



TRANSPOWER

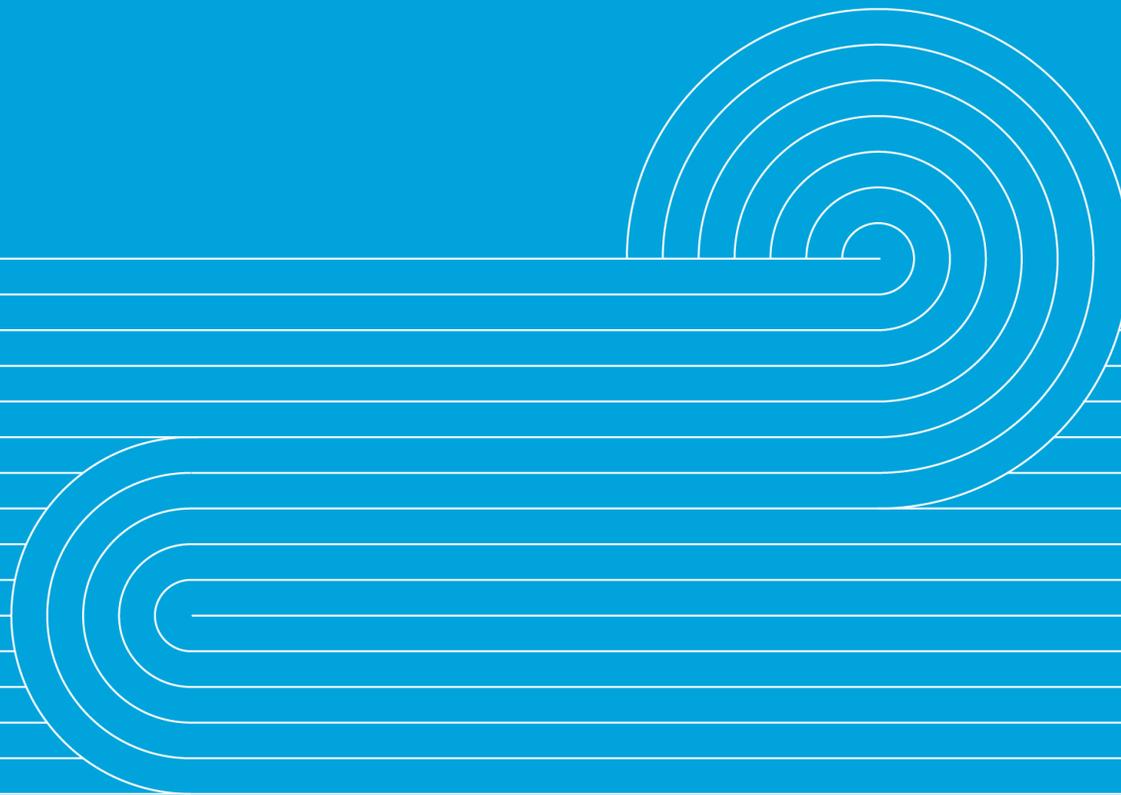
ELECTRICITY
AUTHORITY
TE MANA HIKO



Space weather and its potential impacts

Industry Exercise 2026

5 March 2026



Opening **Karakia**

Kia tau te rangimarie
O te Rangi e tū iho nei
O Papatūānuku e takoto nei
O te taiao e awhi nei
Ki runga i a tātou
Tihei Mauri ora

Translation

Let the peace
of the sky above us
of the earth laid out here
and of the all-embracing universe
settle upon us
Breathe the breath of life

Welcome

Hayden Glass

*General Manager, Wholesale and Supply
Electricity Authority*



Industry Exercise 2026

Opportunity to:

- practise and improve operational and communications processes
- get familiar with System Operator processes and communications
- identify opportunities to strengthen how we would work together

Why?

- strengthen sector wide preparedness
- support national resilience
- help minimise any potential impact on consumers

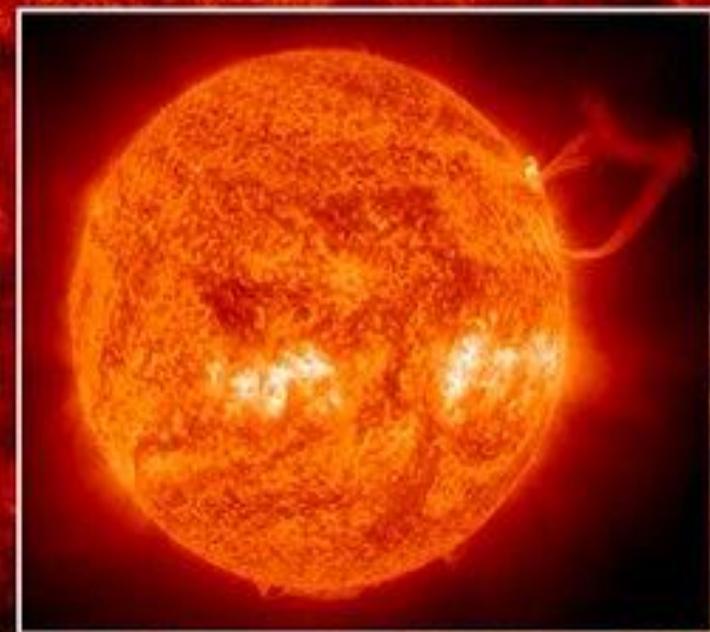


Today's agenda

1. What space weather is and how it can affect NZ's electricity system
2. Roles during a major space weather event
3. Communicating clearly during a major event
4. The Consumer Care Obligations
5. Industry Exercise 2026 – what to expect



Prominence Eruption
(11/12/2024 @ 12:15 UTC)

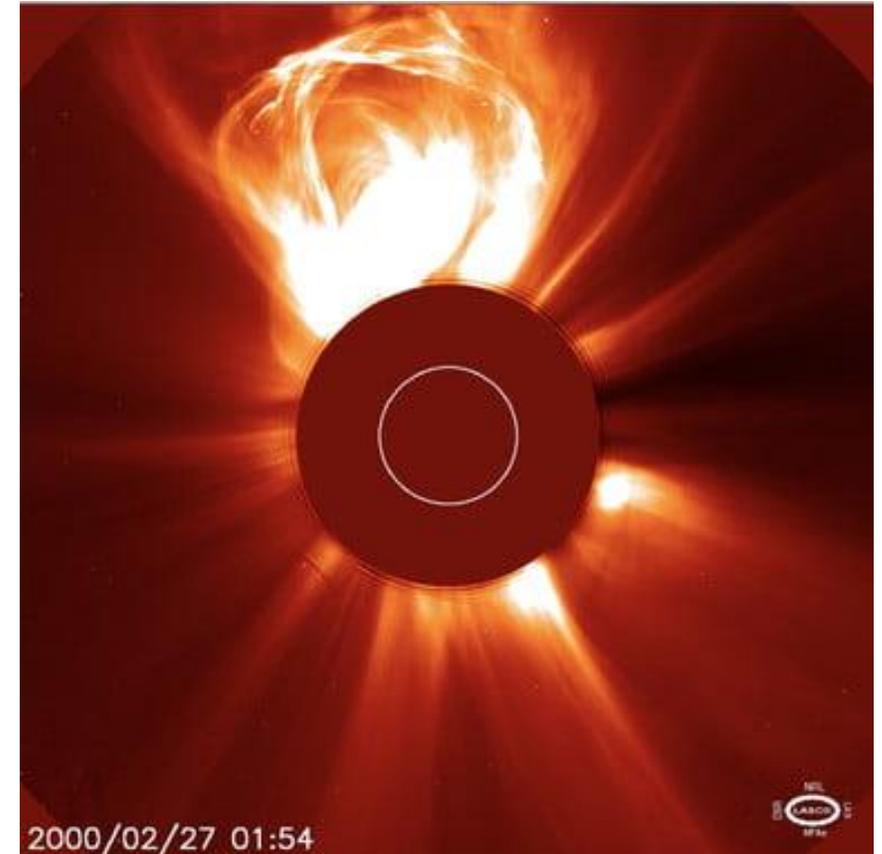
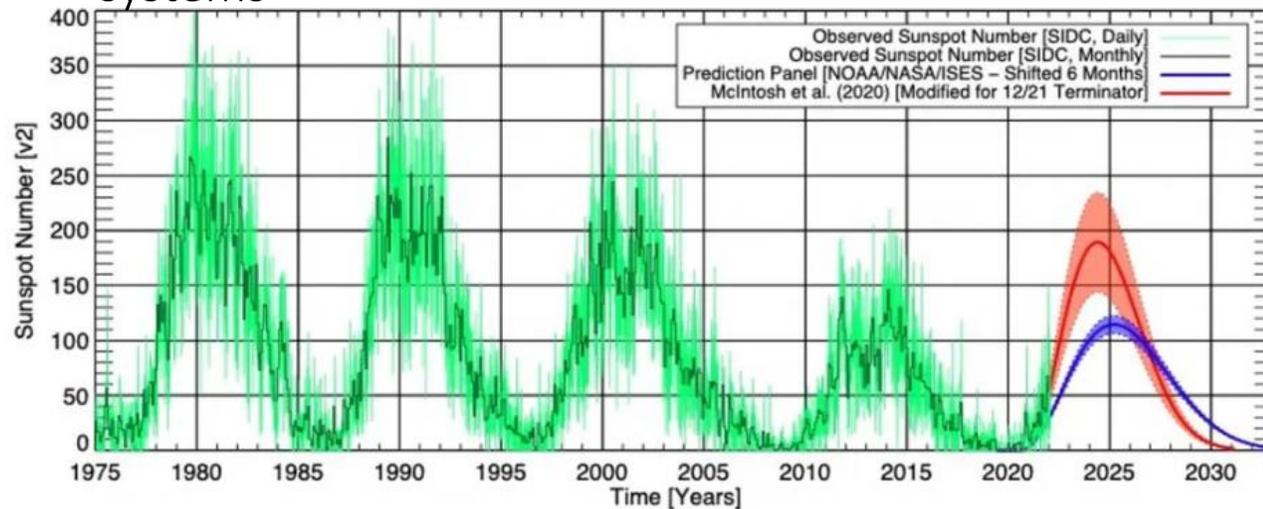


