

Network Operator Operational Response to Storm Ophelia: TSO Perspective

Ray Doyle, Manager System Performance, EirGrid

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Storm Ophelia

- Became aware by 12th Oct that a potentially serious storm was going to impact Ireland
- Advance Planning on 13th October
- All Island approach Adopted
- Attendance at NECG meetings

Weather Alerts

- Met Eireann issued status **red** weather warning on Sat 14 Oct for the west of Ireland, **orange** warning for the remaining counties
- Met Office issued **amber** weather warning for Northern Ireland
- Met Eireann extended status **red** warning nationally at 20:00 on Sun 15 Oct from 06:00 Monday

Advance Planning

- OPI Preparations
 - Recalled transmission plant that was on outage
 - Planned transmission outages were cancelled
 - Status of Auto-Reclosing facilities reviewed
 - Planned for additional resources for the control centres.
 - on-call and availability staff notified
 - Planning extended into Saturday / Sunday with key decisions being taken on power system setup
 - All island approach - tie line flows, reserve jurisdictional / interconnectors.
 - Plant: good geographic spread, inertia, reactive power
 - Key transmission stations selected for manning

Advance Planning

- Communications
 - Key stakeholders contacted; generators, customers, wind farms, ESBN, Regulators, Departments
 - Key support staff requested to attend the Oval, Deansgrange and Castlereagh House (approx. 30 people) early on Monday morning
 - Participation in NECG over the weekend
 - Staff notified of office closures on Sunday evening

