

BUILDING A WORLD OF DIFFERENCE®



BLACK & VEATCH



RETI Phase 2 Update Workgroup

Black & Veatch: Ryan Pletka

January 7, 2010

Agenda

- Review of Progress and Recent Decisions
- Presentation of Results
 - Updated CA CREZ Capacity
 - Impact of California Desert Protection Act
 - Updated Out of State Resources Capacity
 - Updated economics – next week



Review of Progress and Recent Decisions

RETI Phase 2 Update Workgroup Issues

- Economic Model Update 

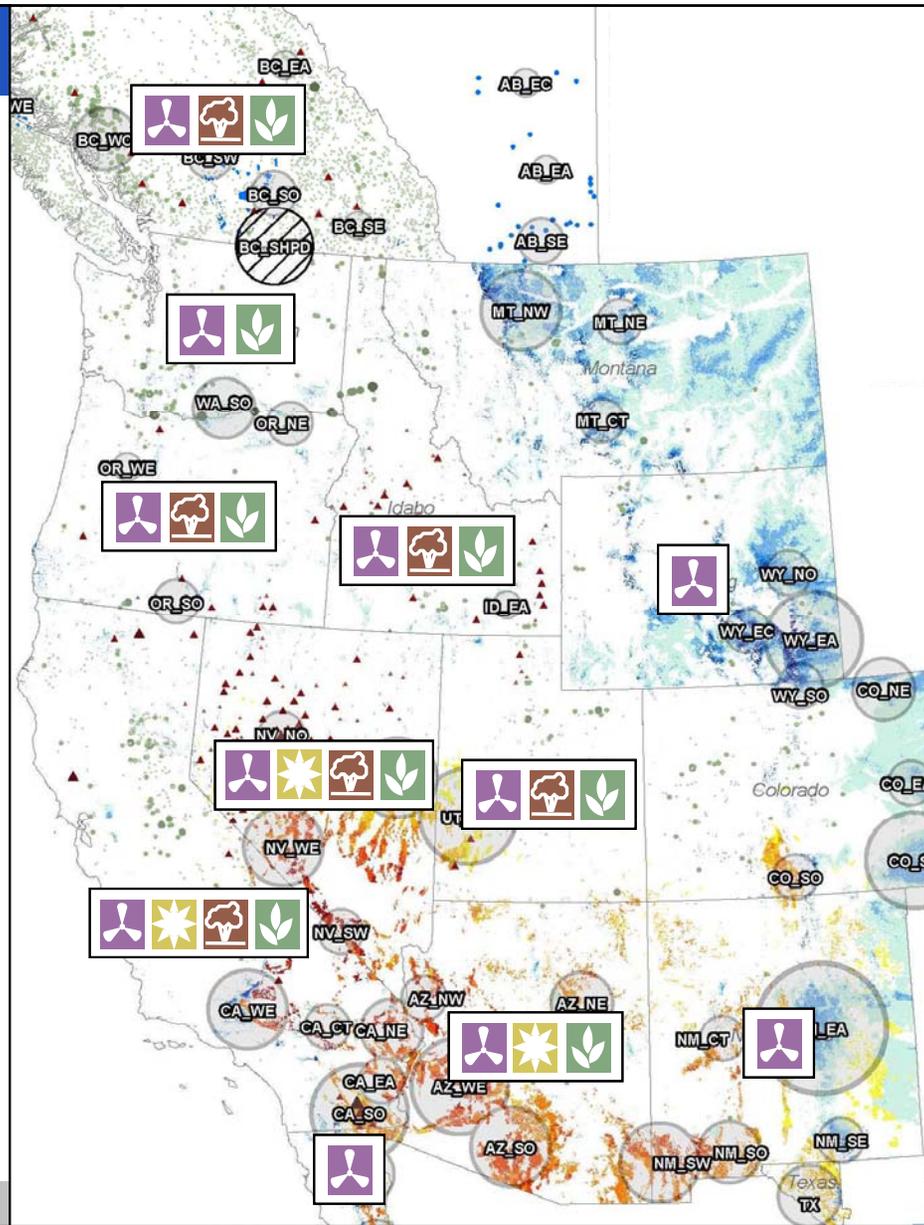
- Extended Analysis of Out-of-State Resources
 - Screening 
 - Transmission Approach 

