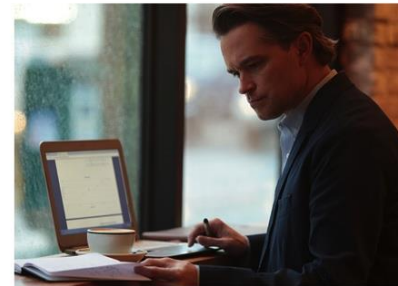


Interconnection Rulemaking Technical Conference

Docket No. 23-R312-01

March 12, 2024



Smart Inverters

- Normal & Abnormal Operation
- Recommended Settings
- Implementation

Hosting Capacity

- Application engineering review process
- Determining high penetration circuits

Virtual Power Plant (VPP)

- Soleil Lofts in Herriman
- Lessons Learned

Interoperability Standards

- IEEE 1547-2018 inclusion
- RMP future implementation

Interconnection Agreement & Application Process

- Review & Improvements



Smart Inverters – Normal Operation

Voltage & Watt/Var power control function requirements

DER category	Category A	Category B
Voltage regulation by reactive power control		
Constant power factor mode	Mandatory	Mandatory
Voltage—reactive power mode	Mandatory	Mandatory
Active power—reactive power mode	Not required	Mandatory
Constant reactive power mode	Mandatory	Mandatory
Voltage and active power control		
Voltage—active power (volt-watt) mode	Not required	Mandatory

Source - IEEE 1547-2018 Table 6

Abnormal operating performance Category I is based on essential *bulk power system* (BPS) stability/reliability needs and reasonably attainable by all DER technologies that are in common usage today.

Abnormal operating performance Category II covers all BPS stability/reliability needs and is coordinated with existing reliability standards to avoid tripping for a wider range of disturbances of concern to BPS stability.

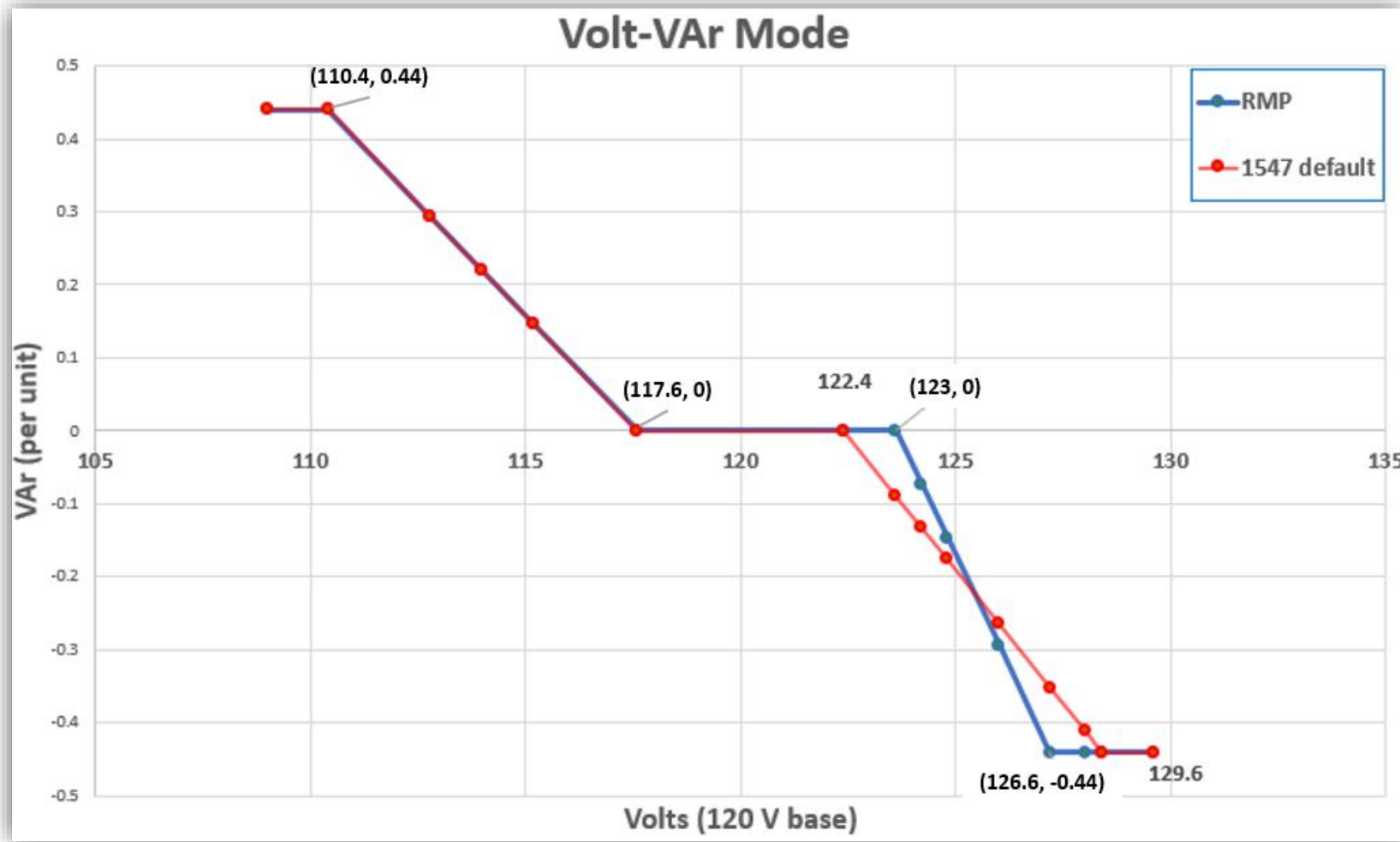
Abnormal operating performance Category III is based on both BPS stability/reliability and distribution system reliability/power quality needs and is coordinated with existing interconnection requirements for very high DER penetration.