What space weather is and how it can affect New Zealand's electricity system

Andrew Renton, Transpower

What is space weather?

- Space weather is “weather from the Sun” the stream of particles and energy that affects space around Earth
- It is continuous but most impactful when the Sun releases large bursts of energy and particles
- The Sun goes through active and quiet periods over time
- Strong space weather from a "Coronal Mass Ejection (CME) can interfere with satellites, GPS, radio, and power systems



Space weather monitoring – NOAA SWPC, MOSWOC, BOM

Space weather monitoring services

- USA NOAA's Space Weather Prediction Center (SWPC), UK MOSWOC, AU BOM monitors the Sun and Earth's space environment using satellites and ground sensors.

What it provides

- Forecasts, watches, warnings, and alerts for space weather impacts on Earth [weather.gov]

Geomagnetic Storm Scale

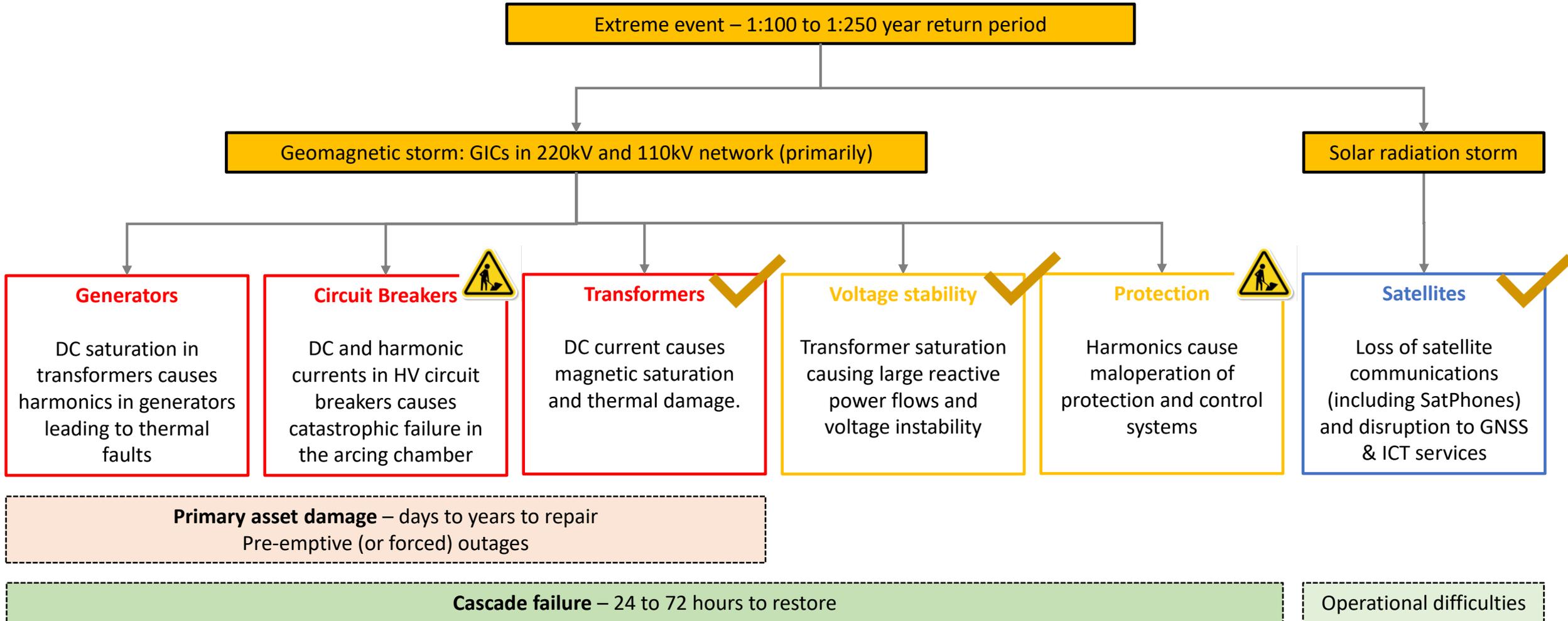
- NOAA rates geomagnetic storms from G1 (Minor) to G5 (Extreme), similar to hurricane categories

Why it matters

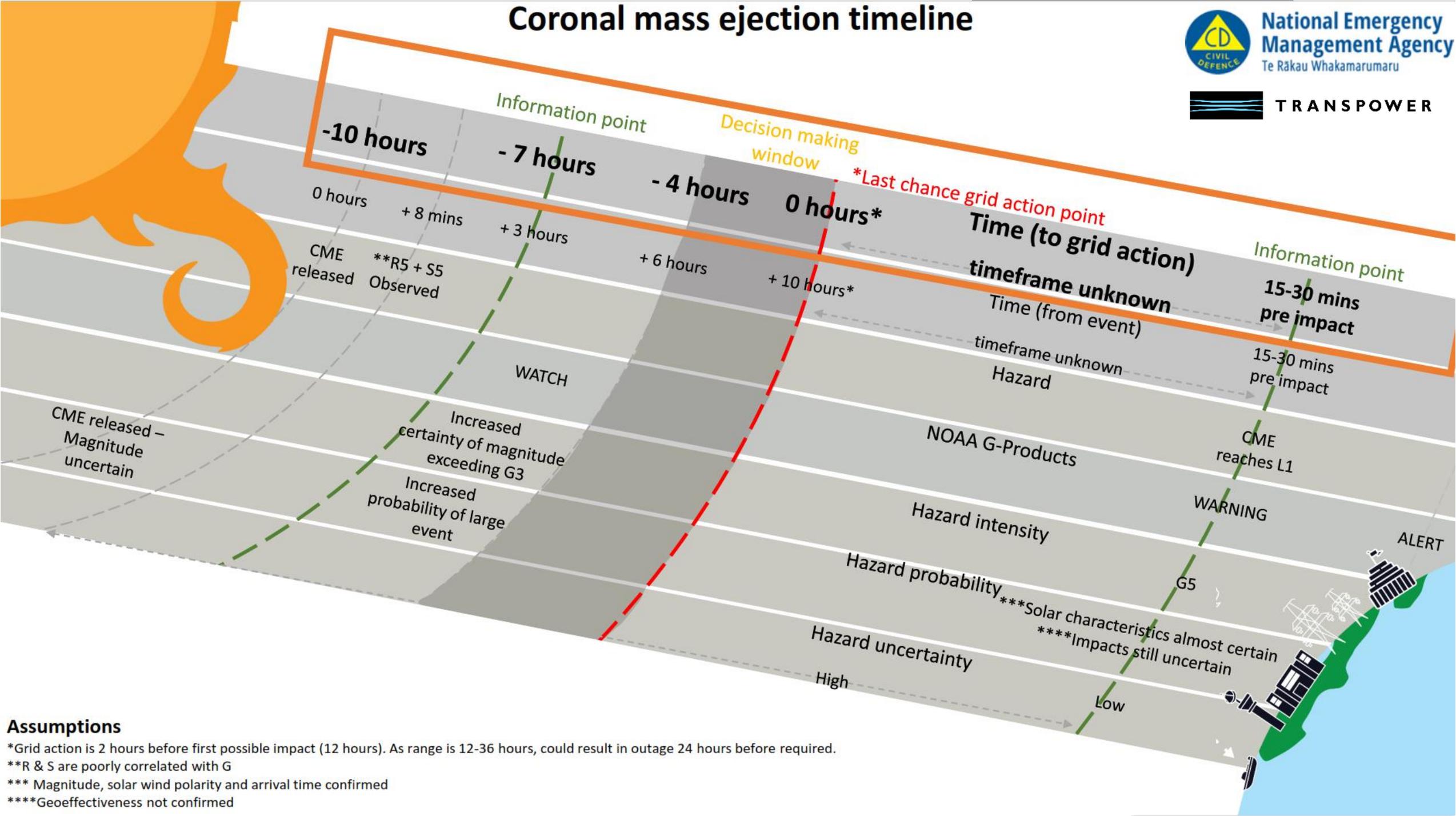
- Higher G-levels mean increasing risk to power grids, satellites, GPS, radio, and aviation, we are only interested at G5s and the larger end of G5