- CREZ and Technology Updates
 - CREZ Updates 
 - Technology Assumptions 

- Net Short Update 

- RPS Implementation Timelines 

Resources to be Considered in RETI Phase 2A Update

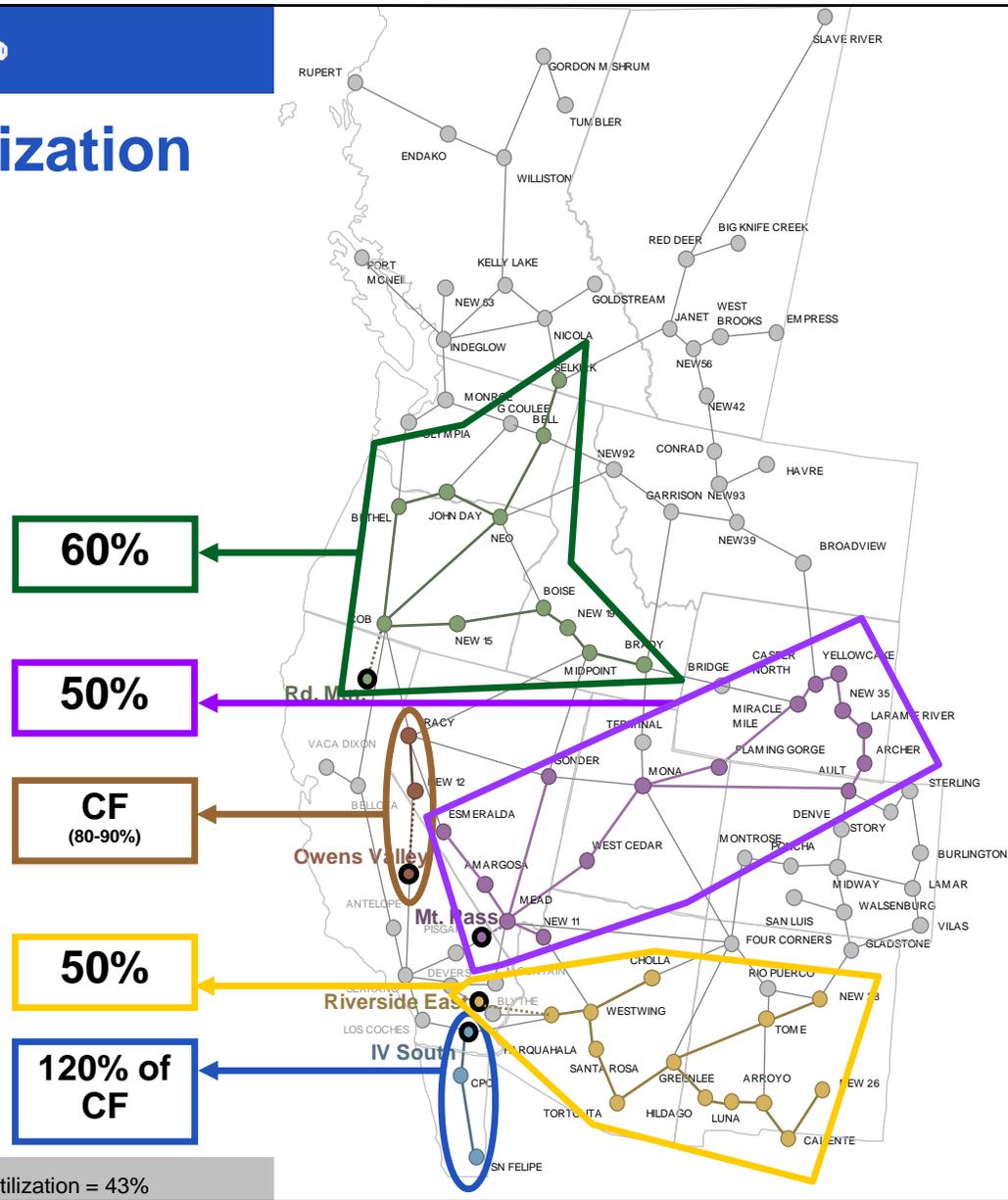


Transmission Cost Approach

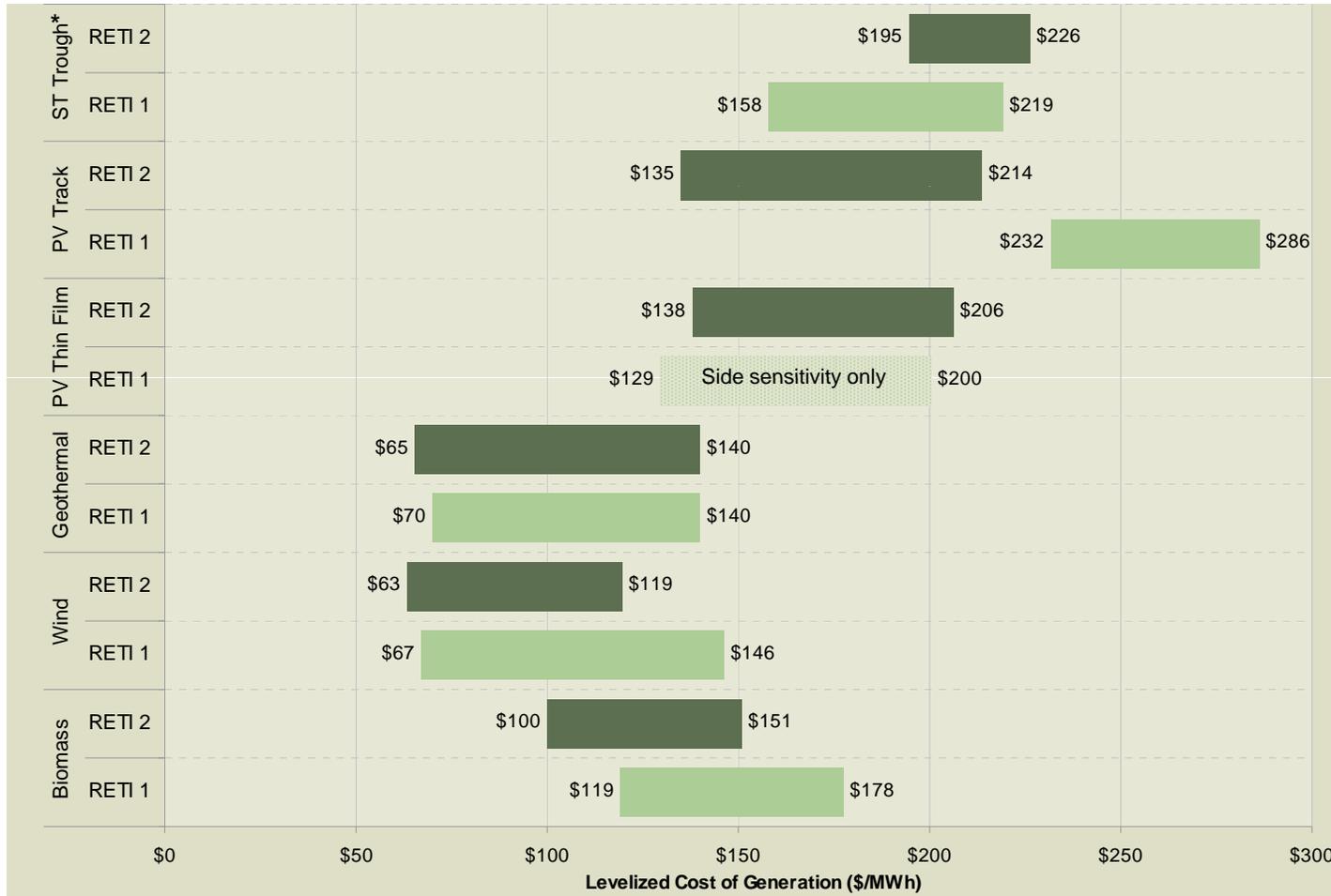
- Out-of-state resources
 - 500 kV single-circuit ac transmission, 1500 MW capacity, \$1.8 million/mile, federally financed, delivered to “gateway CREZs” (e.g., Mountain Pass)
 - From WREZ Transmission Characteristics Working Group
 - Line utilization on following page
- In-state transmission costs:
 - Include all costs for 2A Collector Lines; allocation based on 2A shift factors
 - Include 50% of the 2A Foundation and Delivery Line costs; allocation based on 2A shift factors
 - Use 2A costs, annualized with 10% fixed charge rate

Transmission Utilization

- **Pacific Northwest** has lots of existing transfer, blend of resources (including hydro, biomass, geothermal, wind) → use 60%
- **N. Nevada** is largely geothermal → use resource CF (80-90%)
- **WY/UT/S. NV** – additional study has shown overbuild is economic, use 50%
- **AZ/NM** – Mixed wind and solar; additional study has shown overbuild is economic, use 50%
- **Baja** is all wind → use + 120% of resource CF to account for overbuild and dynamic line ratings*



