

## Compliance with dispatch instructions - a review

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### Recommendations

1. It is recommended that the Committee:
  - (a) **note** the overall level of compliance with dispatch instructions across the energy and reserve markets is satisfactory;
  - (b) **direct** Compliance to publish this review paper, incorporating comments from the Committee and without revealing the names of participants that have failed to comply with dispatch instructions; and
  - (c) **direct** Authority staff to consider a further review of the Code provisions related to compliance with dispatch instructions.

### Rationale

2. Between 1 March 2004 and 25 August 2012, the Electricity Commission (Commission), and later the Electricity Authority (Authority), dealt with 203 breach cases related to participants' non-compliance with dispatch instructions issued by the system operator.
3. Despite the relatively high number of breaches by some participants, the overall level of compliance with dispatch instructions is good when compared to the total number of dispatch instructions issued by the system operator. Monitoring of compliance with dispatch instructions in real time can only be performed by the system operator as it has access to real time data and the means to monitor it. This monitoring is not required by the Electricity Industry Participation Code 2010 (Code). The real time monitoring assists the system operator in performing its obligations. However, Compliance considers that the system operator, together with the Authority, must clarify the actual level of compliance with dispatch instructions. This would involve the system operator:
  - developing clear criteria for assessment deviations from dispatch instructions; and
  - processing the available data to identify events of non-compliance.
4. Based on this analysis and the work to be completed by the system operator, a review of the Code requirements related to compliance with dispatch instructions is desirable.

### Introduction

5. The Compliance team initiated this review of participants' compliance with the system operator's dispatch instructions as a result of an internal review of its compliance

processes and a desire to proactively target some of the more frequently breached provisions of the Code.

6. Non-compliance with dispatch instructions comes under the category of “common quality and security breaches”. Common quality and security breaches are regarded as the more serious breaches of the Code and they must be reported under regulation 7 of the Electricity Industry (Enforcement) Regulations 2010 (Regulations).
7. For the purpose of this paper a breach event is an event of departure or deviation from the dispatch instruction issued by the system operator for a given period of time. Often two or more breach events have been grouped, reported and considered together as one breach case. A breach case may relate to one or more than one breach events.

## Background

8. The New Zealand electricity market differs from most overseas electricity markets. One of the distinguishing characteristics is that every participant who offers to inject energy into the system, or to provide ancillary services, receives dispatch instructions to generate electricity or provide ancillary services at levels determined by the system operator. Ancillary services, for which the system operator issues dispatch instructions, include reserve generation and interruptible load, frequency keeping and voltage support. The system operator also issues dispatch instructions for transmission services over the HVDC.
9. The system operator formulates and issues dispatch instructions based on participants' offers and the system conditions for each trading period. In formulating dispatch instructions, the system operator uses approved mathematical models. The system operator issues tens of thousands of dispatch instructions over 17520 trading periods every year.
10. Depending on the type of participant and the services offered, participants receive dispatch instructions at different intervals. Some base load generators receive dispatch instructions that do not change over a number of trading periods. Ancillary service agents usually receive dispatch instructions that change at the beginning of a trading period. During a period of ramping the level of generation up or down, a participant (especially a marginal generator) may receive dispatch instructions every five minutes. Once a dispatch instruction is issued, it remains valid until a new dispatch instruction replaces it.

## Code requirements

11. Clause 13.82 of the Code requires:

### **13.82 Dispatch instructions to be complied with**

Each **generator** or **ancillary service agent** must comply with a **dispatch instruction** properly given by the **system operator** in accordance with clauses 13.73 or 13.74 except if,—