RMP Recommended Settings

- Normal Operation: **Category B**
 - Voltage Regulation: **Volt-Var**
- Abnormal Operation: **Category III**
- A settings file will be posted to company website
- Alternative settings will be provided by RMP engineering if identified as necessary during review process

PARAMETER	VALUE
MT_FILE_INFO_TYPE	SS
MT_UTILITY_NAME	Rocky Mountain Power
MT_COUNTRY	United States of America
MT_DATE_OF_APPLICABILITY	1/18/2024
MT_NP_NORMAL_OP_CAT-APP	CAT_B
MT_NP_ABNORMAL_OP_CAT-APP	CAT_III
AP_LIMIT_ENABLE-SS	DISABLED
AP_LIMIT-SS	
ES_PERMIT_SERVICE-SS	ENABLED
ES_V_LOW-SS	0.917
ES_V_HIGH-SS	1.05
ES_F_LOW-SS	59.5
ES_F_HIGH-SS	60.1
ES_DELAY-SS	300
ES_RANDOMIZED_DELAY-SS	0
ES_RAMP_RATE-SS	300
CONST_PF_MODE_ENABLE-SS	DISABLED
CONST_PF_EXCITATION-SS	
CONST_PF-SS	
CONST_Q_MODE_ENABLE-SS	DISABLED
CONST_Q-SS	
QV_MODE_ENABLE-SS	ENABLED
QV_VREF-SS	1
QV_VREF_AUTO_MODE-SS	DISABLED
QV_VREF_TIME-SS	300
QV_CURVE_V2-SS	0.98
QV_CURVE_Q2-SS	0
QV_CURVE_V3-SS	1.025
QV_CURVE_Q3-SS	0
QV_CURVE_V1-SS	0.92
QV_CURVE_Q1-SS	0.44
QV_CURVE_V4-SS	1.055
QV_CURVE_Q4-SS	-0.44
QV_OLRT-SS	5

RMP Recommended Settings



V3 is set to 1.025 p.u. This will match what a typical substation is set to on the high end

V4 is set to 1.055 p.u. This will allow for a quicker response for high voltage situations