Typical Cost of Generation Ranges: Current RETI Phase 2 Black & Veatch Proposal





California CREZ Updates

Capacity (MW) Estimates from Phase 2A

CREZ	Phase 1B to Phase 2A		
	Phase 1B	Phase 2A	Change
Barstow	2,136	2,336	200
Carrizo North	1,600	1,600	0
Carrizo South	3,000	3,877	877
Cuyama	400	800	400
Fairmont	6,918	3,518	-3,400
Imperial East	1,723	1,623	-100
Imperial North-A	1,370	1,370	0
Imperial North-B	1,830	1,830	0
Imperial South	3,745	3,715	-30
Inyokern	2,887	2,432	-455
Iron Mountain	5,662	4,912	-750
Kramer	6,627	6,412	-215
Lassen North-A	821	1,467	646
Lassen North-B	2,001	0	-2,001
Lassen South-A	410	410	0
Lassen South-B	1,200	0	-1,200
Mountain Pass	2,878	1,658	-1,220
Needles	1,061	461	-600
Owens Valley	1,400	1,400	0
Palm Springs	770	770	0
Pisgah-A	1,800	2,550	750
Pisgah-B	3,790	0	-3,790
Riverside East-A	1,000	10,550	9,550
Riverside East-B	6,800	0	-6,800
Round Mountain-A	240	384	144
Round Mountain-B	187	187	0
San Bernardino - Baker	1,200	3,670	2,470
San Bernardino - Lucerne	4,290	3,030	-1,260
San Diego North Central	281	281	0
San Diego South	678	678	0
Santa Barbara	433	433	0
Solano	894	894	0
Tehachapi	9,642	10,837	1,195
Twentynine Palms	800	1,805	1,005
Victorville-A	800	1,636	836
Victorville-B	895	0	-895
Victorville-C	340	0	-340
Westlands	0	0	0
Total	82,509	77,526	-4,983

In-State California CREZ Updates from Phase 2A

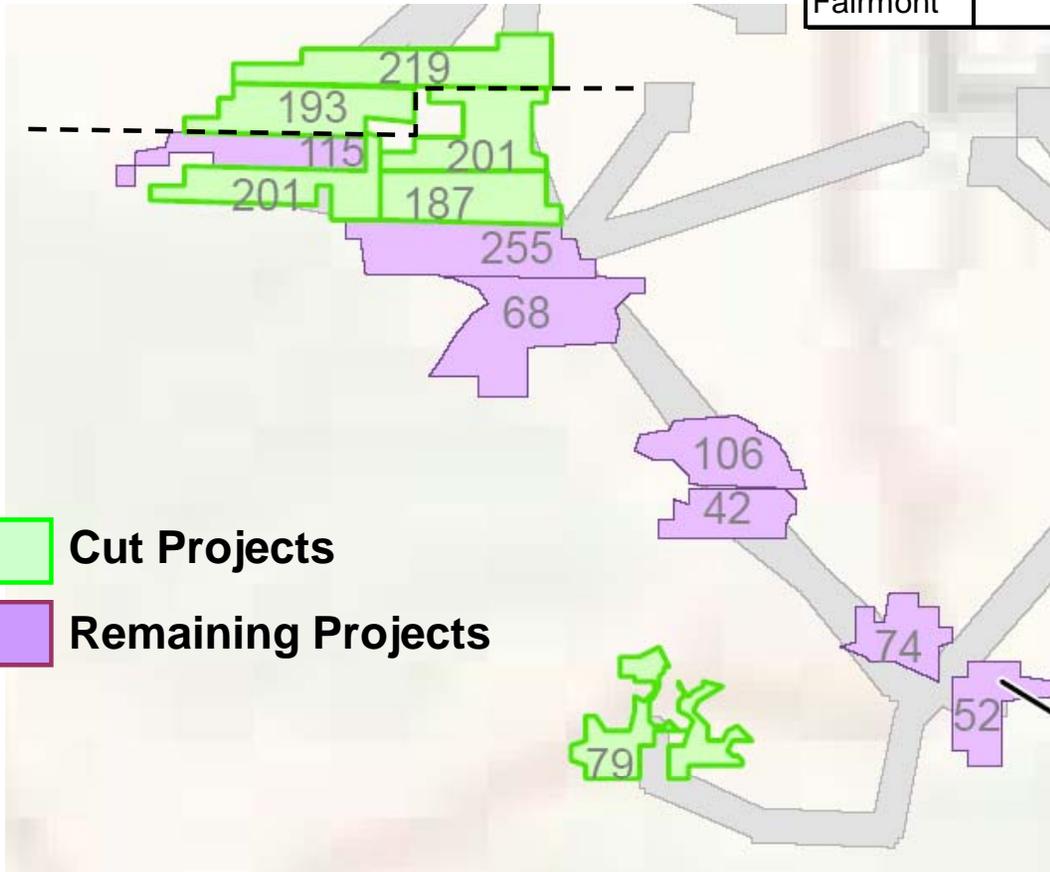
- Fairmont / Tehachapi
- Palm Springs
- Owens Valley
- Westlands Water District