- (a) in the reasonable opinion of the **generator** or **ancillary service agent**, personnel or plant safety is at risk or following the **dispatch instruction** will contravene a law. If such circumstances exist, the affected **generator** or **ancillary service agent** must immediately notify the **system operator** of the circumstance; or
- (b) the plant is already responding to an automated signal to activate **capacity reserve, instantaneous reserve** or **over frequency reserve**; or
- (c) the **generator** or **ancillary service agent** acts in accordance with clause 13.86; or
- (d) in the case of an **intermittent generator** who has complied with clause 13.17, and provided the **system operator** has not advised that a **grid emergency** or system constraint exists that directly affects the **intermittent generator**, the **intermittent generator** is not required to actively comply with a **dispatch instruction**; or
- (e) the **generator** deviates from a **dispatch instruction** for **active power** in order to comply with clause 8.17; or
- (f) the **generator** or **ancillary service agent** deviates from a **dispatch instruction** in order to comply with clause 9 of **Technical Code B** of Schedule 8.3; or
- (g) in the case of a **dispatch instruction** of the type set out in clause 13.73(b) to (f) and (h), the **dispatch instruction** is properly given only if—
  - (i) the **generator** or **ancillary service agent** to whom the **dispatch instruction** is given has a valid and enforceable contract with the **system operator** for the provision of those services and the **dispatch instruction** is consistent with that contract; or
  - (ii) the **dispatch instruction** is given for the purposes of clauses 8.5 and 13.70; or
  - (iii) the **dispatch instruction** is consistent with the **asset owner performance obligations** under clauses 8.22 to 8.24, the **technical codes** concerning voltage and any relevant **dispensation**.

12. Clause 13.86 of the Code provides:

**13.86 Generators and ancillary service agents not obliged to comply with dispatch instructions below threshold**

For any **generating plant, generating unit, block dispatch group** or **station dispatch group**, a **generator** or **ancillary service agent** is not required to comply with 1 or more **dispatch instructions** given by the **system operator** in accordance with clause 13.72 if implementing the **dispatch instruction** or those **dispatch instructions** together would change by less than or equal to—

- (a) for **ancillary service agents**, 1 **MW** from the last **dispatch instruction** that the **ancillary service agent** complied with; or
- (b) for **generators** other than **co-generators**, 1 **MW** from the last **dispatch instruction** that the **generator** complied with; or
- (c) for **co-generators**, 5 **MW** from the last **dispatch instruction** that the **generator** complied with.

## Issues with the Code requirements

13. The criteria for assessing compliance with dispatch instructions are not clear. The Authority, and the system operator, allow a tolerance of 1 MW deviation from a dispatch instruction, based on clause 13.86 of the Code that allows non-compliance with a new dispatch instruction if the difference between the old and the new dispatch instruction is equal or less than 1 MW, or 5 MW for co-generation plants.
14. However, in many cases, this approach is not practicable. Achieving 1 MW compliance is easy for a small generation units (under 10 MW) but is practically impossible for larger generators (above 200 MW). In addition, the output of thermal and geothermal plants is more susceptible to changes in the environment (e.g., ambient temperature and atmospheric pressure, temperature of the cooling water).
15. The Code is also not specific about the tolerable, if any, duration of non-compliance. Low-magnitude-long-duration non-compliance tends to have impact on the markets, while high-magnitude-short-duration non-compliance tends to impact more on system security.
16. Better criteria for assessing compliance with dispatch instructions should be based on assessing deviations as a percentage of the unit's capacity or as a percentage of the unit's dispatch.
17. Another area of potential non-compliance, which requires clarification, is compliance with dispatch instructions during the ramping of generation where a generator departs from the offered ramp rates or from its advised ramp profiles. While most of the hydro generators have high ramping rates and can achieve compliance with dispatch instruction within minutes, the ramping rates of thermal plants are significantly lower based on thermal limitations, and the need for the plants to build up steam quantities and pressure to achieve compliance. Additionally, combined cycle thermal plants have particular non-linear ramping profiles that often last for more than one trading period.
18. The Code is also not specific regarding how non-compliance with dispatch instructions for instantaneous reserves is to be assessed. In practice, the assessment is based on analysis of actual SCADA data after the under-frequency event during which the reserves were provided. Assessment of compliance of partly loaded spinning reserves (PLSR) and tail water depressed reserves (TWD) is problematic as it uses models rather than actual data and is often are contested by participants.

## Monitoring

19. The monitoring of compliance with dispatch instructions falls under the general requirement of the Act for the Authority to monitor compliance with the Code. However, monitoring of compliance with dispatch instructions in real time can only be performed by the system operator, as it has access to real time data and the means to monitor it.

