Brightline West High-Speed Rail Load Interconnection Request

SCE Integrated System Analysis
Transmission & Distribution
November 17, 2020

Project Background

- Brightline West plans to build and operate a new high-speed electric passenger train with service from Southern California to Las Vegas, NV
  - Train speeds up to 200 mph
  - Target to reduce the environmental impact of ~50M annual one-way trips between these areas
  - Authorized for up to $4.2B in private activity bond allocations from CA, NV, and US DOT
  - Expecting to start commercial operation in early 2024
- Phase 1 – Victorville, CA to Las Vegas, NV
  - Nominal track length of 170 miles
  - Customer submitted a request to SCE for two delivery points of service
- Brightline West has announced plans to expand to Rancho Cucamonga, CA and necessary service will be analyzed in subsequent load studies.

Source: Brightline - West Coast https://www.gobrightline.com/west-coast-expansion

Load Studies To-Date

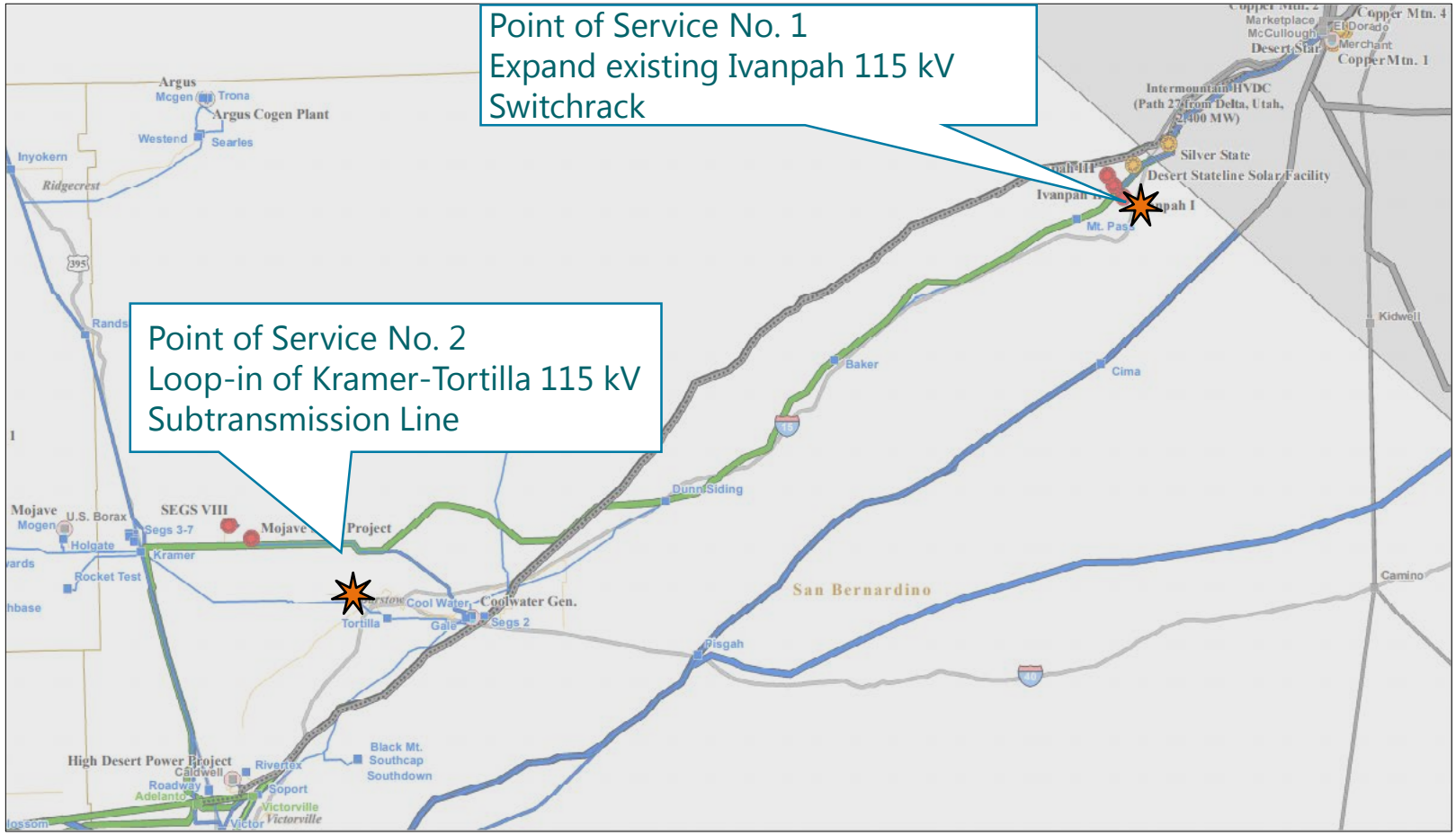
Brightline West Technical Requirements:

- SCE to provide two connections for retail electric service at each of the two delivery point locations:
  - Ivanpah Delivery Point: 56 MW total load
  - Barstow Delivery Point: 56 MW total load
- Customer to own, operate, and maintain power electronics-based converters to connect SCE system to their medium voltage overhead catenary system
- Dynamic load profile results in regeneration of power onto the SCE subtransmission system at the delivery points
  - Method of service (load study) submitted to Customer in May 2020
  - Generator interconnection study in-progress
- Customer requested in-service date in early 2023 to begin commercial operation in early 2024

Study Scope:

- Preliminary scope and cost estimation for interconnection and network upgrades
  - Interconnection Facility
  - Network Upgrade for Interconnection
- Mitigation plans to tackle adverse system impacts
- Customer and SCE signed Letter Agreement in May 2020 for engineering and design

Proposed Customer Electric Delivery Points



Source: California Energy Commission (CEC) Map of Southern California Electric Generation and Transmission Infrastructure. Data is from the California Energy Infrastructure Database (CEIDB)

Point of Service 1 – Ivanpah Delivery Point (IDP)

Project Scope – Interconnection (In-Service Date Q1 2023)

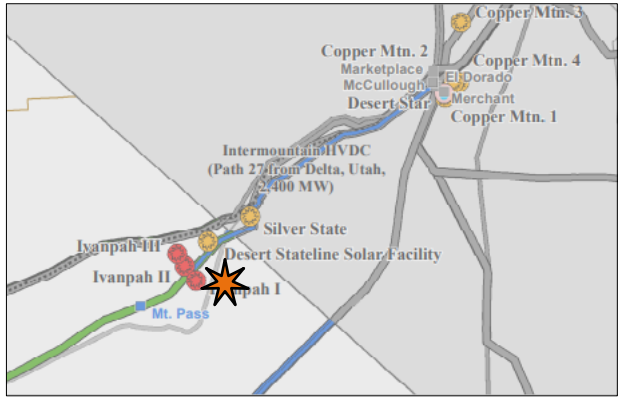
- Construct a new 115 kV four breaker ring bus substation
- Equip two new double-bus double-breaker (DBDB) positions at the existing SCE Ivanpah 115 kV Substation
- Construct two diversely routed 3 mile 115 kV subtransmission lines from Ivanpah Substation to the new ring bus substation

System Impact Study:

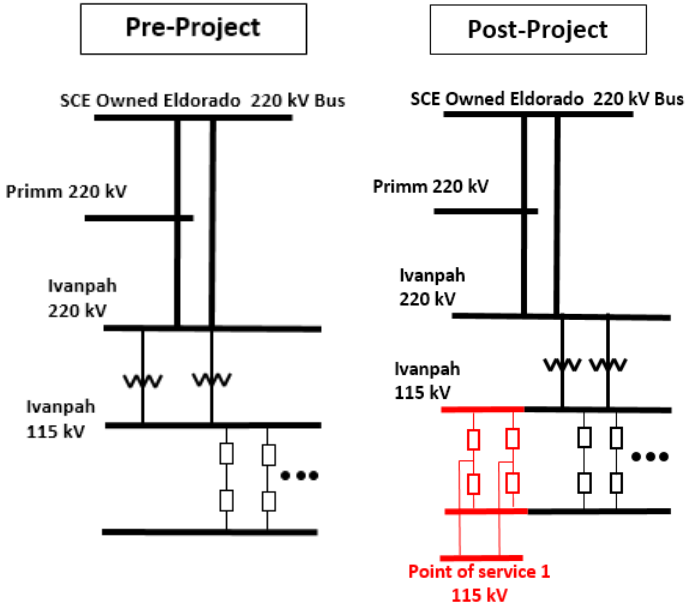
- No thermal or voltage issues identified
- Requires modifications to existing remedial action schemes

Cost Estimate (in $Million):

- Interconnection Facilities: $20
- Network Upgrades (Interconnection): $4*
- Network Upgrades (Mitigation): $0



