

Table 1

Transmission Upgrades Included in the 2019 WECC “Heavy Summer” Seed Case

Transmission Upgrades with Key Regulatory Approvals and Environmental Permits	Transmission Upgrades without Key Regulatory Approvals and Environmental Permits
Tehachapi Segments 1-3 Sunrise Powerlink project	Tehachapi Segments 4-11 New Colorado River (“Midpoint”) 500 kV substation looping in existing 500 kV Palo Verde-Devers #1 line. 500 kV Colorado River-Devers #2 line 500 kV Devers-Valley #2 line
	500 kV Green Path North project
	Build new Barren Ridge 230 kV substation looping in existing 230 kV Owens Gorge-Rinaldi line
	Upgrade existing 230 kV Owens Gorge-Rinaldi line from Barren Ridge to Haskell Canyon with double circuit 230 kV towers
	Add Barren Ridge-Haskell Canyon #2 line on open side of towers
	Upgrade existing 230 kV Owens Gorge-Rinaldi line from Haskell Canyon to Rinaldi
	Add 230 kV Castaic-Haskell Canyon #2 line on open side of towers
	Reconductor Ramon-Devers and Coachella Valley-Devers

Table 2

Grid Configuration Changes Made to Connect CREZ to the Network for Cases A1 and B1

CREZ/Renewable Development Area		Grid Configuration Change
Location	CTPG-Identified Renewable Resource Additions: Installed Capacity (MW)	
Washington	963	Connect renewables to existing McNary 500 kV bus
Montana	103.5	Connect renewables to existing South Cutbank 115 kV bus
	309	Connect renewables to existing Great Falls 230 kV bus
Idaho	130	Connect renewables to existing Goshen 345 kV bus
Oregon	573.6	Connect renewables to existing Malin 500 kV bus
	1063	Connect renewables to existing Grizzly 500 kV bus
Round Mountain-B	78	Connect renewables to existing Round Mountain 500 kV bus
Round Mountain-A	0	N/A
Lassen South	0	N/A
Lassen North	873	Build new Raven 500 kV substation Build 500 kV Raven-Round Mountain #1 line Connect renewables to new Raven 500 kV substation
Humboldt	11	Connect renewables to existing Humboldt 115 kV bus
Solano	408	Build new Solano 500 kV substation Build 500 kV Solano-Vaca Dixon #1 line Connect renewables to new Solano 500 kV bus
Cuyama	0	N/A
Carrizo North	0	N/A
Carrizo South	1545	Build new 230 kV Carrizo substation looping in existing 230 kV Morro Bay-Midway #1 and #2 lines Reconductor 230 kV Morro Bay-Midway #1 and #2 lines Reconductor 230 kV Morro Bay-Gates #1 line Connect renewables to new Carrizo 230 kV bus
Nevada N	0	N/A

