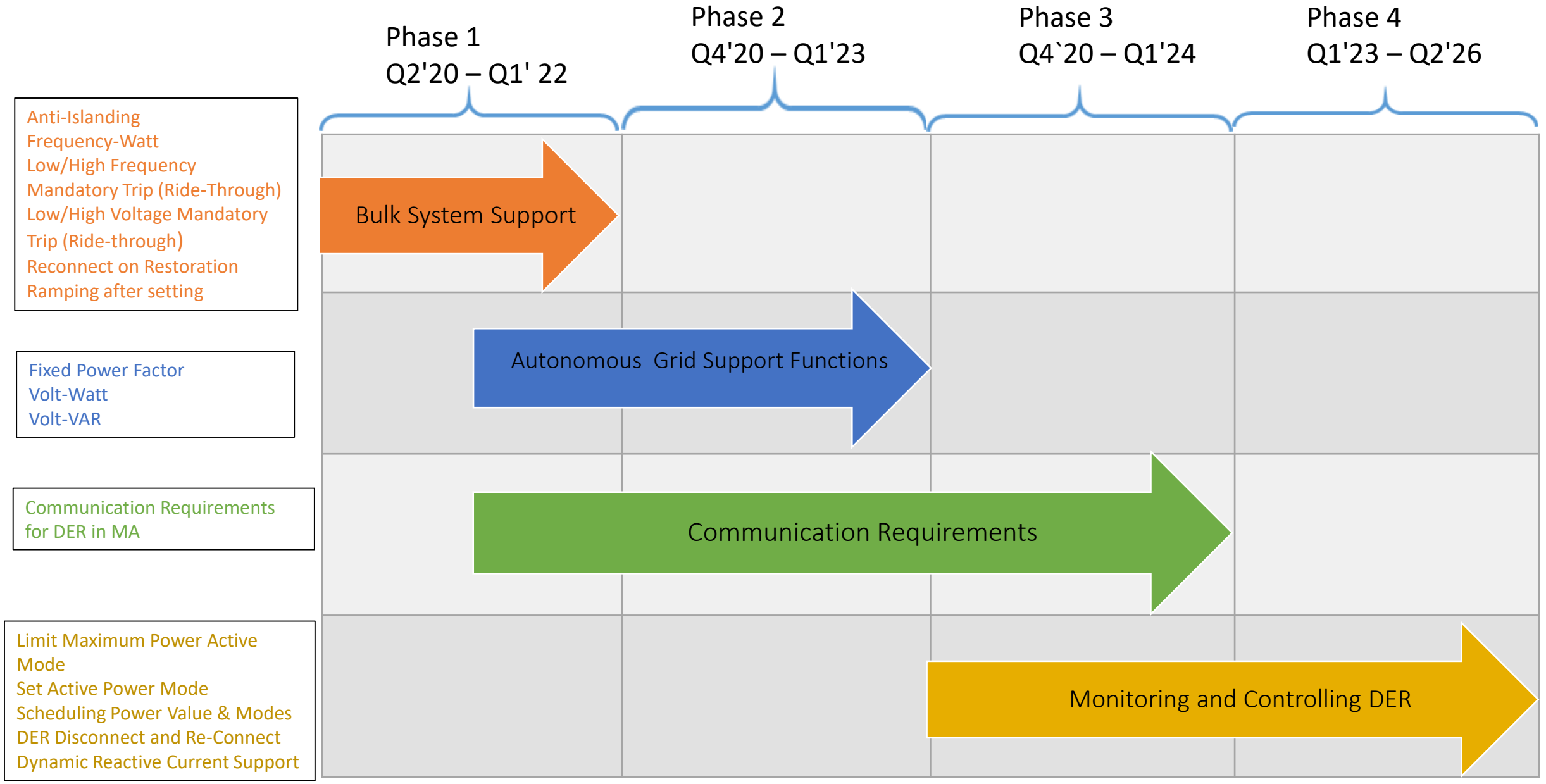
MA-IEEE 1547 Adoption Roadmap

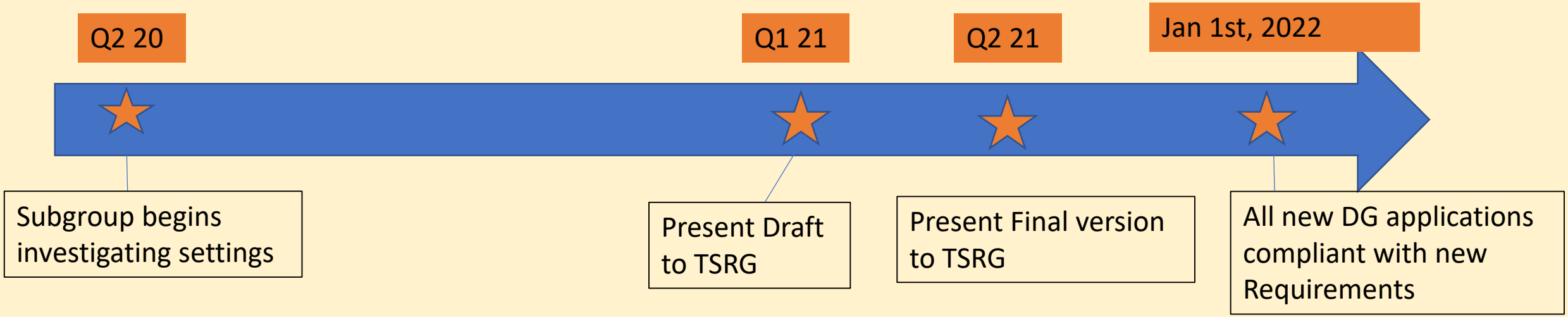
MA-TSRG Subgroup

Adoption Roadmap