20. The monitoring of compliance with dispatch instructions by the system operator is not required by the Code. However, the real time monitoring assists the system operator in performing its principal performance obligations as a reasonable and prudent system operator. If one or more parties do not comply with dispatch instructions, this may jeopardise the system operator's ability to manage the power system.
21. Prior to the introduction of the system operator's new market systems in July 2009, the system operator had the ability to monitor compliance with dispatch instructions. The system operator monitored compliance with dispatch instructions by using filters applied to data from its SCADA system. This functionality has not been available following the introduction of the new market system.
22. The Code does not provide any specific obligation on participants to monitor compliance with dispatch instructions. However, the Authority expects participants to self-monitor their output to ensure that they comply with dispatch instructions.
23. Recently, the system operator started to review the available data to identify cases of significant non-compliance. It is expected that this review will clarify the issues with the Code requirements and the criteria for non-compliance (tolerance) by eliminating cases where the deviations from the dispatch instructions are insignificant (otherwise considered as "noise").

## Statistics

24. This review covers the period from 1 March 2004 to 25 August 2012. During this period the Commission and the Authority received 160 breach notifications regarding non-compliance with dispatch instructions. The total number of breaches regarding non-compliance with dispatch instructions for the period was 203, as some of the breach notifications covered multiple events of non-compliance.
25. The parties with the highest number of cases of non-compliance with dispatch instructions were (...). The number of cases of non-compliance with dispatch instructions by large generators (...) is illustrated by Fig 1 below.
26. Among co-generators, the participants with the highest number of cases of non-compliance with dispatch instructions were (...). The number of cases of non-compliance with dispatch instructions by co-generators is illustrated by Fig 2 below.
27. Among providers of interruptible load (mainly industrial sites and distributors), the participants with the highest number of cases were (...). The number of cases of non-compliance with dispatch instructions by providers of interruptible load is illustrated by Fig 3 below.

28. The cases regarding non-compliance with dispatch instructions are unevenly spread between 2004 and 2012. The highest number of cases was in 2008 (42 cases), followed by 2005 (31 cases) and 2010 (30 cases). The number of cases of non-compliance with dispatch instructions by year is illustrated by Fig 4 below.