Description of California CREZ Updates

- **CUT Fairmont Wind:** While Fairmont has strong technical potential for wind development, there is a lack of commercial interest in developing projects in the area. In order to align Black & Veatch and commercial interest for the area, Black & Veatch reassessed the CREZ. The reassessment focused on proximity of projects to the Antelope Valley Poppy Reserve, residential encroachment and land ownership parcelization. As a result of the reassessment, Black & Veatch decided to cut four projects, representing 668 MW. These projects are largely adjacent to the Poppy Reserve, but also include one project further south that would be difficult to develop due to parcelization and residential encroachment. In addition to the project cuts, associated gen-ties were removed and the CREZ boundaries reshaped.
- **CUT Tehachapi Wind:** Two projects in the Tehachapi CREZ were very near the Antelope Valley Poppy Reserve and were cut for many the same reasons as the projects in the Fairmont CREZ. These two projects represented 412 MW of wind capacity. In addition to the project cuts, associated gen-ties were removed and the CREZ boundaries reshaped.
- **CUT Palm Springs Wind:** The Palm Springs CREZ includes a large amount of existing wind capacity, but over 700 MW of additional capacity was identified in RETI Phase 1. The wind industry has suggested that only 200-300 MW of additional wind are likely to be developed on the remaining land due to urban encroachment and significant siting constraints. These factors were considered in RETI Phase 1. Four projects were cut from the Palm Springs CREZ as a result of further review. The projects were cut due to county setback requirements from two highways in the area, and agreements with two organizations in the area for a moratorium on wind development. As a result, the CREZ was cut from 769 MW to 332 MW. In addition to the project cuts, associated gen-ties were removed and the CREZ boundaries reshaped.
- **ADD new Westlands Solar CREZ:** A new solar CREZ has been identified on the Westlands Water District property in the Central Valley. This CREZ is in a moderate solar area, but more importantly it consists of disturbed agricultural land and is adjacent to existing transmission. This CREZ will be up to 5000 MW.
- **ADD to Owens Valley Solar CREZ:** Inyo County has requested consideration of additional lands for renewable energy development based on recently expressed commercial interest in the area. Black & Veatch had originally screened many solar sites in Inyo County due to lack of commercial interest and relatively poor economics compared to solar CREZ further south. Black & Veatch has added project some sites back to the analysis that were previously cut. The most economic projects adjacent to the existing CREZ (and existing transmission) were added. The additions increase the size of the Owens Valley CREZ from 1400 MW to 5000 MW. These new project sites are primarily located on or near Owens Dry Lake. Due to water diversions started decades ago, LADWP dried up the lake and is now responsible for extensive dust mitigation activities on the lake. LADWP has announced a 50 MW solar pilot project at the lake to test the ability of solar to control dust emissions.

Fairmont / Tehachapi Wind

	Phase 2A	Current	Net Change
Tehachapi	10,837	10,425	-412
Fairmont	3,518	2,850	-668