Category		Effect
Scale	Description.	Duration of event will influence severity effects
G5	Extreme	widespread voltage control and protective system problems can occur, some grid systems may experience complete collapse. Transformers may suffer damage
G4	Severe	possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid
G3	Strong	voltage corrections may be required, false alarms triggered on some protection devices
G2	Moderate	high-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage
G1	Minor	weak power fluctuations can occur

Risks to the electricity industry



Coronal mass ejection timeline

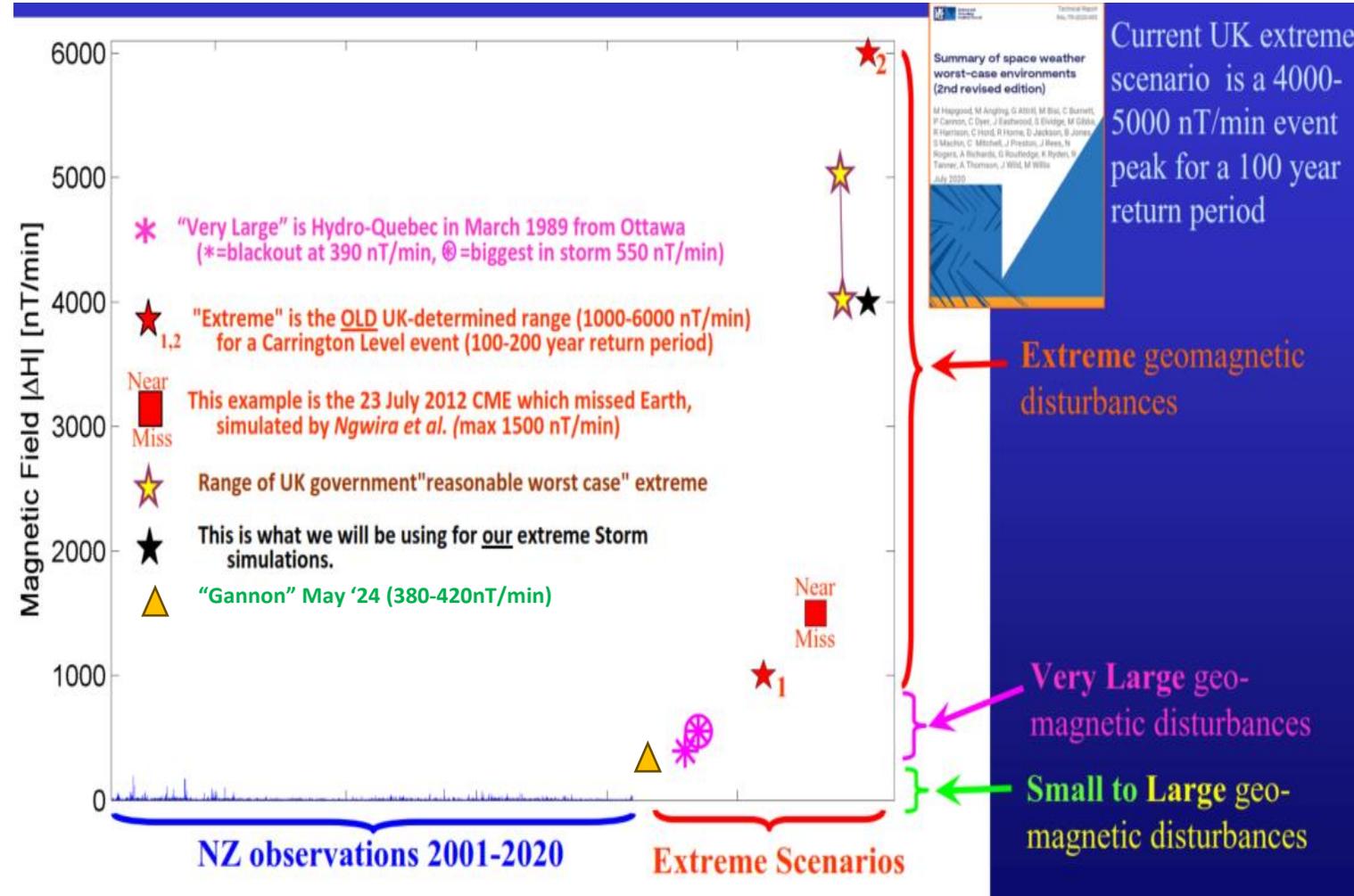


Assumptions

- *Grid action is 2 hours before first possible impact (12 hours). As range is 12-36 hours, could result in outage 24 hours before required.
- **R & S are poorly correlated with G
- *** Magnitude, solar wind polarity and arrival time confirmed
- ****Geoeffectiveness not confirmed

Should we be worried?

- May 2024 G5 “Gannon” (420nT/min) largest storm in 20 years estimated at 1:10, produced, largest GIC currents in NZ of 200A, mitigation plan was triggered.
- We are planning for a 1:100 year event 8-10 times larger with return period with similar seismic and volcanic hazard exposure Mt Taranaki eruption, Hikurangi Trench



Expected CME GIC event consequence by magnitude and island

Expected CME GIC System Impacts							
Event Category	Event Probability (yrs)	Expected Field Change (nT/min)	South Island			North Island	
			Likely Impact	Mitigations	Likely Impact	Mitigations	
Extreme G5 (NOAA SWPC)	Extreme (Transpower)	1:10 - 15	<500	Minor Isolated tripping and alarms	PR-DP-1077 Implement monitoring PR-DP-252 Implement Lower SI only Await L1 confirmation	Insignificant Isolated tripping and alarms	PR-DP-1077 Implement monitoring Await L1 confirmation
		1:30	>500 <1,000	Moderate Isolated tripping and alarms	PR-DP-1077 Implement monitoring PR-DP-252 Implement Lower SI only Await L1 confirmation Additional 100MVAR reactive plant made available	Minor Isolated tripping and alarms	PR-DP-1077 Implement monitoring Await L1 confirmation
	Catastrophic (Transpower)	1:30-50	>1,000 <2,500	Significant Generation and demand loss expected	PR-DP-1077 Full implementation PR-DP-252 Implement SI only Call before L1 MAN-TWI islanding, 1200MW SI generation removed Recall all outages Additional 200MVAR reactive plant made available	Moderate Some trippings and alarms Likely loss of HVDC 15-20% demand reductions	PR-DP-1077 Implement monitoring PR-DP-252 Prepare for NI implementation Await L1 confirmation Possible demand management if SI generation lost
		1:100	>2,500 <4000	Extensive Significant loss of generation and demand INV, NMA, All Canterbury & South Canterbury, Nelson & Marlborough loss of supply WestCoast islanded 30% self supply	PR-DP-1077 Full implementation PR-DP-252 Implement nationally Call before L1 MAN-TWI islanding Recall all outages Additional 200MVAR reactive plant made available	Significant Some trippings and alarms 20-30% demand reduction Loss of HVDC Isolated supply loss HEN, HEP, BPE	PR-DP-1077 Full Implementation PR-DP-252 Implement nationally Call before L1 Recall all outages Additional 100MVAR reactive plant made available



PĀTAI?