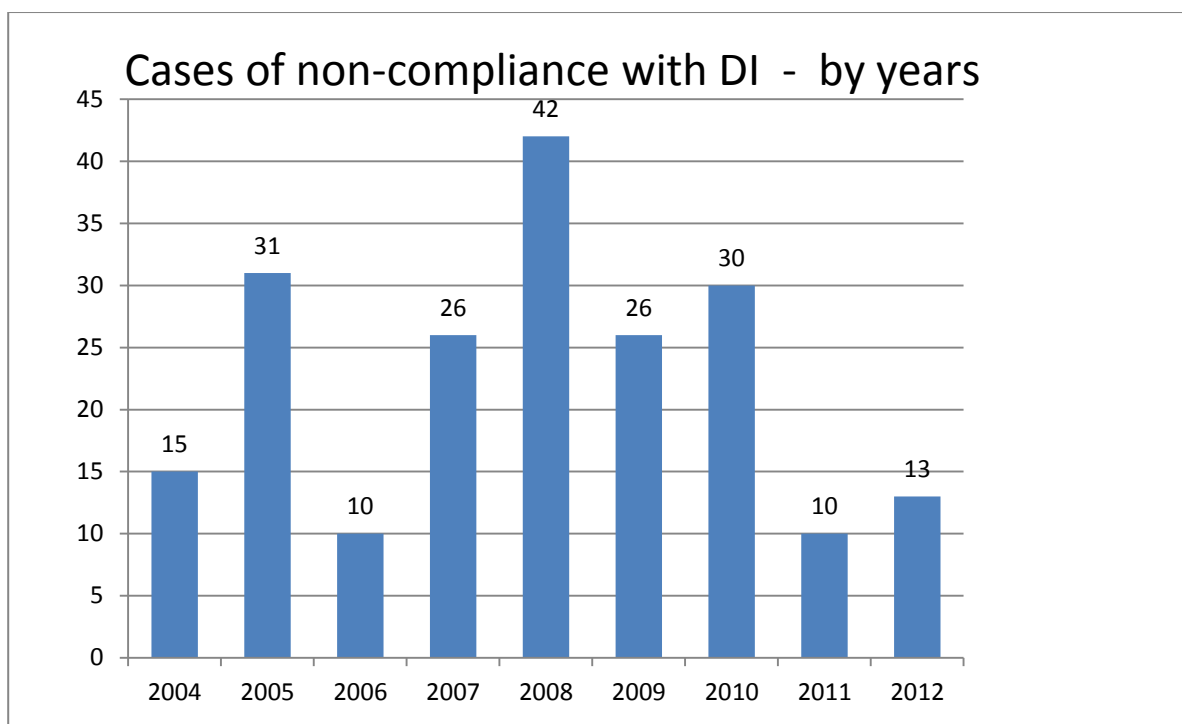


Fig. 4

29. A relatively small number of cases (18 cases or 9% of the total number of cases) were short duration deviations from dispatch instructions of 5 minutes or less. 90 cases (or 45% of the total number of cases) were medium duration events lasting for up to one trading period. 95 cases (or 46% of the total number of cases) were events of a long duration lasting more than one trading period. The number of cases of non-compliance with dispatch instructions by duration is illustrated by Fig 5 below.

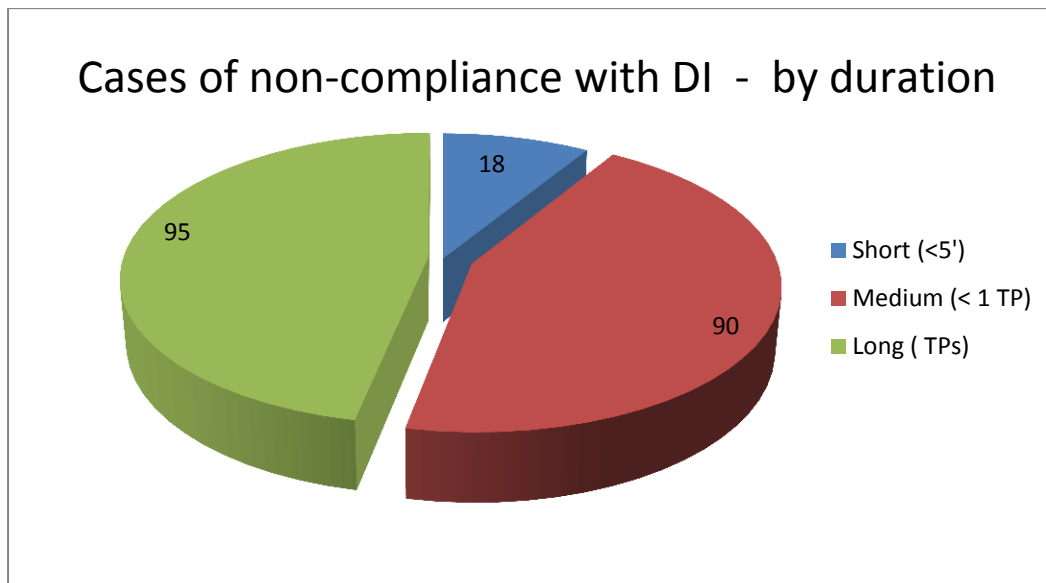


Fig. 5

30. In terms of the market, operational and security impact of each case of non-compliance with dispatch instructions, one case had high impact, 17 cases had a medium impact and 185 cases had low or no impact. The number of cases of non-compliance with dispatch instructions by severity is illustrated by Fig 6 below.