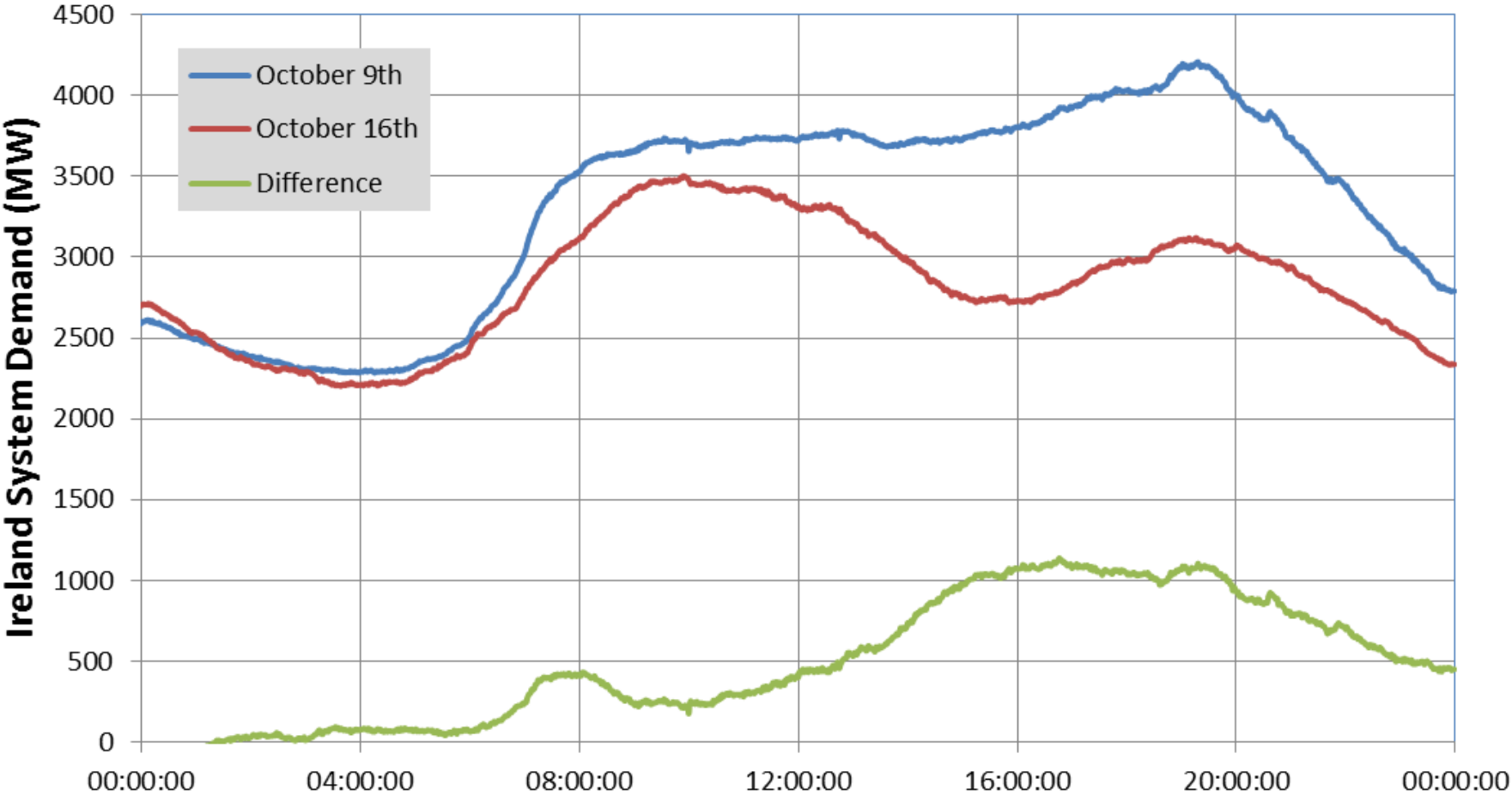
Roles and Responsibilities

- Monday:
 - OCE in the Control Centre
 - Situation Room manned
 - NCC had extra TX staff and ECC manned
 - Sub-teams available:
 - Comms / Shift-staffing:
 - Restoration options/ Paths
 - System Studies
 - Protection Operation/ Fault Analysis
 - Rep back and forth to NECG

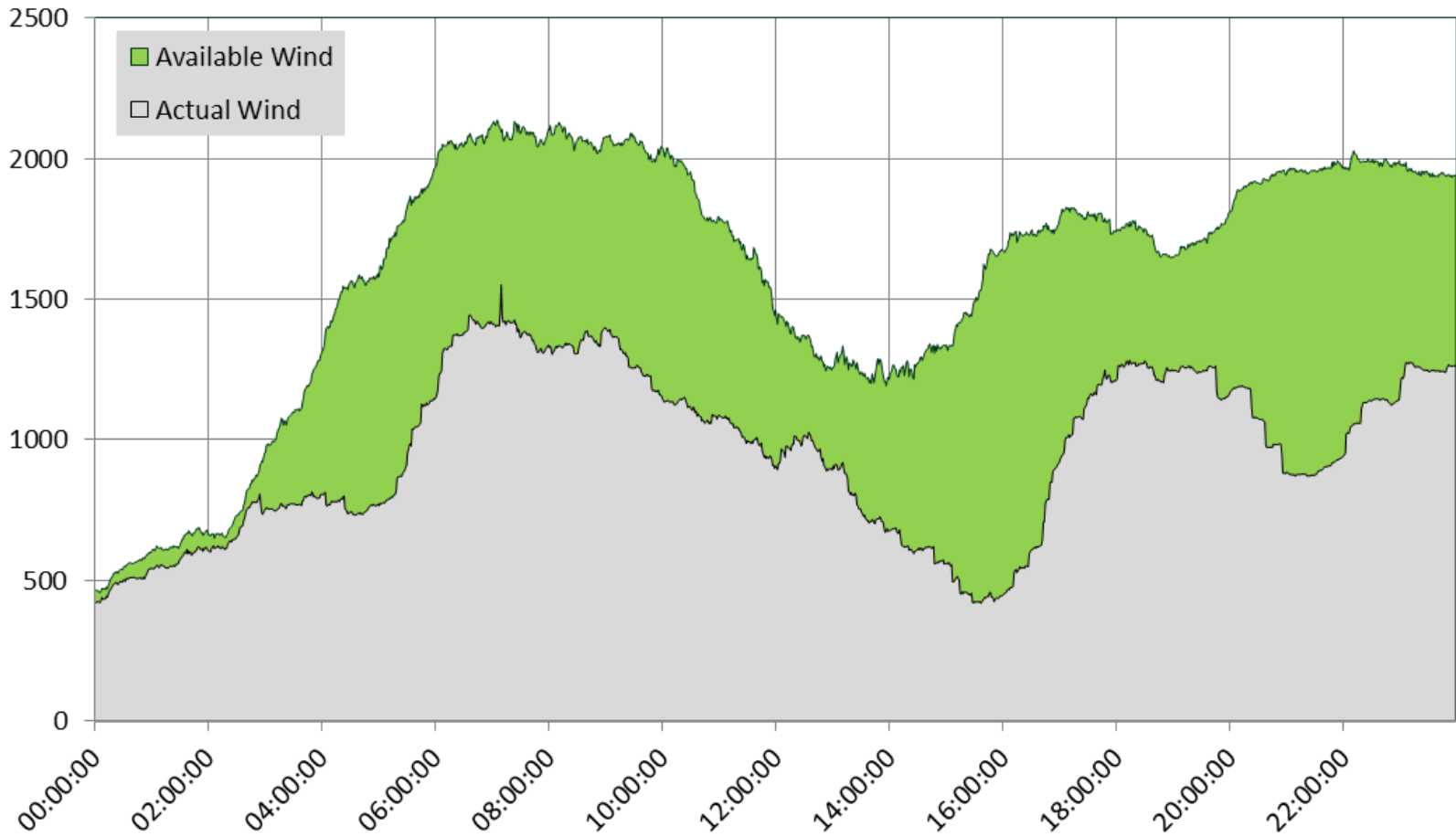
Coordination During Event

- Internal Coordination Meetings
 - 12 meetings co-ordinated from Situation room from 07:30 to 22:00
 - Review of latest storm updates
 - Updates on power system status
 - Info to/ from NECG
 - Decisions on staffing arrangements
- National Coordination Group Meetings
 - Three meetings 09:30; 14:00 and 19:00
- Northern Ireland Multi Agency Meetings
 - Three meetings at 11:00, 14:00 and 19:00