Roles during a major space weather event

Chris Taylor, NCC Operations Manager, Transpower

Key Players in a Space Weather Response

- **Transpower – System Operator and Grid Operations**
- **Electricity Industry participants**
(Generators/EDBs/Direct Connects/Retailers)
- **New Zealand Space Weather Science Advisory Panel (SWxSAP)**
- **National Emergency Management Agency (NEMA)**
- Earth Sciences New Zealand & Otago University
- International forecasting and monitoring agencies
Includes National Oceanic and Atmospheric Administration (NOAA)



What is a 'Critical GIC Event'

- Defined as a geomagnetic storm where the **rate of change in Earth's magnetic field exceeds 1,200 nT/min***, potentially reaching **4,000 nT/min**.
- Represents a **1-in-100-year class event** with high possibility of:
 - Multiple transformer and reactive plant alarms/trips
 - Widespread voltage instability
 - Localised or widespread loss of supply
 - Potential cascade failure

nT/min = nanotesla/min

Critical GIC Event Triggers

- **Initial Trigger:** A “**G4 or above**” **WATCH** notification is received from NOAA, or any other information presents that indicates a potential threat
- The **SWxSAP** will analyse available data and information to determine the **threat level** and develop **scientific advice**.
- **If an inbound event is** predicted to meet *Critical GIC Event* threshold, SWxSAP shall inform the SO.
 - This initiates the industry-wide critical event plan.
- The fastest CMEs reach earth in 15-18 hours. Giving ~12 hours to prepare



The System Operator's Role During a Critical GIC Event

Key Communications led by the SO:

- Communicate that a **Critical GIC Event** is underway via **CAN** notice
- Issue **WRN**, and **GEN** notices to signal required actions of Generators, EDBs, Direct Connect Customers and the Grid Owner.
- Stand up and host regular **Incident Management Team (IMT) coordination meetings**
- Host wider **industry briefings** to inform participants of the situation and response plan.

Key Actions led by the SO:

- **Between 10-4 hours from CME arrival**
 - Receive updated offers for generating plant that will be removed from service
 - Determine impacts for electricity supply, and communicate the forecast demand management requirements.
- **Between 4-1 hours from CME arrival**
 - Coordinate the **shutdown** of at-risk generating units.
 - Reconfigure the Grid to minimise GIC
 - **Manage demand** based on remaining generation and transmission asset availability.

Generator Requirements

Critical GIC Event conditions are likely to force the removal of large amounts of generation from service.

Asset Owners are responsible for the decisions to remove their generating units.

- Upon receipt of a **Warning** notice (**WRN**) from the SO (approx. 10 hours from CME arrival), Generators are requested to:
 - **Update offers** to reflect any **assets that will be unavailable for service**
 - **Increase generation offers** elsewhere, where possible
 - **Notify the SO ASAP** if generation must be removed at short notice.
- The SO will centrally **coordinate ramp-down** order and timing to:
 - **Maintain voltage/reactive support** as required.
 - **Prevent simultaneous shutdown causing frequency excursions that could lead to collapse.**
- To **protect restart capability**, black start units at selected stations must be shut down when instructed (i.e . Aviemore, Clyde, Maraetai 1, Tokaanu)



Distributor (EDB) and Direct Connect Requirements

Managing Demand During a Critical GIC Event

- With major generation assets removed, it is possible that significant generation shortfalls will eventuate.
- The System Operator may need to:
 - Declare a **Grid Emergency** and manage demand
 - Indicative Load limits will be forecast and published ahead of time.
 - This will allow time for customers to plan their demand management strategy.
- Be prepared for extended periods of significant demand management (~36 hours)
 - Consider: How will you manage this operationally? What will you communicate to your communities?

DAT – Indicative limits under a Warning Notice

Demand Allocations

Demand Allocation (MW) published by the System Operator

Schedule ID: INDUSTRY EXERCISE 22-May-2026 04:00

Indicative demand allocations. These load limits may take effect if a Grid Emergency is declared. Do not shed load.

Load Limit Applies to Powerco across the following GXP: All GXPs

DATE	START TIME	END TIME	GXP	DEMAND ALLOCATION (MW)	PREVIOUS DEMAND ALLOCATION (MW)	LOAD FORECAST (MW)
2026-05-20	4:00	4:29	All GXPs	NO LIMIT	N/A	507.2
2026-05-20	4:30	4:59	All GXPs	NO LIMIT	N/A	516.2
2026-05-20	5:00	5:29	All GXPs	513.2	N/A	540.3
2026-05-20	5:30	5:59	All GXPs	521.3	N/A	579.2
2026-05-20	6:00	6:29	All GXPs	539.0	N/A	634.1
2026-05-20	6:30	6:59	All GXPs	583.2	N/A	728.9
2026-05-20	7:00	7:29	All GXPs	606.2	N/A	808.3
2026-05-20	7:30	7:59	All GXPs	617.8	N/A	882.5
2026-05-20	8:00	8:29	All GXPs	635.1	N/A	907.3
2026-05-20	8:30	8:59	All GXPs	531.0	N/A	885.0
2026-05-20	9:00	9:29	All GXPs	513.1	N/A	855.2
2026-05-20	9:30	9:59	All GXPs	496.7	N/A	827.8
2026-05-20	10:00	10:29	All GXPs	474.7	N/A	791.1
2026-05-20	10:30	10:59	All GXPs	453.9	N/A	756.4
2026-05-20	11:00	11:29	All GXPs	438.8	N/A	731.3
2026-05-20	11:30	11:59	All GXPs	419.7	N/A	699.5
2026-05-20	12:00	12:29	All GXPs	416.0	N/A	693.3
2026-05-20	12:30	12:59	All GXPs	405.5	N/A	675.8
2026-05-20	13:00	13:29	All GXPs	397.5	N/A	662.5

DAT – Instructed limits under Grid Emergency

Demand Allocations

Demand Allocation (MW) published by the System Operator

Schedule ID: INDUSTRY EXERCISE 22-May-2026 04:00

Grid Emergency has been declared - Control Load to the demand allocations below.

Load Limit Applies to Powerco across the following GXP: All GXPs

DATE	START TIME	END TIME	GXP	DEMAND ALLOCATION (MW)	PREVIOUS DEMAND ALLOCATION (MW)	LOAD FORECAST (MW)
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Retailer Requirements

Considerations for Retailers

- Demand shedding requirements may cause a disconnection to medically dependent customers.
- Expect an increase in customer enquiries about power cuts.
- Be prepared for extended periods of loss of supply (36 hours)



When the Storm hits

- Measured storm intensity is only available when the CME reaches L1 satellites (~15 minutes before earth)
- SO will continue **2-hourly IMT coordination meetings** to update on:
 - Storm intensity
 - Transformer/NER alarms
 - Generator disconnections
 - Transmission faults
 - Updates to demand management requirements
- Storm may be more, or less, severe than predicted.
- Further generation and transmission outages could occur, leading to further loss of supply, or
- If storm severity is lower than predicted, some generation may return to service allowing some demand restoration.



Post Event Restoration

- SWxSAP will provide confirmation that the storm has passed
- Generators will be requested to reoffer generation
- Grid owner will be requested to return equipment to service
- Demand will be restored as and when generation availability allows
- NOTE: Some assets may remain out of service for inspection/repair



Summary

- Critical Events are rare but **high-impact** and can threaten large parts of the NZ grid.
- Managing them requires:
 - Early scientific advice (SWxSAP)
 - Coordinated shutdowns
 - Proactive demand management
 - Immediate execution of Grid Emergency procedures
- Preparation now (IMTs, internal plans, asset awareness) is essential.





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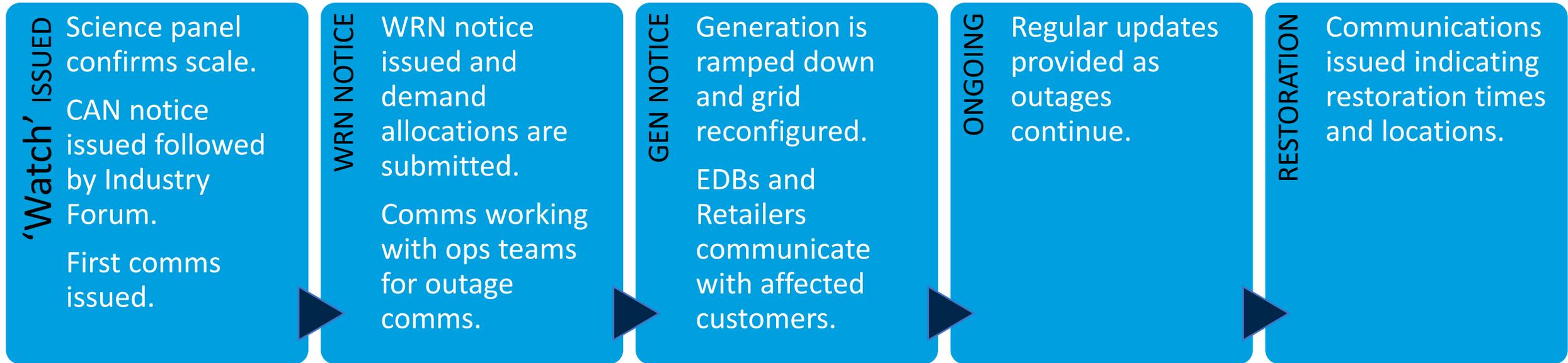