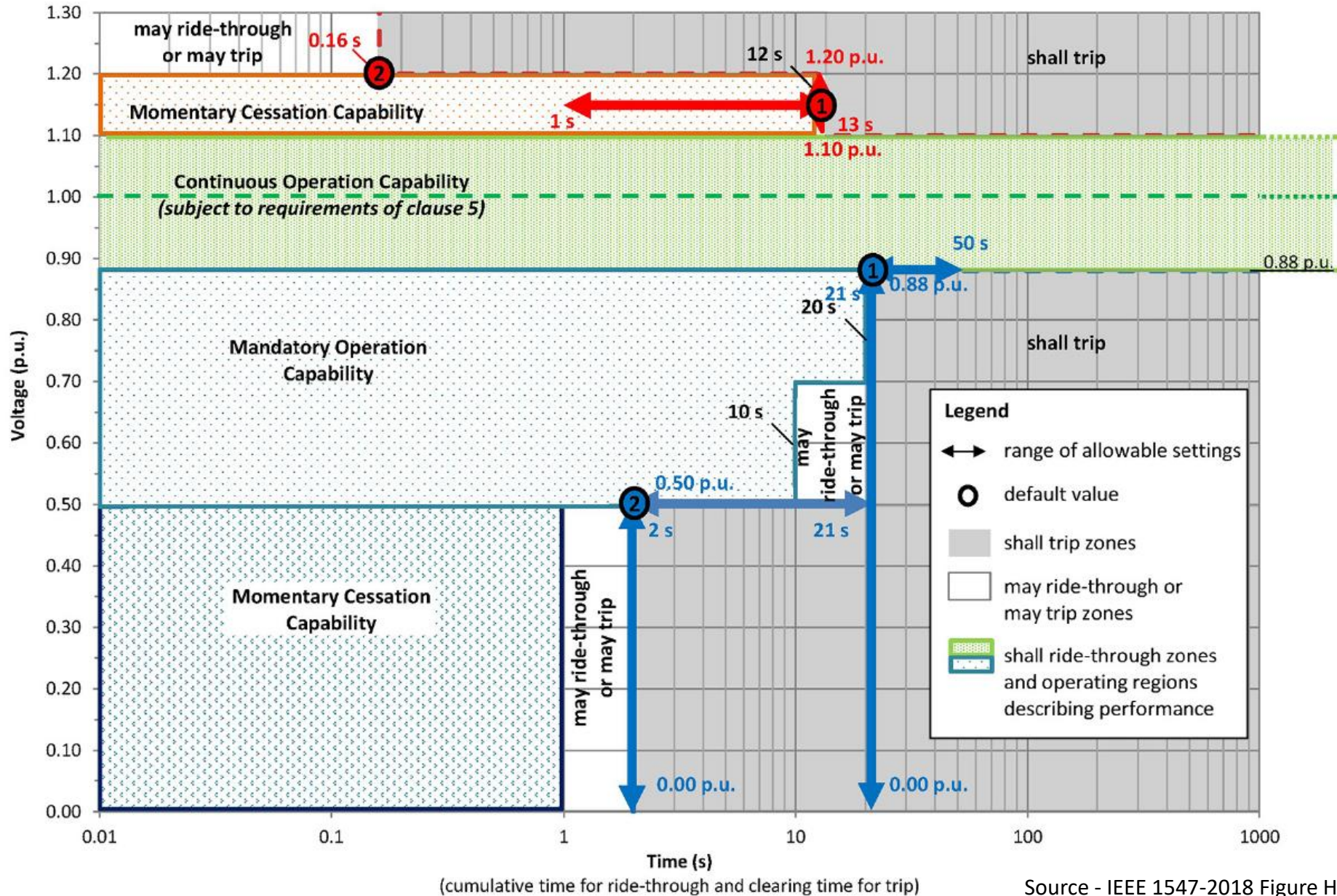
Voltage Ride-through Requirements for CAT III

Voltage range (p.u.)	Operating mode/response	Minimum ride-through time (s) (design criteria)	Maximum response time (s) (design criteria)
$V > 1.20$	Cease to Energize	N/A	0.16
$1.10 < V \leq 1.20$	Momentary Cessation	12	0.083
$0.88 \leq V \leq 1.10$	Continuous Operation	Infinite	N/A
$0.70 \leq V < 0.88$	Mandatory Operation	20	N/A
$0.50^c \leq V < 0.70$	Mandatory Operation	10	N/A
$V < 0.50^c$	Momentary Cessation ^d	1	0.083