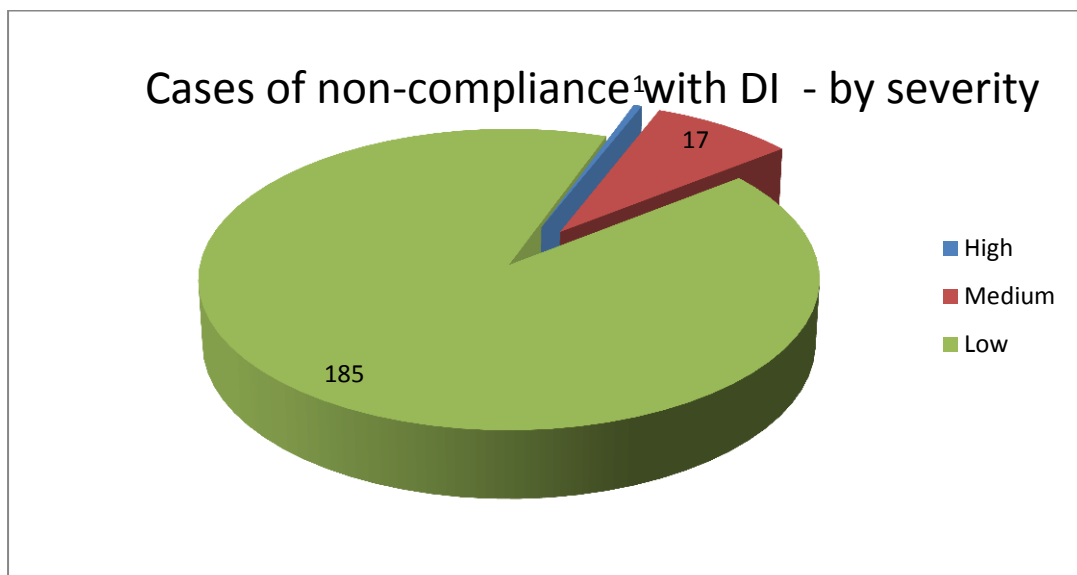


Fig. 6

31. Most of the cases (154 cases or 76% of the total number of cases) related to dispatch instructions for energy, 47 cases (or 23% of the total number of cases) related to dispatch instructions for instantaneous reserves (IR) and two cases related to frequency keeping (FK). No cases of non-compliance with dispatch instructions for voltage support have been reported. The number of cases of non-compliance with dispatch instructions by type of dispatch instruction is illustrated by Fig 7.