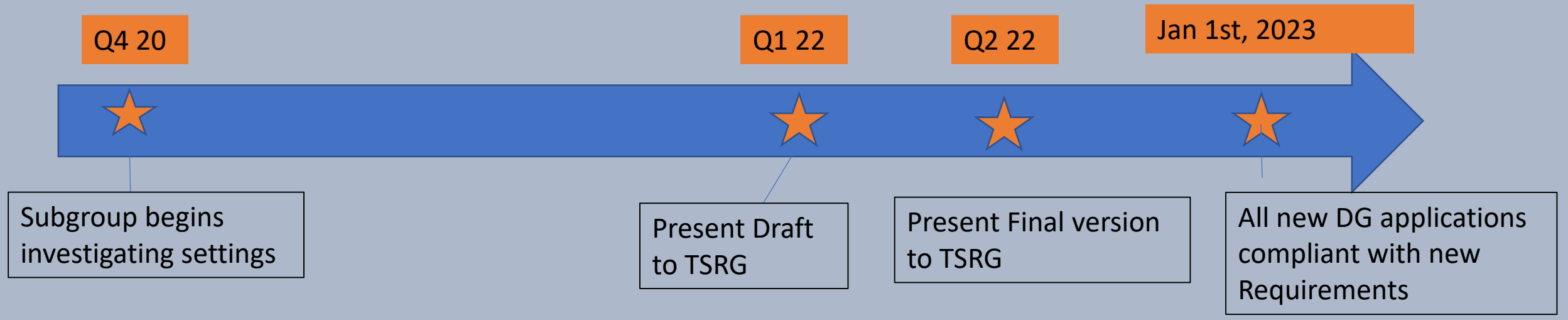
Start Dates are when the investigation starts
End Dates are target Implementation Dates
All dates are subject to change