Communicating in a space weather event

Joseph Hornell, Senior Communications Advisor, Transpower

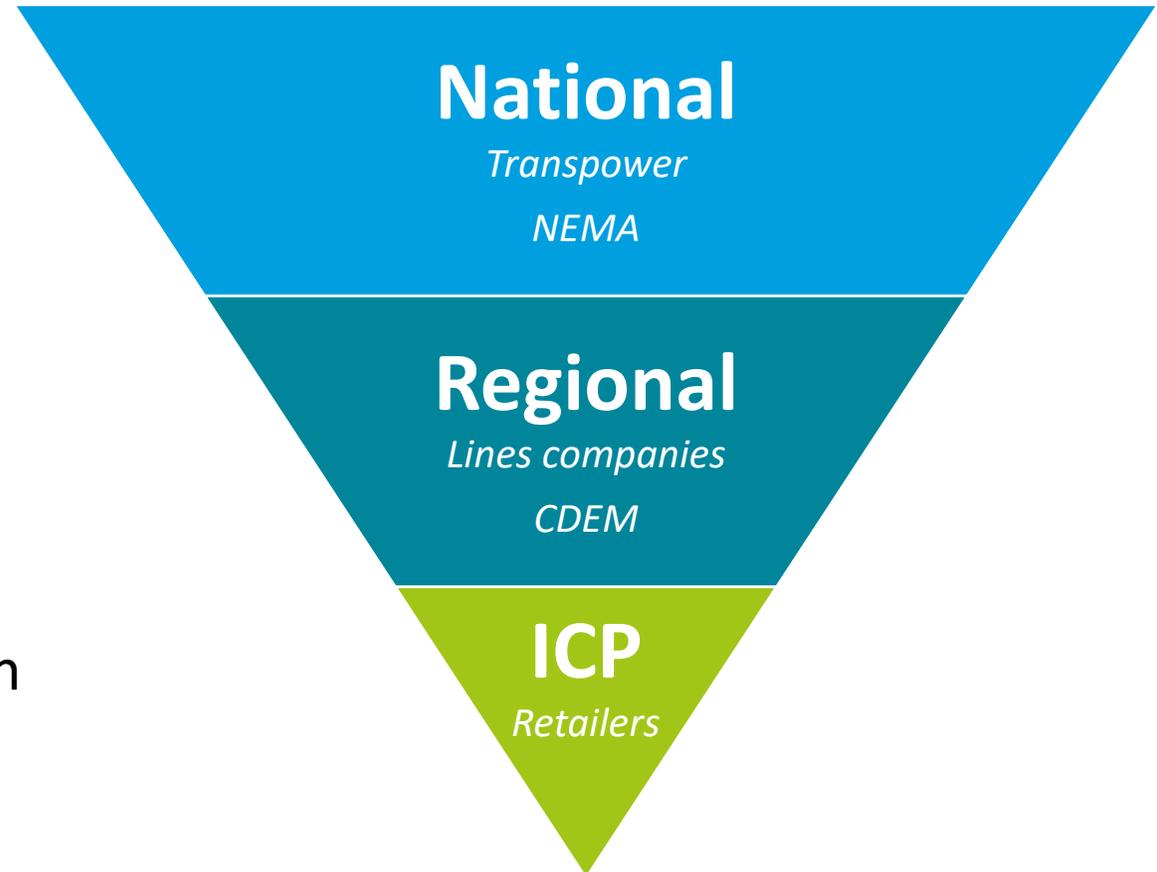
Jessica Williams, Senior Communications Advisor, National Emergency Management Agency

Stages of communication (greater than G4)



Layers of communication

- All of us have a part to play in communicating
- Three key levels of communication
 - National
 - Regional
 - Consumer
- Different levels hold different information
- Need to ensure messaging is consistent



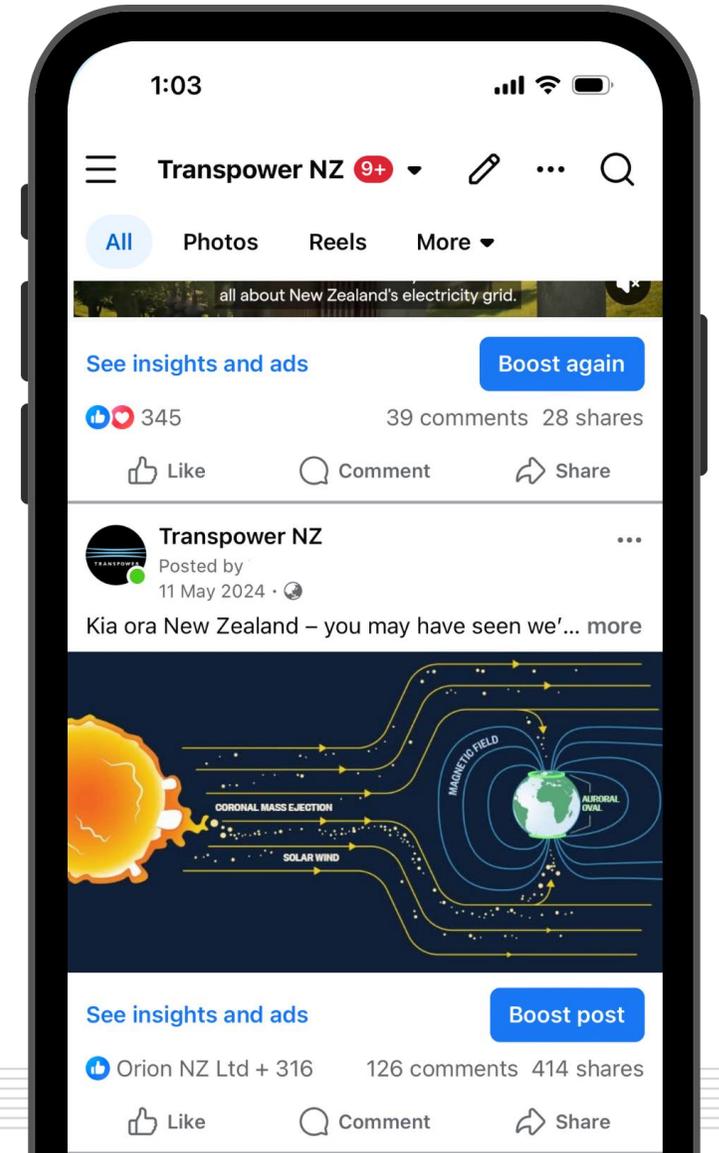
Transpower communications channels

Channels for industry:

- Operational notices
- Major Power System Event Contact List
- Industry briefing
- IMT liaison
- Radio (if needed)

Channels for public:

- Website
- Facebook
- Media release and interviews



Regional level: what lines companies might do

- Coordinate with retailers
- Create dedicated page on website to update
- Liaise with media and send releases to local outlets
- Post to social media, direct to other sources of information, and engage with customers
- Liaise with local authorities, emergency services, civil defence to be on the same page
- Set up pre-recorded messages on 0800 numbers
- Update outage maps depending on nature of load management



Consumer level: what retailers might do

- Email customers
- Text customers
- Phone customers
- Information on:
 - Websites
 - Apps
 - Phone lines
- Pay attention to Consumer Care Obligations and medically dependent consumers



Considerations

How do we ensure consistency of information?

How will your comms and ops teams work together?

What's the likely scenarios on your network with load limits?

