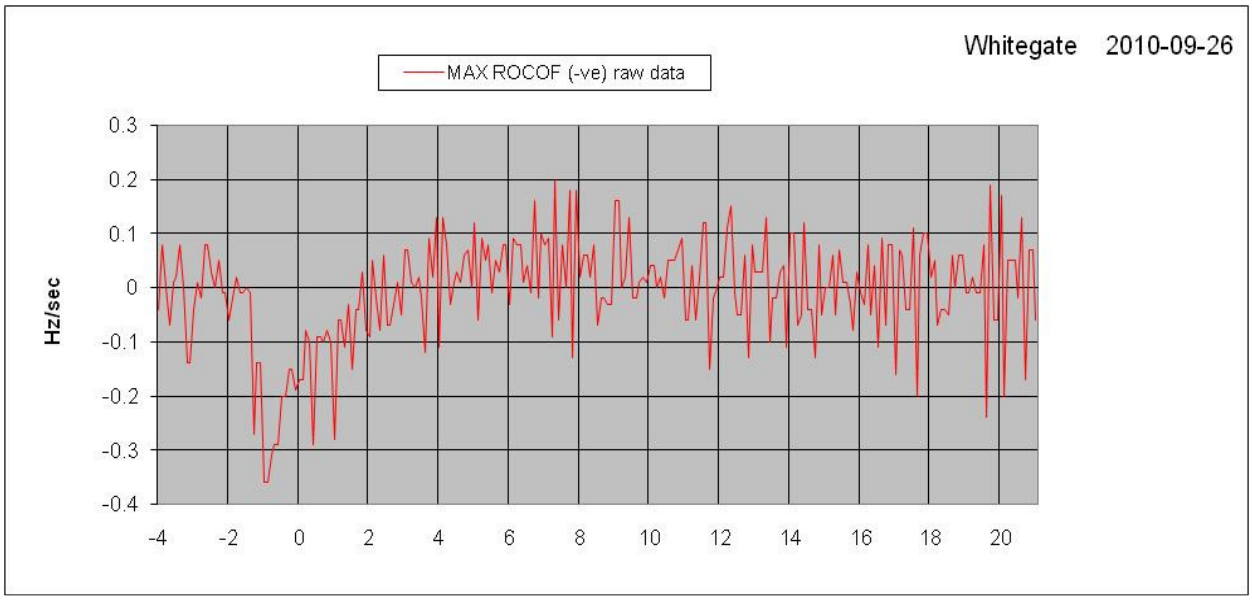

MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Whitegate 2010-08-04
Hz/sec
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
49.1
Hz
-4
-2
0
2
4
6
8
10
12
14
16
18
20
Secs

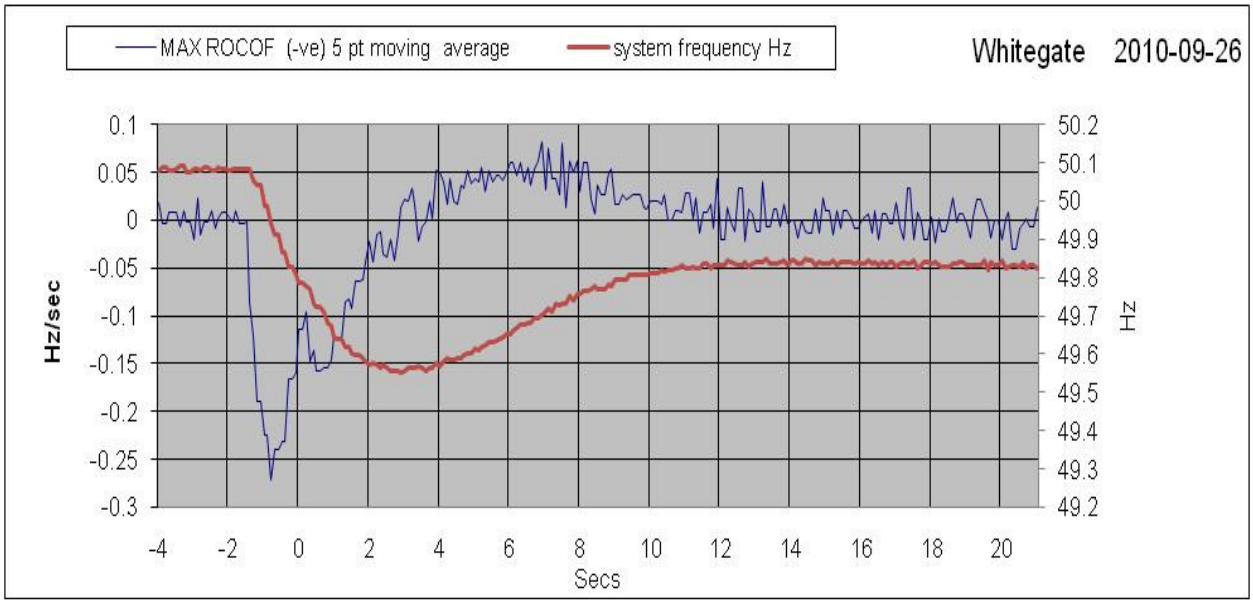

Whitegate 2010-08-18
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-4 -2 0 2 4 6 8 10 12 14 16 18 20


MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Whitegate 2010-08-18
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
50.2
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs


Tynagh 2010-09-10
MAX ROCOF (-ve) raw data
Hz/sec
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-4
-2
0
2
4
6
8
10
12
14
16
18
20


MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Tynagh 2010-09-10
Hz/sec
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
49.85
49.8
49.75
49.7
49.65
49.6
49.55
49.5
49.45
Hz
-4
-2
0
2
4
6
8
10
12
14
16
18
20
Secs


Whitegate 2010-09-26
MAX ROCOF (-ve) raw data
Hz/sec
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-4 -2 0 2 4 6 8 10 12 14 16 18 20


MAX ROCOF (-ve) 5 pt moving average
system frequency Hz
Whitegate 2010-09-26
Hz/sec
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
50.2
50.1
50
49.9
49.8
49.7
49.6
49.5
49.4
49.3
49.2
Hz
-4 -2 0 2 4 6 8 10 12 14 16 18 20
Secs