Hurricane Ophelia System Demand



Hurricane Ophelia - Actual and Available Wind



High Level Summary – 16 October

- System Amber Alert Level 1 issued at 08:21 in NCC
- 16 x 110 kV transmission trips / reclose between 11:07 and 14:22. 1 x 110 kV circuit forced. All trips occurred across the south (in counties Cork, Waterford & Wexford)
- No transmission events in NI.
- No transmission customers disconnected.
- Amber Alert cancelled at 20:20
- ~350,000 customers in Ireland and ~53,000 customers in Northern Ireland disconnected during the event.

Sequence of System Faults – 16 Oct

Time	Faulted Plant	Fault Type	Protection	Faulted	Transient /
			Action	System	Permanent
11:07:45	Coolroe - Inniscarra 110 kV	RE	Trip	110 kV	Transient
11:07:45	Kilbarry - Knockraha 2 110 kV	-	T&R	110 kV	Permanent
11:22:34	Bandon - Dunmanway 110 kV	SE	T&R	110 kV	Transient
11:23:30	Bandon - Dunmanway 110 kV	SE	T&R	110 kV	Transient
11:28:03	Bandon - Dunmanway 110 kV	SE	T&R	110 kV	Transient
11:34:01	Bandon - Raffeen 110 kV	RE	T&R&T at BAN. T&R at RAF.	110 kV	Transient
11:41:27	Bandon - Dunmanway 110 kV	SE	T&R	110 kV	Transient
11:43:00	Bandon - Raffeen 110 kV	RE	T&R	110 kV	Transient
11:43:54	Knockraha - Midleton 110 kV	TE	T&R	110 kV	Transient
11:50:50	Knockraha - Midleton 110 kV	SE	T&R&T	110 kV	Transient
11:54:23	Midleton: T141 110 kV CB	RST	Trip	DSO	Permanent
11:56:10	Knockraha - Midleton 110 kV	TE	T&R at KRA. Trip at MID.	110 kV	Transient
11:57:15	Knockraha: Midleton 110 kV CB	TE	T&R	110 kV	Transient
12:38:32	Inniscarra - Macroom 110 kV	RE	Trip at INS. T&R&T at MAC.	110 kV	Transient
13:53:49	Great Island - Wexford 110 kV	RS	T&R	110 kV	Transient
13:54:16	Great Island - Wexford 110 kV	RS	T&R&T	110 kV	Transient
14:06:00	Butlerstown - Killoteran 110 kV	-	T&R	110 kV	Transient
14:06:00	Butlerstown: T142 110 kV CB	RSE, RST	Trip	DSO	Permanent
14:20:01	Great Island - Wexford 110 kV	ST	T&R	110 kV	Transient
14:23:27	Great Island - Wexford 110 kV	ST	T&R	110 kV	Transient

System Issues

- Wind generation curtailed in the South
 - As storm moved, curtailment was lifted and applied in impacted regions
- High voltage seen in the South West
 - Generators operating significantly leading
- Demand dropped off significantly until late afternoon
 - ~1000MW below normal
 - Supply Interruptions
 - Load down due business closures / people at home (Status Red)
 - Negative Reserve issues (ability to deal with loss of load)
- CCGT trip in afternoon
- Loss of normal communication to one gen station
- Nine Transmission stations lost primary ac supplies
 - Standby generators operated successfully

Key Points

- Power System performed well
 - Transmission infrastructure coped with high wind speeds
 - Roches Point wind speeds of 111 km/h at 11:00 hours and maximum gust of 156 km/h
 - No customer disconnections due transmission/generation issues
 - Communications, Control systems, Scada/EMS, Control Centre Tools all performed well
- Advance notice / forward planning for the event was key
- Setting up power system in "defensive" operating mode
- All island approach
 - ability to react as storm moved across the country
- Ability to maintain communications across all elements of the power system and with key stakeholders was vital

Key Points

- Feedback from NEEG very important for understanding wider impacts and safe planning of staff movements
- Access to regular/accurate weather forecast updates
- Auto-Reclosing of tripped lines key to system resilience
- Quick access to fault information/ records key to decision making when tripped lines require manual restoration
- Personnel available to support control centres with studies/ event analysis key to dealing with evolving situation in real time

Thank You for your attention

Questions?