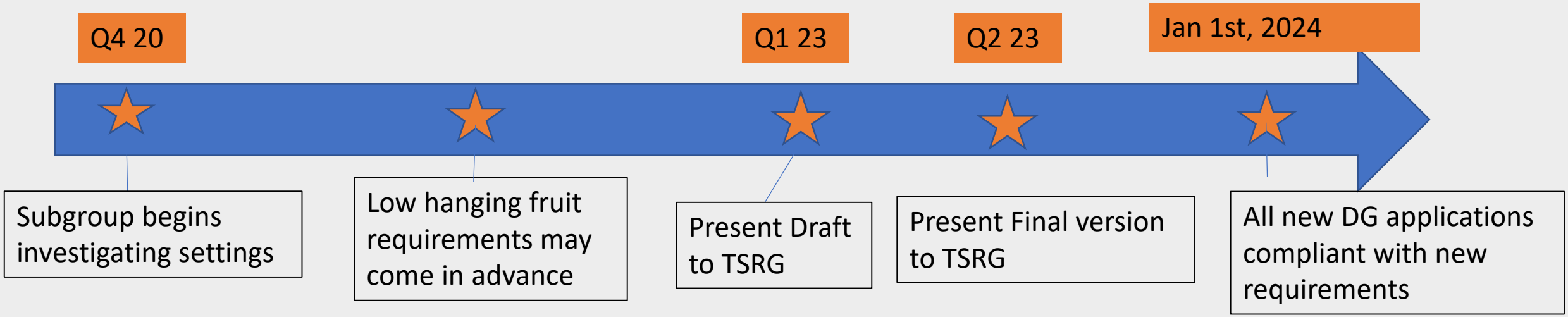
Phase 1 Bulk System Support



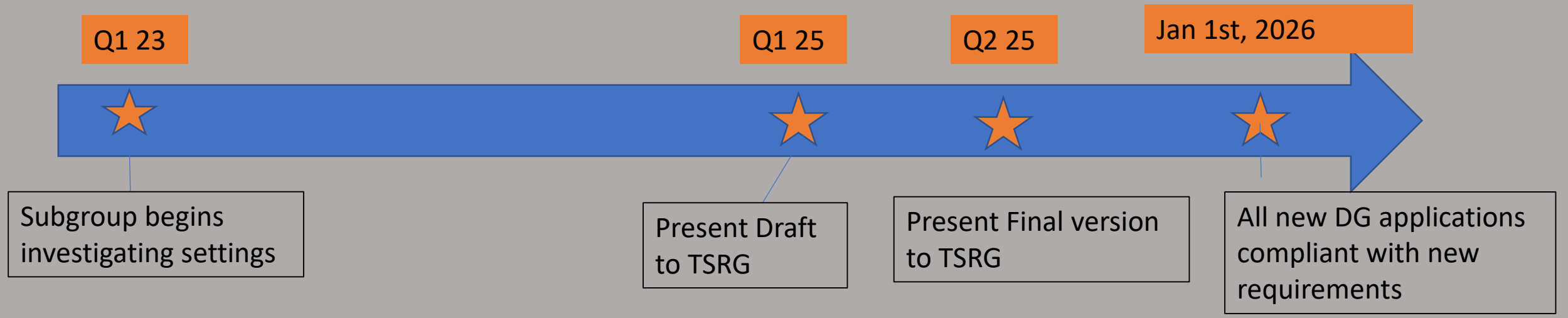
Phase 2: Autonomous Grid Support Functions



Phase 3: Communication Requirements



Phase 4: Monitoring and Controlling DER



External Engagement Plan For Feedback

External Engagement	WHO	What	Due Date
Transmission Operators	Brad Marszalkowski (NE-ISO)	Present to the NPCC + Other states in NE	02/11/2021
TSRG Update	Samer Arafa (National Grid) +Jeannie Amber (Eversource)	Present a Watermarked draft format of what Phase 1 settings will be and how it be presented. Offer 1 month for comments	02/18/2021 05/18/2021
Developer Update	Mrinmayee kale (Borrego) and Michael Wall (Nexamp)	To present to developer community and request feedback	03/15/2021
Forum on Inverter Grid Integration Issues (FIGII) Meeting	Samer Arafa (National Grid)	Present a Watermarked draft format of what Phase 1 settings	03/15/2021
Transmission Owners	EDC leads to coordinate with their transmission companies	Make sure agreement and alignment on settings	03/15/2021
Manufacture Updates	Tony Morreale (LIG Consultants)	Present to DER manufacturer community and identify issues with compliance.	03/15/2021
EDC's websites	EDC leads	New requirements documentation.	Within two weeks after the Q2 TSRG or after finalization, Aprrox 06/01/2021
Municipals	Brad Marszalkowski (NE-ISO)	Present final Phase 1 settings requirements	06/15/2021