Location	Study Load	2023-Q2 2024	Q3 2024-2032
IDP	56 MW	28 MW	56 MW



* The only CAISO-controlled portions of this delivery point scope are the Ivanpah 115 kV bus extension and circuit breakers

Point of Service 2 – Barstow Delivery Point (BDP)

Project Scope – Interconnection (In-Service Date Q1 2023)

- Construct a breaker-and-a-half (BAAH) 115 kV switching station with seven circuit breakers
- Loop in the existing Kramer-Tortilla 115 kV Subtransmission Line

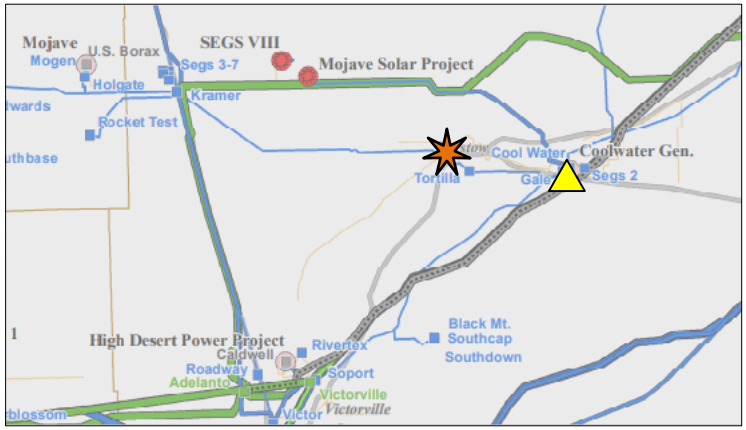
System Impact Study:

- No thermal issues identified
- Violation of applicable reliability standards and planning criteria:
  - Post Contingency Steady State Voltage Deviation
    - N-1 of Kramer-BDP 115 kV
    - N-1 of Kramer-Cool Water 115 kV
  - Post Contingency Steady State Voltage
    - N-1 of Kramer-BDP 115 kV
    - N-1 of Kramer-Cool Water 115 kV

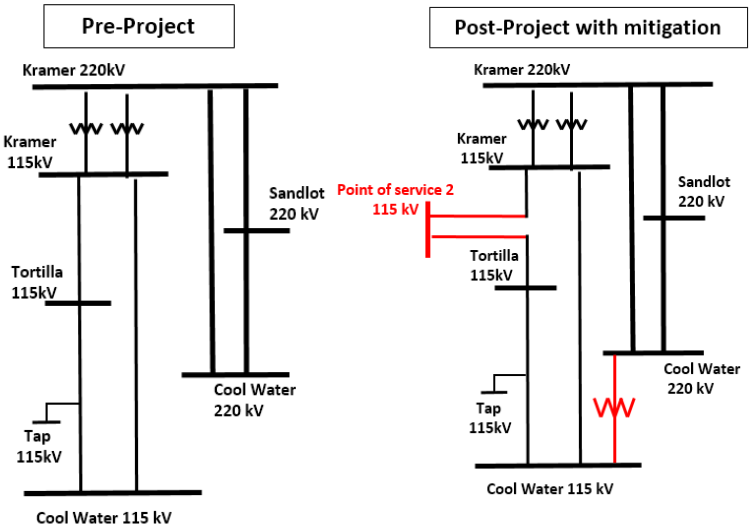
Cost Estimate (in $Million):

- Interconnection Facilities: $2
- Network Upgrades (Interconnection): $10*
- Network Upgrades (Mitigation): $47

* The entire proposed BAAH loop-in substation at Barstow will be CAISO-controlled, which results in a higher portion of this cost as a network upgrade