Nevada C	120	Remove existing 115 kV Control-Inyokern #1 and #2 lines Build 230 kV Control-Inyokern #1 line Connect renewables to existing Control 230 kV bus via new radial 230 kV line
	69.2	Connect renewables to existing Dixie Valley 230 kV bus ("Oxbow A")
	50	Connect renewables to existing Oxbow 230 kV bus ("Oxbow B") with radial 230 kV line
Nevada S	217	Connect renewables to existing Marketplace 500 kV bus
Owens Valley	0	N/A
Inyokern	242	Remove existing 115 kV Inyokern-Kramer #1 and #2 lines Add 230 kV capability at existing Inyokern substation Add 230 kV Inyokern-Kramer #1 and #2 lines on double-circuit towers Connect renewables to new Inyokern 230 kV bus
Kramer	343.7	Expand Kramer substation by adding 500 kV capability Connect renewables to existing Kramer 230 kV bus
Mountain Pass	358	Build new Mountain Pass 500 kV substation Build 500 kV Mountain Pass-El Dorado #1 line Build 500 kV Mountain Pass-Baker #1 line Connect renewables to new Mountain Pass 500 kV bus
	410	Build new Mountain Pass2 287 kV substation looping in existing 287 kV Mead-Victorville #1 line Connect renewables to new Mountain Pass2 287 kV substation
San Bernardino - Baker	825	Build new 500 kV Baker substation Build 500 kV Baker-Barstow #1 line Connect renewables to new Baker 500 kV bus
Barstow	850	Build new Barstow 500 kV substation Build 500 kV Barstow-Lugo #1 line Connect renewables to new Barstow 500 kV bus
Pisgah	3248	Build new Pisgah 500 kV substation looping in existing 500 kV Lugo-El Dorado #1 line Build 500 kV Pisgah-Barstow #1 line Connect renewables to new Pisgah 500 kV bus
Victorville	0	N/A
San Bernardino - Lucerne	174	Build new Lucerne 500 kV substation Build 500 kV Lucerne-Lugo #1 line Connect renewables to new Lucerne 500 kV bus
Twentynine Palms	0	N/A
Tehachapi	3250.8	Connect renewables to existing Barren Ridge 230 kV bus
	617.5	Connect renewables to new Windhub 230 kV bus added as part of Tehachapi Segments 4-11
Fairmont	345	Build new Fairmont 500 kV substation looping in existing 500 kV Adelanto-Rinaldi and 500 kV Victorville-Rinaldi lines Connect renewables to new Fairmont 500 kV bus
Arizona	333	Connect renewables to existing Westwing 500 kV bus
Riverside East	1562	Connect renewables to new Colorado River 500 kV bus
Needles	0	N/A
Iron Mountain	0	N/A
Palm Springs	146.6	Connect renewables to existing Devers 230 kV bus
Imperial North-A	352	Build new SS6 230 kV substation Build new 230 kV SS6-Midway #1 and #2 lines on double circuit towers Connect renewables to new SS6 230 kV bus
Imperial North-B	386	Connect renewables to existing Midway 230 kV bus
Imperial South	16.5	Connect renewables to existing Rockwood 92 kV bus
	100	Connect renewables to existing Dixieland 230 kV bus
	349.4	Connect renewables to existing Imperial Valley 230 kV bus
Imperial East	15	Connect renewables to existing Pilot Knob 92 kV bus
Baja-A (La Rumorosa)	0	N/A
Baja-B (Santa Catarina)	0	N/A
San Diego South	0	N/A
San Diego	23	Build new Bullmoose 13.8 kV substation connected radially to existing Border 69kV bus Connect renewables to new Bullmoose 13.8 kV bus
San Diego North Central	0	N/A
Santa Barbara	92	Connect renewables to PG&E's existing Mesa 230 kV bus
TOTAL	20552.8	