Source - IEEE 1547-2018 Table 16

RMP Recommended Settings

Category III



Source - IEEE 1547-2018 Figure H.9

Adoption of New Standards

- IEEE 1547-2018 standard that establishes criteria and requirements for interconnection of DER (replaced IEEE 1547-2003)
- IEEE 1547.1-2020 standard that establishes conformance test procedures
- UL 1741 SB industry standard for certification that incorporates IEEE 1547.1 (2021)
- In 2023-2024, UL 1741 SB certified inverters have become more readily available for consumers



RMP Recommended Start Date

- Inverters will be required to meet IEEE 1547-2018 and UL 1741 SB beginning June 1, 2024

Determining hosting capacity during application review

- Review each application based on its order in the queue
- Identify if the DER is on a circuit with high DER penetration
- Use modeling software to determine existing DER installed on particular circuit
- Find the circuit peak and minimum daytime loading (MDL)
 - Calculate the MDL if real time data is not available
- Determine if proposed generation can be interconnected without any upgrades
 - If anti-islanding protection is needed, a level 3 system impact study will be performed

Soleil Lofts in Herriman, UT

Project Summary

- 600+ apartment units
- Each unit has its own meter with solar and battery
- RMP has control to dispatch batteries using a distributed battery grid management system (DBGMS)
- 24/7/365 availability for frequency response, peak load management, circuit congestion, etc.

Lessons Learned

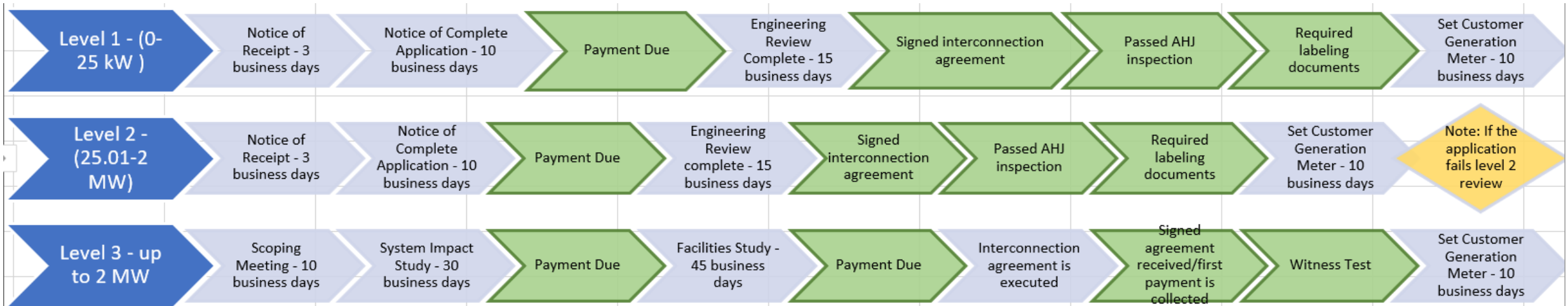
- Verified use cases for peak load management, frequency response, and emergency backup during outage
- Dependable dispatchable energy reserve
- High voltage created by high penetration solar and battery
 - Solution: Implementing reprogrammed inverters to enable active regulation using RMP recommended smart inverter settings
- AC disconnect issues with water getting in the enclosure caused several extended generation outages for the customer to fix



Interoperability Requirements

- IEEE 1547-2018 section 10 added interoperability requirements for inverters
 - A DER shall have provisions for a local DER interface capable of communicating to support the information exchange requirements specified in this standard for all applicable functions that are supported in the DER.
- Inverters certified to meet UL 1741 SB will include the ability for interoperability
- Rocky Mountain Power has not moved forward with interoperability requirements currently
 - The Company is implementing the smart inverter settings for passive control
 - Very high penetration may drive a future need for interoperability where the Volt-VAr, Volt-Watt regulation is inadequate

Interconnection Application Process



Applications (Utah)

	2021	2022	2023
Level 1	9,227	11,506	5,891
Level 2	58	57	52
Level 3	1	3	6



Additional Questions & Discussion