Appendix

FEBRUARY 11, 2021 HOLYOKE, MASSACHUSETTS

Proposed Changes to ISO-SRD

NPCC DER Forum

Brad Marszalkowski

SENIOR ENGINEER

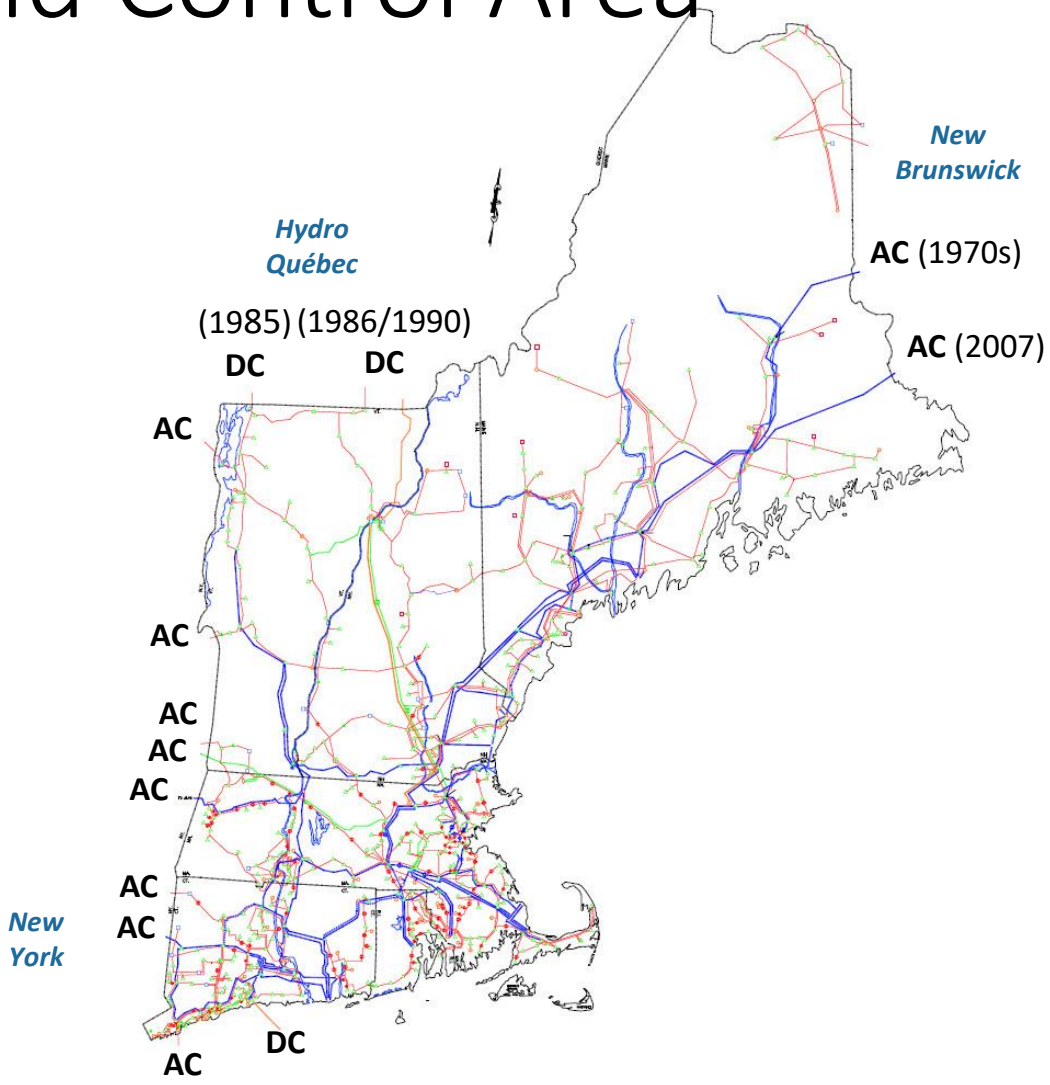
Purpose of the Presentation

- Discuss MA-IEEE 1547-2018 Roadmap
- Present proposed changes to currently in place ISO-SRD