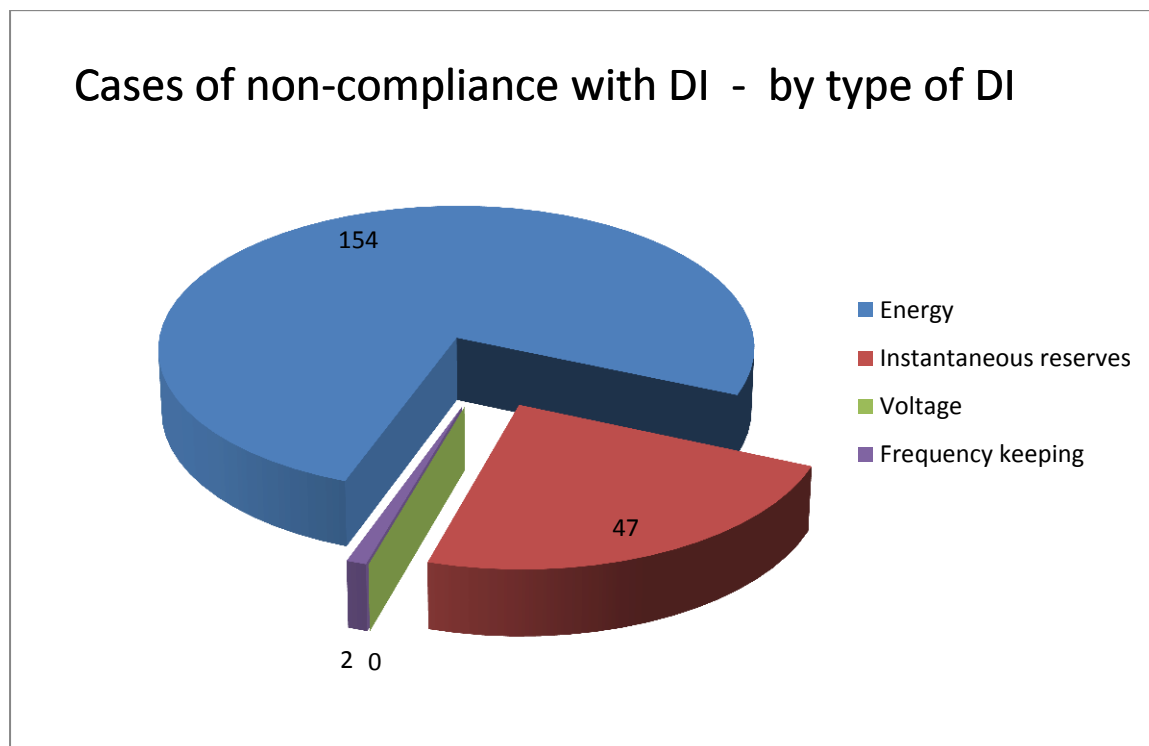


Fig. 7

32. The reasons for non-compliance with dispatch instructions can be arranged into five main groups – human error, communications failures, equipment failures, process deficiencies or the involvement of third parties. The number of cases of non-compliance with dispatch instructions by the reason for the non-compliance is illustrated by Fig 8 below.
33. In 79 cases, the reason for non-compliance was a human error (in cases where processes and procedures exist but were not properly followed), in 50 cases the reason was an equipment failure, and in 10 cases the reason was a communication failure. The total number of reasons for non-compliance with dispatch instructions is greater than the number of cases as, in many cases, there was more than one contributing factor.



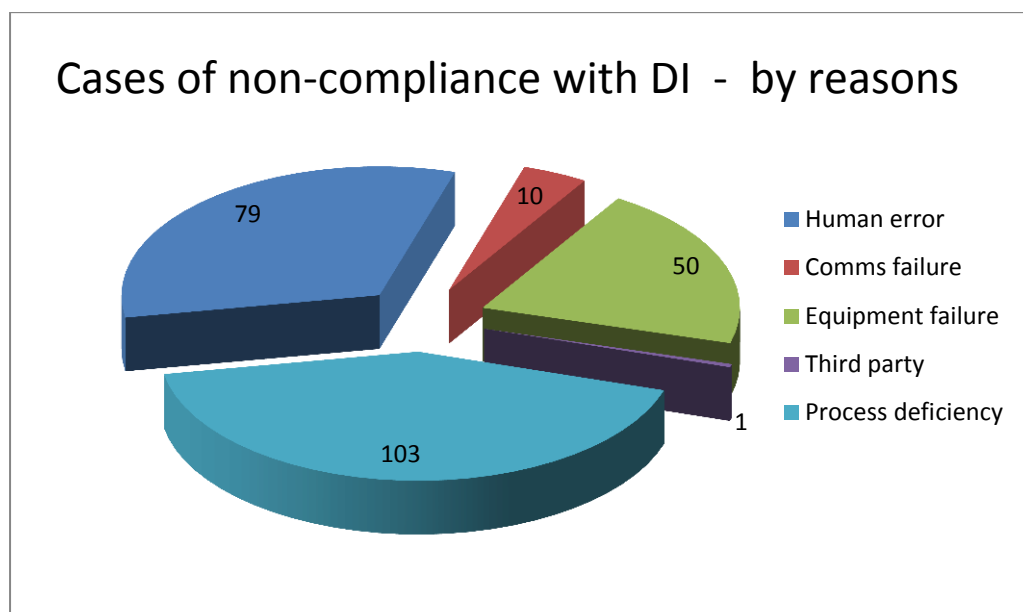


Fig. 8

34. In 103 cases, the reason for non-compliance was a process deficiency. The process deficiencies included:

- participants failing to notify the system operator of a circumstance under clause 13.82(a) (a bona fide situation) where one of the circumstances existed;
- participants failing to revise offers when there is a change of generation or ancillary service availability; or
- participants' staff failing to follow the proper internal communication protocols between traders and station operators.