Table 3

Grid Configuration Changes Made to Connect CREZ to the Network for Case C1

CREZ/Renewable Development Area		
Location	CTPG-Identified Renewable Resource Additions: Installed Capacity (MW)	Grid Configuration Change
Washington	963	Connect renewables to existing McNary 500 kV bus
Montana	103.5	Connect renewables to existing South Cutbank 115 kV bus
	309	Connect renewables to existing Great Falls 230 kV bus
Idaho	130	Connect renewables to existing Goshen 345 kV bus
Oregon	573.6	Connect renewables to existing Malin 500 kV bus
	1063	Connect renewables to existing Grizzly 500 kV bus
Round Mountain-B	78	Connect renewables to existing Round Mountain 500 kV bus
Round Mountain-A	0	N/A
Lassen South	0	N/A
Lassen North	873	Add new Raven 500 kV substation Build 500 kV Raven-Round Mountain #1 line Connect renewables to new Raven 500 kV substation
Humboldt	11	Connect renewables to existing Humboldt 115 kV bus
Solano	408	Build new Solano 500 kV substation Build 500 kV Solano-Vaca Dixon #1 line Connect renewables to existing Vaca Dixon 500 kV bus via new radial 500 kV line
Cuyama	0	N/A
Carrizo North	0	N/A
Carrizo South	1545	Build new 230 kV Carrizo substation looping in existing 230 kV Morro Bay-Midway #1 and #2 lines Reconductor existing 230 kV Morro Bay-Midway #1 and #2 lines Connect renewables to new Carrizo 230 kV bus
Nevada N	0	N/A
Nevada C	120	Remove existing 115 kV Control-Inyokern #1 and #2 lines Build 230 kV Control-Inyokern #1 line Connect renewables to existing Control 230 kV bus via new radial 230 kV line
	69.2	Connect renewables to existing Dixie Valley 230 kV bus ("Oxbow A")
	50	Connect renewables to existing Oxbow 230 kV bus ("Oxbow B") with radial 230 kV line
Nevada S	217	Connect renewables to existing Marketplace 500 kV bus
Owens Valley	0	N/A
Inyokern	242	Remove existing 115 kV Inyokern-Kramer #1 and #2 lines Add 230 kV capability at existing Inyokern substation Add 230 kV Inyokern-Kramer #1 and #2 lines on double-circuit towers Connect renewables to new Inyokern 230 kV bus
Kramer	343.7	Connect renewables to existing Kramer 230 kV bus
Mountain Pass	768	Build new Mountain Pass 500 kV substation looping in existing 500 kV Marketplace-Adelanto line Connect renewables to new Mountain Pass 500 kV bus
San Bernardino - Baker	825	Build new Baker 500 kV substation looping in existing 500 kV Marketplace-Adelanto line Connect renewables to new Baker 500 kV bus
Barstow	850	Build new Barstow 500 kV substation looping in existing 500 kV Marketplace-Adelanto line Connect renewables to new Barstow 500 kV bus
Pisgah	3248	Build new Pisgah 500 kV substation looping in existing 500 kV El Dorado-Lugo #1 line and existing 500 kV Mohave-Lugo #1 line Connect renewables to new Pisgah 500 kV bus
Victorville	0	N/A

San Bernardino - Lucerne	174	Build new Lucerne 500 kV substation Build 500 kV Lucerne-Lugo #1 line Connect renewables to new Lucerne 500 kV bus
Twentynine Palms	0	N/A
Tehachapi	3250.8	Connect renewables to new Barren Ridge 230 kV bus
	617.5	Connect renewables to new Windhub 230 kV bus added as part of Tehachapi Segments 4-11
Fairmont	345	Build new Fairmont 500 kV substation looping in existing 500 kV Adelanto-Rinaldi and 500 kV Victorville-Rinaldi lines Connect renewables to new Fairmont 500 kV bus
Arizona	333	Connect renewables to existing Westwing 500 kV bus
Riverside East	1562	Connect renewables to new Colorado River 500 kV bus
Needles	0	N/A
Iron Mountain	0	N/A
Palm Springs	146.6	Connect renewables to existing Devers 230 kV bus
Imperial North-A	352	Build new SS6 230 kV substation Build new 230 kV SS6-Midway #1 and #2 lines on double circuit towers Connect renewables to new SS6 230 kV bus
Imperial North-B	386	Connect renewables to existing Midway 230 kV bus
Imperial South	16.5	Connect renewables to existing Rockwood 92 kV bus
	100	Connect renewables to existing Dixieland 230 kV bus
	349.4	Connect renewables to existing Imperial Valley 230 kV bus
Imperial East	15	Connect renewables to existing Pilot Knob 92 kV bus
Baja-A (La Rumorosa)	0	N/A
Baja-B (Santa Catarina)	0	N/A
San Diego South	0	N/A
San Diego	23	Build new Bullmoose 13.8 kV substation connected radially to existing Border 69kV bus Connect renewables to new Bullmoose 13.8 kV bus
San Diego North Central	0	N/A
Santa Barbara	92	Connect renewables to PG&E's existing Mesa 230 kV bus
TOTAL	20552.8	