BACKGROUND

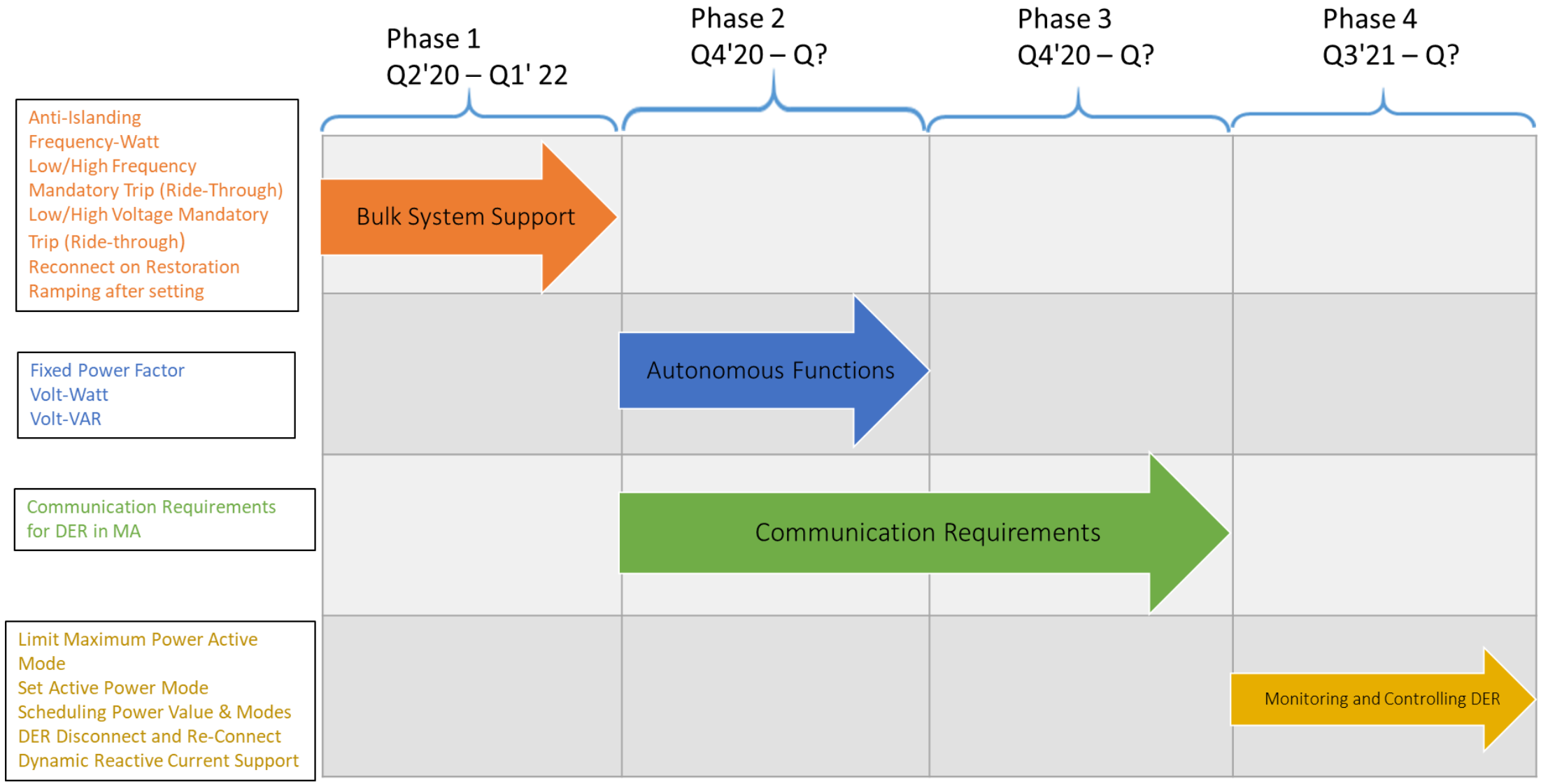
ISO New England Control Area

- **350** dispatchable generators in the region
- **31,200 MW** of generating capacity
- **9,000 miles** of high-voltage transmission lines (115 kV and above)
- **13** transmission interconnections to neighboring power systems in New York and Eastern Canada:
  - New York (8 AC ties, 1 DC tie)
  - Hydro Québec (2 DC ties)
  - New Brunswick (2 AC ties)
- Region's all-time summer peak demand set on August 2, 2006 at **28,130 MW**
- Region's all-time winter peak demand set on January 15, 2004 at **22,818 MW**



Note: AC stands for Alternating Current and DC stands for Direct Current

Proposed MA-IEEE Adoption Roadmap



ISO-SRD & Newly Proposed SRD Voltage Trip Settings

Shall Trip – IEEE Std 1547-2018					
Shall Trip Function	**ISO SRD Settings (CAT II)**		**Newly Proposed SRD Settings (CAT III)**		
	Voltage (p.u. of nominal voltage)	Clearing Time(s)	Voltage (p.u. of nominal voltage)	Clearing Time(s)	Within ranges of allowable settings?
OV2	1.20	0.16	1.20	0.16	Yes
OV1	1.10	2.0	1.10	2.0	Yes
UV1	0.88	2.0	0.88	**3.0**	Yes
UV2	0.50	1.1	0.50	1.1	Yes