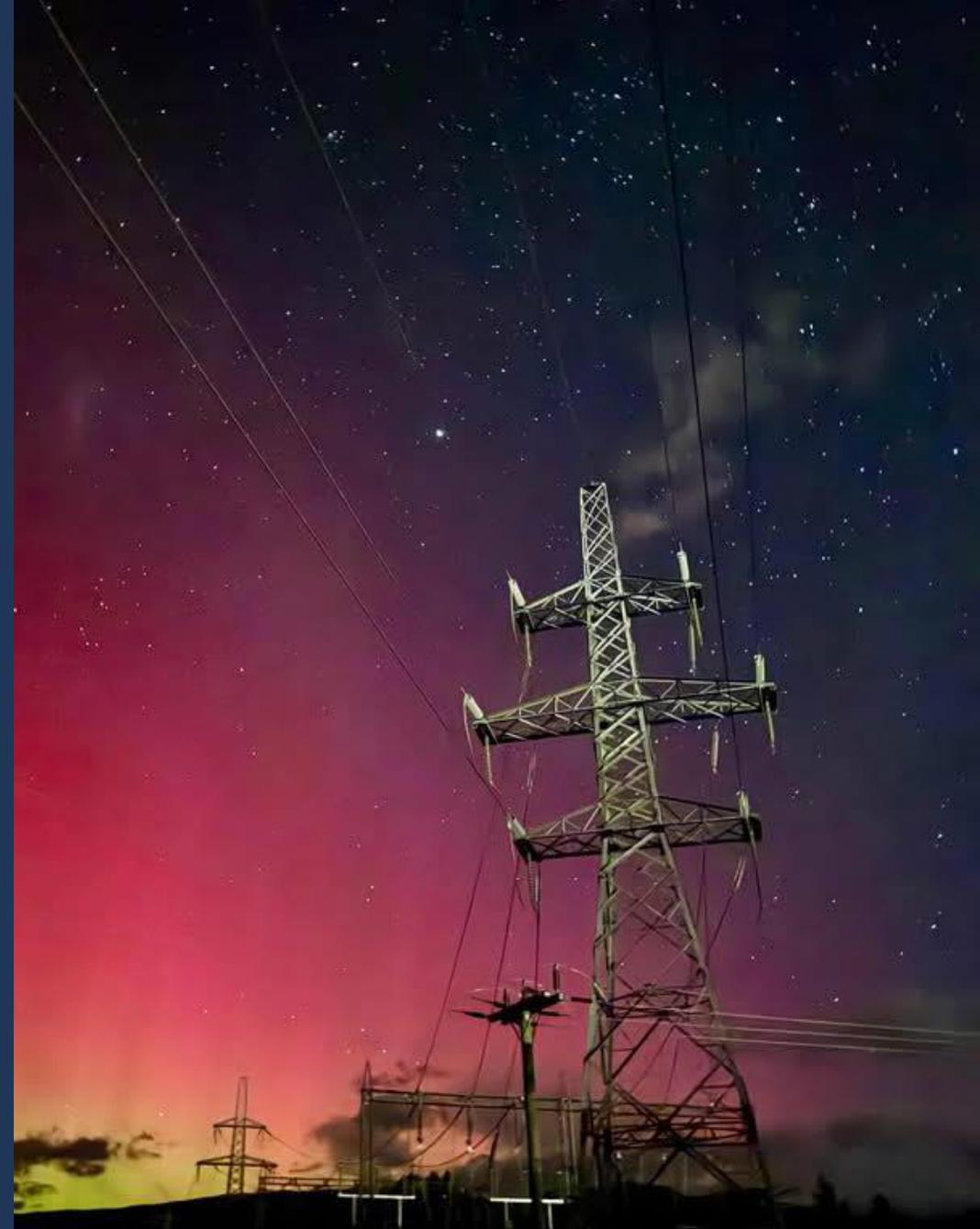
Do you have contacts at your local CDEM?

What information do retailers and EDBs need to share for customer comms?

How will you blend national and local messaging?

How will your team share the load?

How will you moderate mis/disinformation?





NEMA's role in Space Weather

Jessica Williams

5 March 2026



**National Emergency
Management Agency**
Te Rākau Whakamarumarū



What NEMA does

Steward, operator and assurer of the emergency management system

Lead or support the response to and recovery from emergencies

Emergency management is:

- Locally led
- Regionally enabled
- Nationally supported

Space weather will require an all-of-government and an all-of-society response



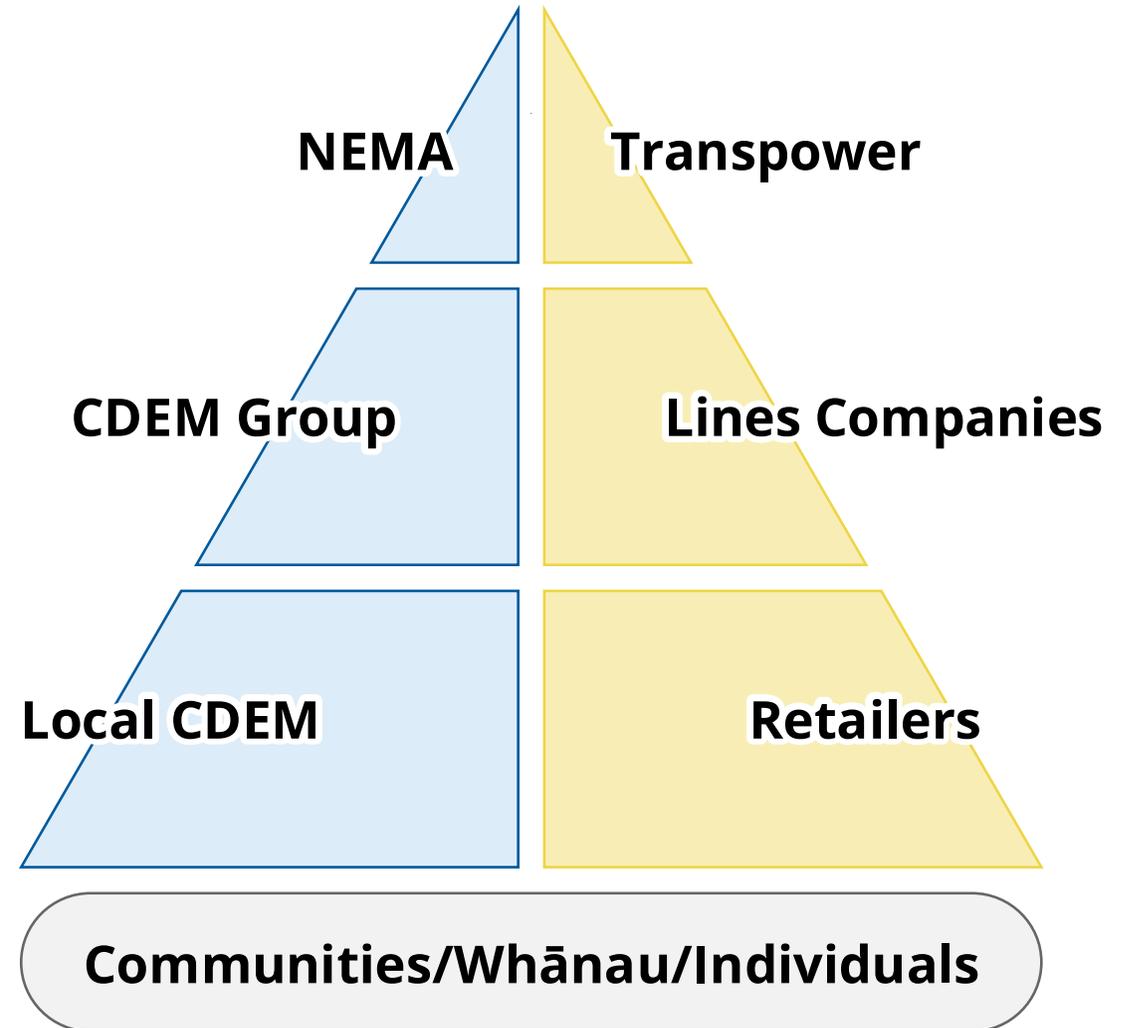


Like the electricity sector, the emergency management system is devolved

National level

Regional level

Local level



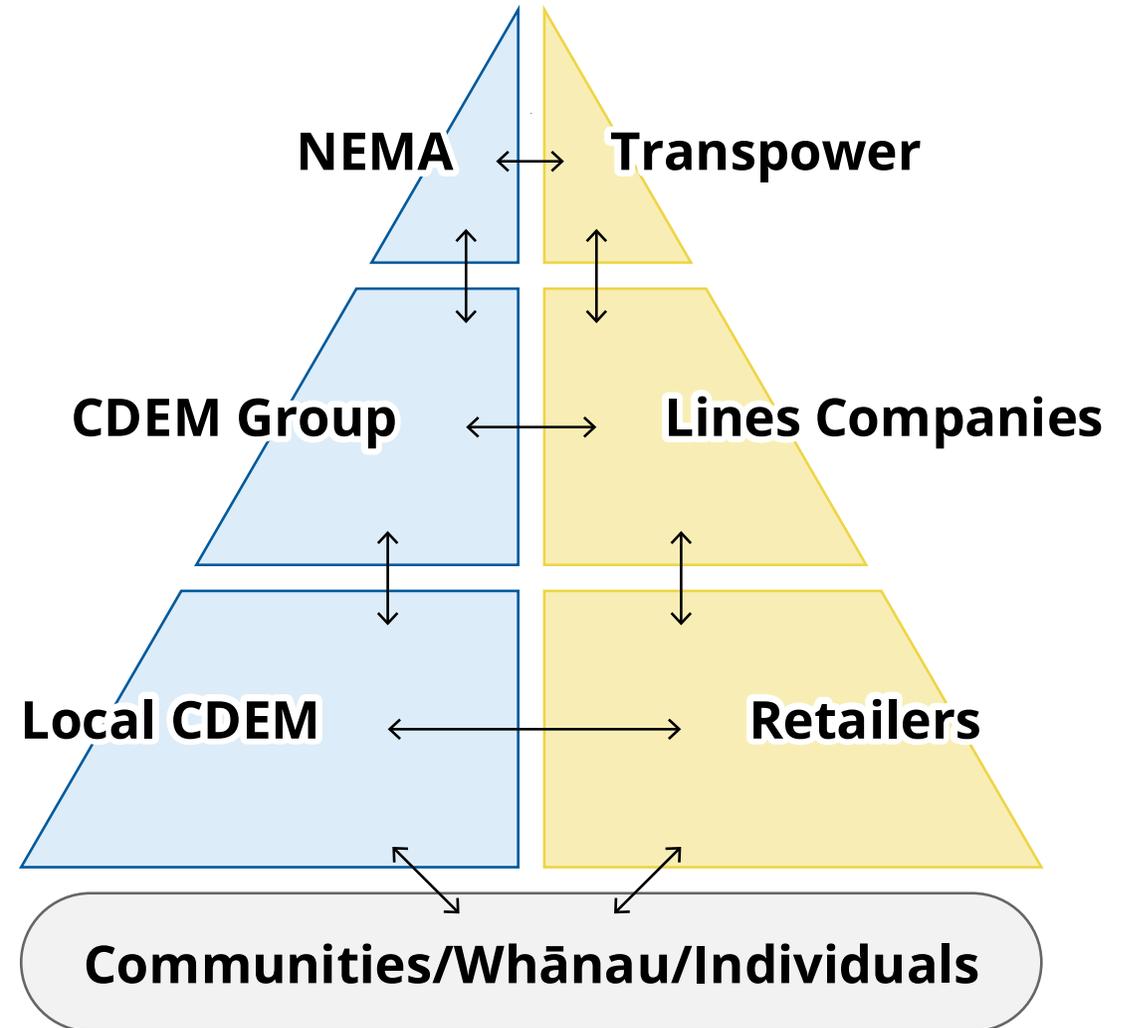


During a response, each level maintains contact...

National level

Regional level

Local level





National Space Weather Response Plan

Responding quickly will require complex decisions – short-term disruption vs long-term consequences

Decisions will be made in a highly uncertain environment

The Plan's intent: make the best use of limited warning time to mitigate impact on our communities





Public information resources



Get Ready website

- Preparedness advice
- Multiple languages and alternate formats
- Advice for medically dependent consumers
- Making a plan



Consistent Messages

- Nationally agreed, peer-reviewed messages for multiple hazards
- Focuses on the “4 Rs” – risk reduction, readiness, response, recovery
- Free to use with attribution to NEMA



NEMA digital channels

- Impact-focused public education
- Socials: Facebook, Instagram, X
- NEMA website: information in emergencies, zero data



Pātai?

space.weather@nema.govt.nz

The Consumer Care Obligations

Heather Webster

Senior Compliance Advisor, Electricity Authority



Why the CCOs matter during major space weather events

The Consumer Care Obligations:

- help protect consumers when they need support the most
- ensure retailers stay focused on people's wellbeing, not just technical or operational issues
- set out requirements for retailers and distributors to ensure information about medically dependent consumers is shared.

What this means for you

Be prepared

- Make sure you know your obligations, have the right processes in place
- Make sure you have identified and know how to support vulnerable and medically dependent consumers

Communicate clearly

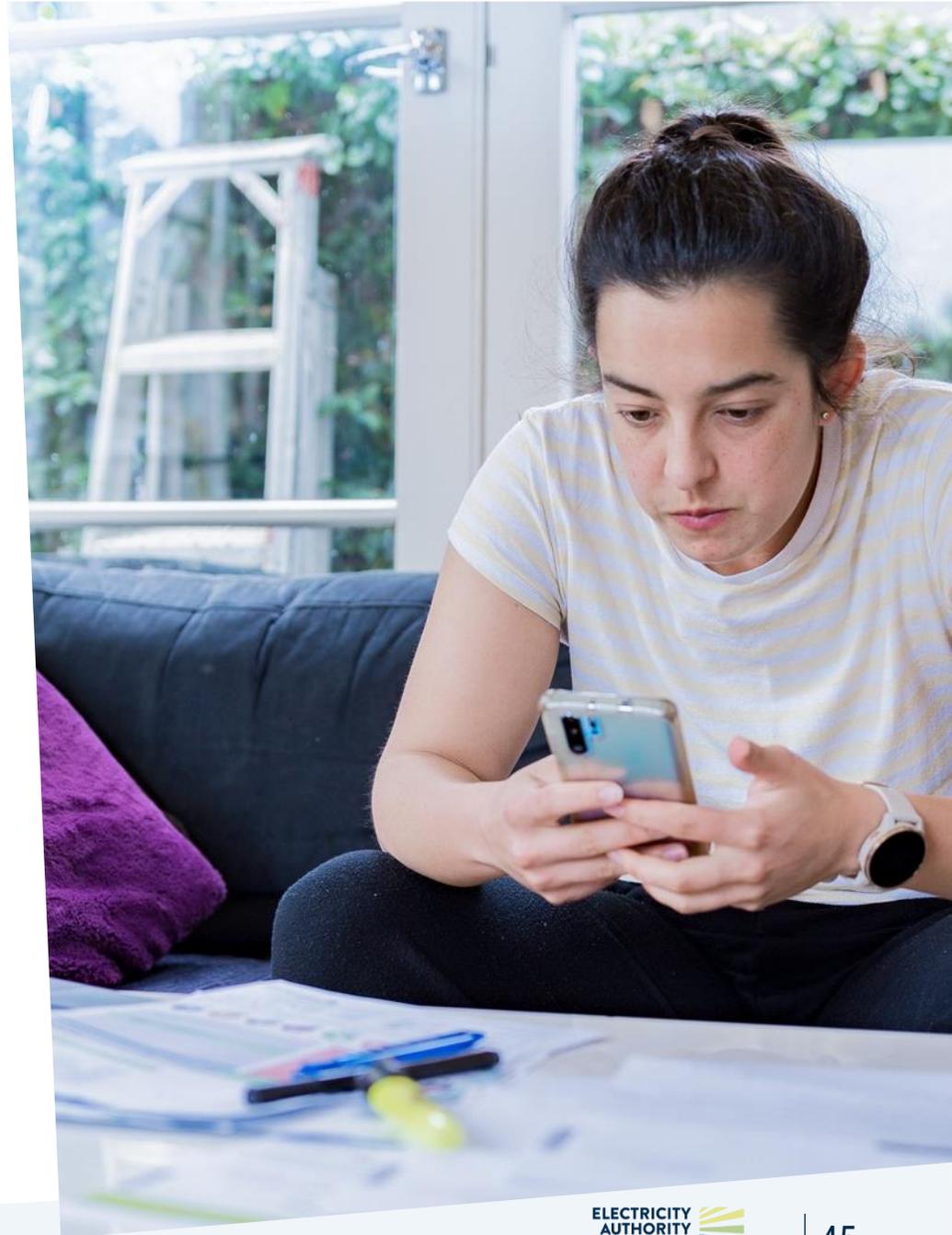
- Provide clear, practical information
- Keep messages consistent to reduce confusion and build trust

Co-ordinate your response

- Share information - work with the sector, UDL, local authorities etc
- Ensure a unified response to strengthen public trust

Be people-centred

- Be fair and empathic, support consumer safety and wellbeing
- Prioritise vulnerable and medically dependent consumers



Support medically dependent consumers

Preparation is key

- Tell consumers why important to have an emergency response plan and be prepared
- Available on the Electricity Authority's website - [Emergency_response_plan.pdf](#)

Follow their plans

- Tell consumers to follow the checklist in their plans during an emergency

Emergency response checklist

Immediate actions

- Notify your power company and confirm they have your medically dependent status.
- Ensure you have instructions for restarting medical equipment after a power cut.
- Pack a grab bag with essential items and keep it accessible.

Information to include in your plan

- Support contacts: Names and phone numbers of two support people who can assist.
- Power company contact: Company name and emergency phone number.
- Medical contacts: Your doctor's and hospital's contact details.
- Equipment details: The make, model, and function of critical medical or other electrical equipment.
- Medications and accessories: Location of your medication and supplies, stored for easy access.
- Alternative locations: Address and transportation plan for where to go during a prolonged outage.
- Equipment failure protocol: Steps to take if your medical equipment stops working.

Things to keep in mind

- **Don't rely on the internet or a landline phone to contact people** – they might not work in a power cut.
- **If you have a backup power supply, make sure you know how to use it.**
- **Think about what you'll do if your backup power supply or batteries run out.**
- **If your batteries are rechargeable, check them regularly to make sure they're charged.**
- **Think about how you'll keep your mobile phone charged in a power cut.** USB power banks lose their charge over time so check it regularly to make sure it's fully charged. If possible, keep a car charger for your cell phone.