Location	Study Load	2023-Q2 2024	Q3 2024-2032
BDP	56 MW	28 MW	56 MW



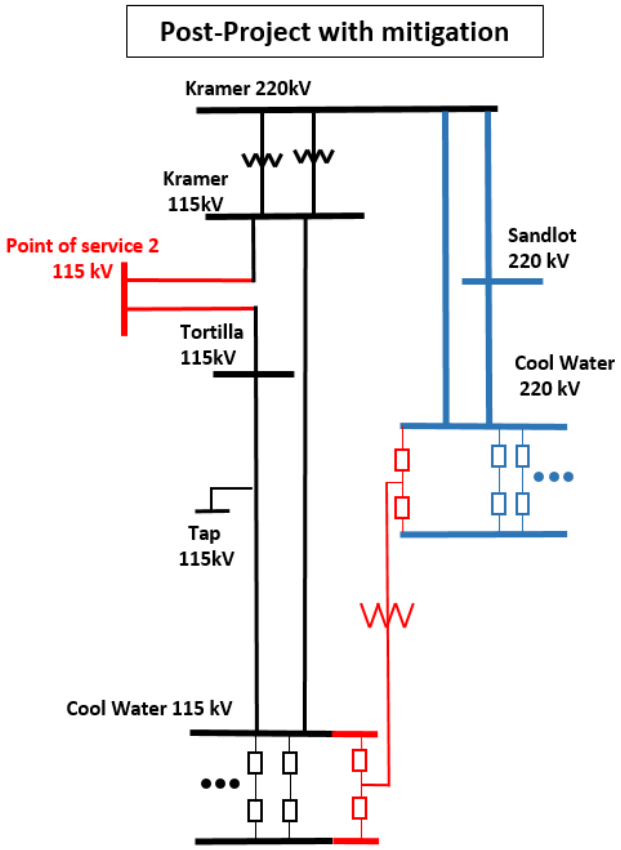
Point of Service 2 – BDP Mitigation (1/2)

Project Construction Scope – Mitigation (In-Service Date Q2 2024)

- Construct a 220/115 kV transformer bank to connect the existing Cool Water 220 kV and Cool Water 115 kV Switchracks
  - Install one (1) DBDB 220 kV Position, one (1) DBDB 115 kV Position and one (1) new 220/115 kV transformer
  - Install tie line from existing 220 kV to substation expansion and a new 115 kV tie line to the substation expansion

Reliability and Area Assessment

- Reinforces Kramer 115 kV area to avoid N-1 voltage violations
- Reclassifies existing 220 kV radial facilities to network ISO control
  - Sandlot 220 kV Substation
  - Kramer – Cool Water 220 kV line
  - Kramer – Sandlot and Cool Water – Sandlot 220 kV lines
  - Reclassification would add a depreciated portion of the facilities above to FERC rate base
- Other system benefits:
  - Improves reliability and operational flexibility in the Kramer Subtransmission System
  - Strengthens the system under N-0 and N-1 conditions
  - Expands CAISO network footprint to accommodate additional future load, generation and energy storage projects



Red – New Construction
Blue - Existing radial facilities reclassified as network

Point of Service 2 – BDP Mitigation (2/2)

Preferred Mitigation	Considerations
Construct a 220/115 kV transformer bank to connect the existing Cool Water 220 kV and Cool Water 115 kV Switchracks	• Improves system reliability and operational flexibility • Low technical risk and environmental impact due to use of standard substation equipment and existing SCE land • Beneficial in addressing existing and future reliability concerns independent of the train

Alternative Mitigations	Considerations
1. Loop-in existing Kramer-Cool Water 220 kV transmission line	• Increases substation loop-in costs • Timing conflicts with the customer requested in-service date • Highest environmental impact
2. New Kramer-BDP No.2 115 kV subtransmission line	• Provides a reduced benefit to the Kramer 115 kV system as compared to the 220/115 kV transformer bank • Timing conflicts with the customer requested in-service date • Highest environmental impact
3. Dynamic voltage support device	• Does not provide the benefit of an additional source to the Kramer 115 kV system • Anticipate higher lifetime O&M and capital replacement costs due to active control systems • Highest technical risk and less scalable for future needs

Summary

Location	Interconnection Facilities – Cost ($M)	Network Upgrades (Interconnection) - Scope & Cost ($M)		Network Upgrades (Mitigation) – Cost ($M)
Delivery Point 1: Ivanpah	$20	• Extend 115 kV bus at Ivanpah Substation • Equip two (2) 115kV Positions with 2 circuit breakers	$4	$0
Delivery Point 2: Barstow	$2	• One (1) new BAAH 115kV Substation • Subtransmission to loop existing line into the new substation	$10	$47
Total ($M)	$22	$14		$47
	$83			

Assumptions

- Scope and costs provided are conceptual and derived from the 2020 SCE CAISO Unit Cost Guide.
- Estimates do not provide allocation of standard and added facilities. Customer will be responsible for appropriate facilities charges in accordance with SCE Rule 2 and other applicable tariffs.
- Mitigation costs include an estimated depreciated portion of the interconnection facilities at Sandlot 220 kV Substation and radial Kramer – Cool Water, Cool Water – Sandlot, and Sandlot – Kramer 220 kV lines.
- Multiple maintenance, reliability and generator interconnection projects currently exist in the Cool Water area and as such, opportunities to optimize design and bundle for construction and capital efficiency may exist.