ISO-SRD Voltage Ride-Through Capability and Additional Operational Requirements

Voltage Range (p.u.)	Operating Mode/ Response	Minimum Ride-Through Time(s) (design criteria)	Maximum Response Time(s) (design criteria)	Comparison to IEEE Std 1547-2018 for Category II
V > 1.20	Cease to Energize	N/A	0.16	Identical
1.175 < V ≤ 1.20	Permissive Operation	0.2	N/A	Identical
1.15 < V ≤ 1.175	Permissive Operation	0.5	N/A	Identical
1.10 < V ≤ 1.15	Permissive Operation	1	N/A	Identical
0.88 ≤ V ≤ 1.10	Continuous Operation	infinite	N/A	Identical
0.65 ≤ V < 0.88	Mandatory Operation	Linear slope of 8.7 s/1 p.u. voltage starting at 3 s @ 0.65 p.u.: $T_{VRT} = 3\ \text{s} + \frac{8.7\ \text{s}}{1\ \text{p.u.}}(V - 0.65\ \text{p.u.})$	N/A	Identical
0.45 ≤ V < 0.65	Permissive Operation [a,b]	0.32	N/A	See footnotes a & b
0.30 ≤ V < 0.45	Permissive Operation [b]	0.16	N/A	See footnote b
V < 0.30	Cease to Energize	N/A	0.16	Identical

The following additional operational requirements shall apply for all inverters:

a. In the Permissive Operation region above 0.5 p.u., inverters shall ride-through in Mandatory Operation mode, and

b. In the Permissive Operation region below 0.5 p.u., inverters shall ride-through in Momentary Cessation mode with a maximum response time of 0.083 seconds.

Newly Proposed SRD Voltage Ride-Through Capability and Additional Operational Requirements

Voltage Range (p.u.)	Operating Mode/ Response	Minimum Ride-Through Time(s) (design criteria)	Maximum Response Time(s) (design criteria)	Comparison to IEEE Std 1547-2018 (2nd ed.) for Category III
V > 1.20	Cease to Energize	N/A	0.16	Identical
1.10 < V ≤ 1.20	Momentary Cessation	12	0.083	Identical
0.88 ≤ V ≤ 1.10	Continuous Operation	infinite	N/A	Identical
0.70 ≤ V < 0.88	Mandatory Operation	20	N/A	Identical
0.5 ≤ V < 0.70	Mandatory Operation	10	N/A	Identical
V < 0.50	Momentary Cessation	N/A	0.083	Identical

ISO-SRD & Newly Proposed SRD Frequency Trip Settings (No Changes)

Shall Trip Function	Required Settings		Comparison to IEEE Std 1547-2018 (2nd ed.) default settings and ranges of allowable settings for Category I, Category II, and Category III		
	Frequency (Hz)	Clearing Time(s)	Frequency	Clearing Time(s)	Within ranges of allowable settings?
OF2	62.0	0.16	Identical	Identical	Yes
OF1	61.2	300.0	Identical	Identical	Yes
UF1	58.5	300.0	Identical	Identical	Yes
UF2	56.5	0.16	Identical	Identical	Yes

ISO-SRD & Newly Proposed SRD Frequency Ride-Through Capability (No Changes)

Frequency Range (Hz)	Operating Mode	Minimum Time(s) (design criteria)	Comparison to IEEE Std 1547-2018 (2nd ed.) for Category II & III
f > 62.0	No ride-through requirements apply to this range		Identical
61.2 < f ≤ 61.8	Mandatory Operation	299	Identical
58.8 ≤ f ≤ 61.2	Continuous Operation	Infinite	Identical
57.0 ≤ f < 58.8	Mandatory Operation	299	Identical
f < 57.0	No ride-through requirements apply to this range		Identical

ISO-SRD & Newly Proposed SRD Grid Support Utility Interactive Inverter Functions Status

Function	ISO SRD Default Activation State	Newly Proposed SRD Default Activation State
SPF, Specified Power Factor	OFF	On @ Unity
Q(V), Volt-Var Function with Watt or Var Priority	OFF	OFF
SS, Soft-Start Ramp Rate	ON Default value: 2% of maximum current output per second	DER shall enter service in accordance with IEEE 1547-2018 Clause 4.10.3, part c.
FW, Freq-Watt Function	OFF	ON

New Additions to Newly Proposed SRD

- Addition of requirements around Non-Inverter based units
- ROCOF requirements
- Expanded return to service requirements
- Complete compliance with IEEE-1547-2018

Questions