Retailer Guidance on the Consumer Care Obligations

- Retailer Guidance sets out good practice for major weather events and widespread power cuts
- Prioritise medically dependent and vulnerable consumers
- Communicate clearly and consistently

Retailer Guidance is on the Electricity Authority's website:
[Consumer Care Obligations – Retailer guidance](#)



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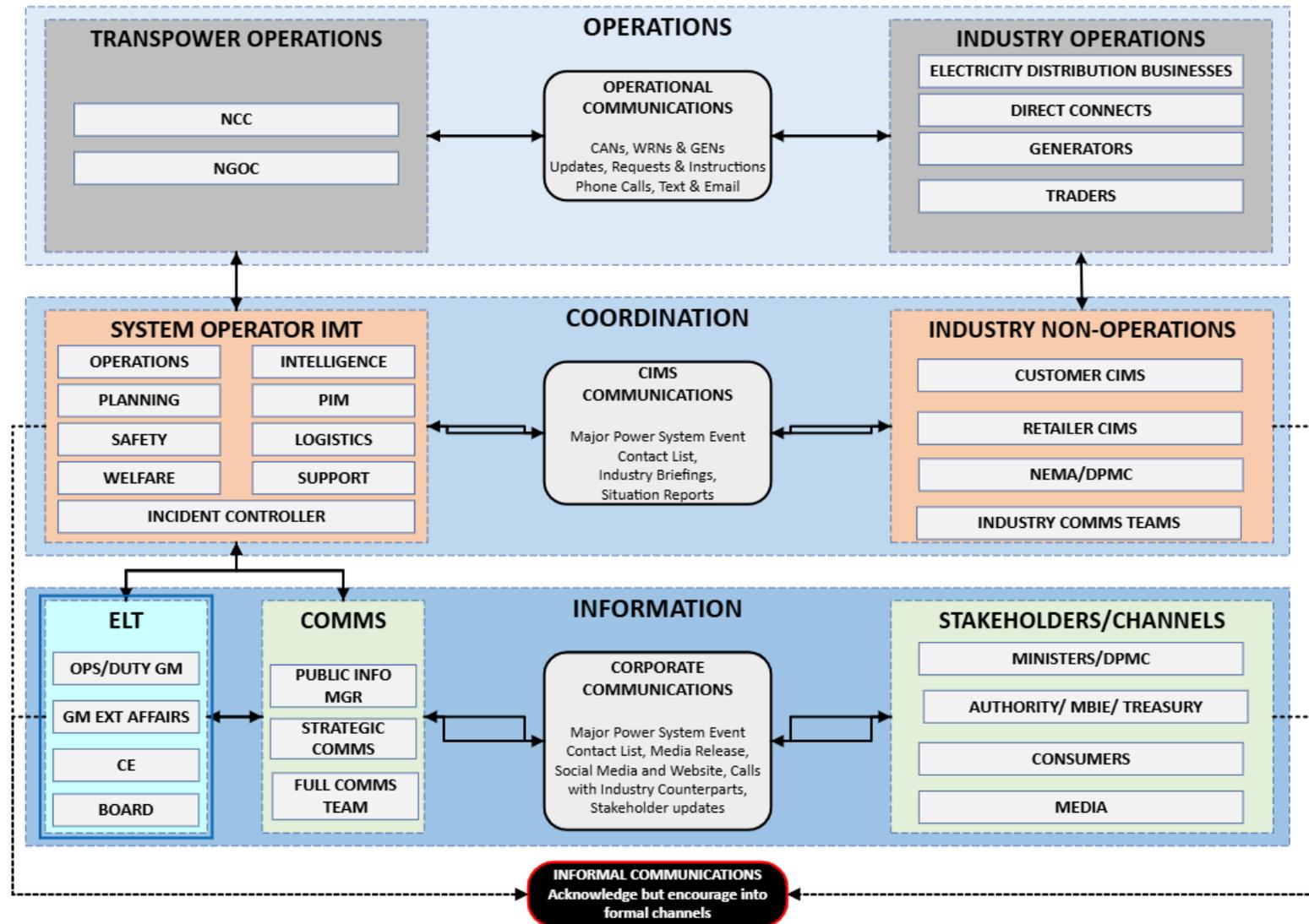
consumercare@ea.govt.nz



Industry Exercise 2026 – what to expect

Chris Taylor, NCC Operations Manager, Transpower

Exercise Structure



What to expect

- Work through major space weather scenario over 1.5 days (20 May 12.30pm - 21 May 3.30pm)
- Comms staff attend briefing on Day 1, 12.30-1pm (and all of day 2)
- Timed injects from System Operator as event unfolds
- Regular IMT meetings
- Operations and Comms work in unison
- Complete a workbook - one for each organisation
- Social media simulator - respond to posts, share press releases etc
- Hot debrief at end of exercise



Testing Operational and Communications Response

- Critical GIC Events have a significant, widespread impact.
- A key outcome is to drive cooperation between operations, IMT groups and comms and throughout the sector, and to identify the challenges we face.
- So, comms teams - work closely with your operations teams to understand their challenges and what that will mean for communication in a real event.
- Focus on using the exercise to build your internal capabilities, and identify the tools, messaging and resources you may need for the real thing



Exercise Workbooks

- Participants will be asked to complete exercise workbooks during the exercise.
- Guidance will be provided by facilitators regarding when to complete each section.
- Only one workbook needs to be completed per participating organisation.
- If you have multiple attendees from your organisation, please consider how you will communicate to complete the workbook.





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Thank you

We recommend you:

- confirm roles and responsibilities for your team for the exercise
- if any of your exercise team has changed, let us know
- review your incident management processes and communications
- identify any gaps to test or strengthen
- attend the **exercise pre-briefing on Tuesday 12 May 1.00pm**

Questions? IndustryExercise@transpower.co.nz



Closing **Karakia**

Unuhia, unuhia,
Unuhia ki te uru tapu nui
Kia wātea, kia māmā, te ngākau,
Te tinana, te wairua, i te ara tangata
Koia rā e Rongo, whakairia ake ki runga
Kia tina! Tina! Hui e! Tāiki e!

Translation

Draw on, draw on
draw on the supreme sacredness
to clear, to free the heart,
the body and spirit of humankind
That is Rongo suspended high above us
Draw together! Affirm!

Ngā mihi

Thank you

TRANSPower.CO.NZ
EA.GOVt.NZ

**ELECTRICITY
AUTHORITY**
TE MANA HIKO 



Exercise Structure

Day 1

Real Time	Event Time	Countdown to 'Event'	Summary
12:30	22:30	T-12	Introduction and Exercise initiation – WATCH notice issued by NOAA and SWxSAP advises SO to expect earth bound CME of 'Critical GIC Event' magnitude.
13:00	23:00	T-11	Activation of Industry Response Plan. SO publishes a CAN . Industry Briefing held.
13:15 – 14:00	23:15 – 00:00	T-10 to T-9	SO publishes a WRN , seeking updates to generation offers. Generators to respond with changes to offer for generation that will be made unavailable prior to onset of solar storm. Increase of offers for some generation possible.
14:00	00:00	T-9	SO develops a coordinated ramp down plan and demand management strategy. DAT schedules with demand limits will be sent to EDB and direct connect exercise participants.
16:00	02:00	T-7	EDBs & direct connect customers develop strategies for demand management.
17:00	03:00	T-6	Close Day 1



Exercise Structure

Day 2

Real Time	Event Time	Countdown to 'Event'	Summary
09:00	N/A	N/A	Recap previous day
09:30 – 11:00	05:30 – 07:00	T-3.5 to T-2	Grid Emergency declared. Generation shutdown for slow ramping plant. Latest Demand Allocations published and demand management initiated.
11:00	07:00	T-2	Grid Emergency declared for Grid reconfiguration. SO instructs Grid Owner to remove circuits from service to reduce GIC.
11:30	07:30	T-1.5	Black Start units shutdown
12:00	08:00	T-1	Shut down fast ramping generation. Demand schedules updated if required. Demand participants to manage demand as instructed.
13:00	09:00	T-0	Storm onset. Industry Briefing held to inform all parties
13:15 – 13:45	Lunch Break		
13:45	10:00	T+1	Industry Briefing to advise what to expect during solar storm (possibilities of grid equipment and generator faults or short notice outages.
14:15	20:00	T+10	(TIME JUMP) . SWXSAP declares event over. IMT convenes to initiate restoration
14:30	20:30	T+10.5	SO ends Grid Emergencies and issues CAN to advise event over. Generators offer back in. Transmission restored. Demand restoration initiated.
15:30	Event Finish		