35. Only a small number of breaches relating to non-compliance with dispatch instructions were self-reported by participants. More than 90% of the breaches were reported by the system operator and/or by the participants after an inquiry by the system operator.

36. Out of 203 breach cases, 117 cases were closed with a warning, and 18 cases were subject to a formal investigation.

## Analysis

37. The system operator issues a large number (more than a thousand on average) of dispatch instructions every day. Out of tens of thousands of dispatch instructions issued over a period of more than eight years, only a tiny fraction of a per cent have not been complied with. This is illustrative of a very high level of operational discipline and compliance across the industry.

38. At the same time, the system operator and participants recognise the fact that station output can be influenced by various factors that result in fluctuations around a generator's setpoint, and the bigger the generator, the bigger the fluctuations.

39. The current approach for assessment of compliance with dispatch instructions takes into account the actual magnitude of the output deviations and the duration of these deviations.
40. A higher number of breach events by large generation companies is understandable. The figures are consistent with these participants' market share and the complexity of their operations, especially their thermal and geothermal plants. In terms of co-generation plants, the number of breach events is related to the complexity of the plant and the associated industrial process.
41. The number of breaches remains small compared to the number of dispatch instructions issued. Assessing the trend of the number of breach events relating to non-compliance with dispatch instructions over the last eight years is difficult due to the short period of time and the relatively small number of breaches per participant.
42. It should be noted, that in most of the cases, the breach events occurred in batches (see Fig. 1 to 3)—often a participant will have more than one breach event over a relatively short period of time. This leads to a participant changing its processes and providing extra training for staff resulting in improved compliance.
43. The relatively small number of short duration breach events (under five minutes) is consistent with the system operator's assessment criteria where many short duration events and events with a smaller magnitude are not reported as breaches. Only the cases with a long duration or a significant deviation are pursued. It should be noted that all cases of non-compliance with dispatch instructions for instantaneous reserves are considered to be long duration breaches. This is because these breaches are identified as a result of an under-frequency event where it is usually difficult to determine how long the reserves have not been available.
44. The predominant number of cases of non-compliance with dispatch instructions relate to energy, and to a lesser extent, instantaneous reserves. The distribution of breach events by type of dispatch instruction correlates with the type of dispatch instruction issued by the system operator.
45. The distribution of cases based on the severity of the breach shows that 91% of the breach events had minimal or no impact. Despite this, based on the potential for non-compliance with dispatch instructions to have a significant market and security impact, more than half of all cases were closed with a warning letter issued (117 cases) or were subject to a formal investigation (18 cases).
46. An analysis of participants' reasons for non-compliance with dispatch instructions identifies some scope for improvement. Possible improvements include:
  - participants tidying up their processes for notifying the system operator of a bona fide situation;
  - participants submitting revised offers following changes of generation or ancillary service availability in a timely manner; and

- participants' staff following internal communication protocols between traders and station operators.
47. The percentage of cases caused by equipment failure or communication failure does not change significantly across market participants or across the years analysed. This suggests that despite the proper maintenance and upgrading of the existing hardware they will always be present.
48. A relatively high number of breaches (79 cases) were caused by a human error. Despite the high level of automation across the industry, and specifically in the dispatch process, human involvement still presents a significant risk factor. Human errors do happen, even with the presence of information systems and alarms to warn operators of deviations from dispatch set points.
49. New and better systems are being introduced into new generation plants to assist operators. However, upgrading of the existing systems and their replacement is a slow and resource demanding process. As well as improving systems, all participants have well-developed training programs for their staff and regularly remind all operators of the importance of compliance with dispatch instructions.

## Conclusions

50. Despite some participants' relatively high number of breaches relating to non-compliance with dispatch instructions, the overall level of compliance with dispatch instructions is good compared to the number of dispatch instructions issued by the system operator.
51. However, the system operator indicated it will clarify the actual level of compliance with dispatch instructions. This would involve the system operator:
- developing of criteria for the system operator to assess deviations from dispatch instructions; and
  - processing the available data to identify events of non-compliance.
52. Based on this analysis and the work to be completed by the system operator, a review of the Code requirements related to compliance with dispatch instructions is desirable.