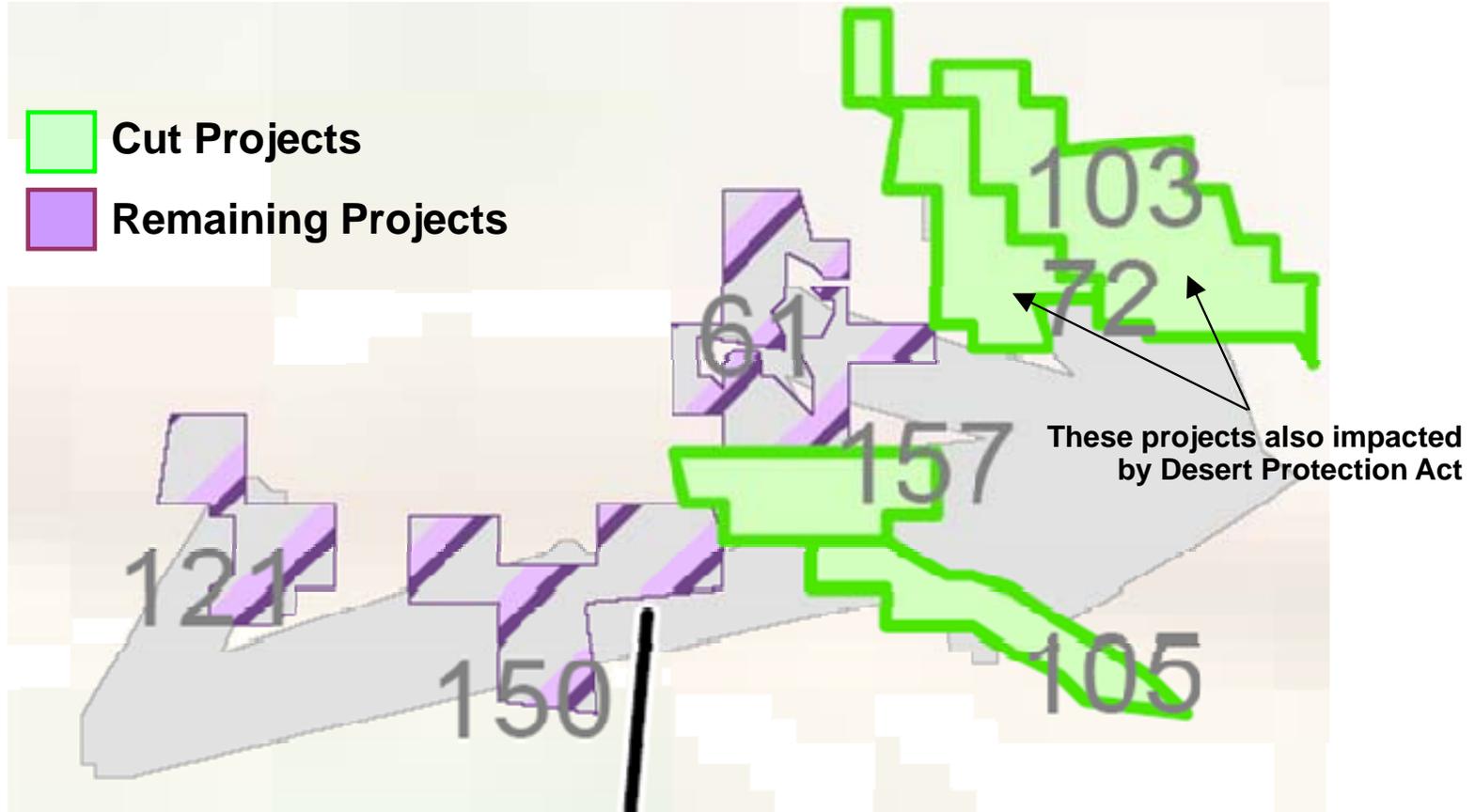


- Cut Projects**
- Remaining Projects**

Palm Springs Wind

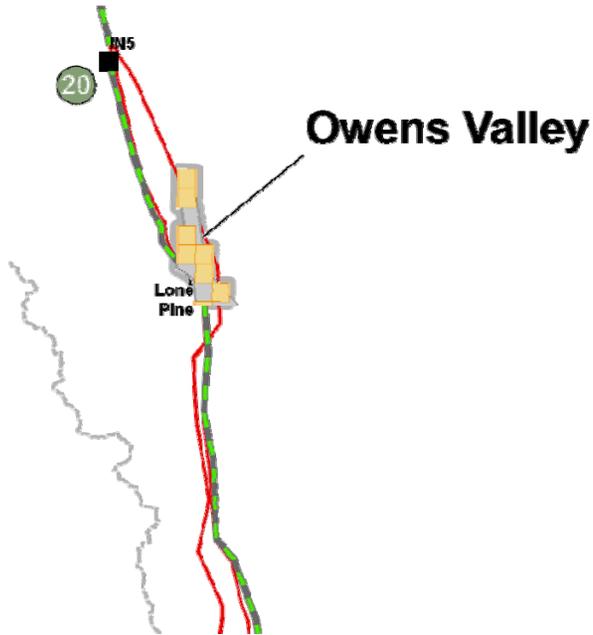
	Phase 2A	Current	Net Change
Palm Springs	770	333	-437

- Cut Projects
- Remaining Projects

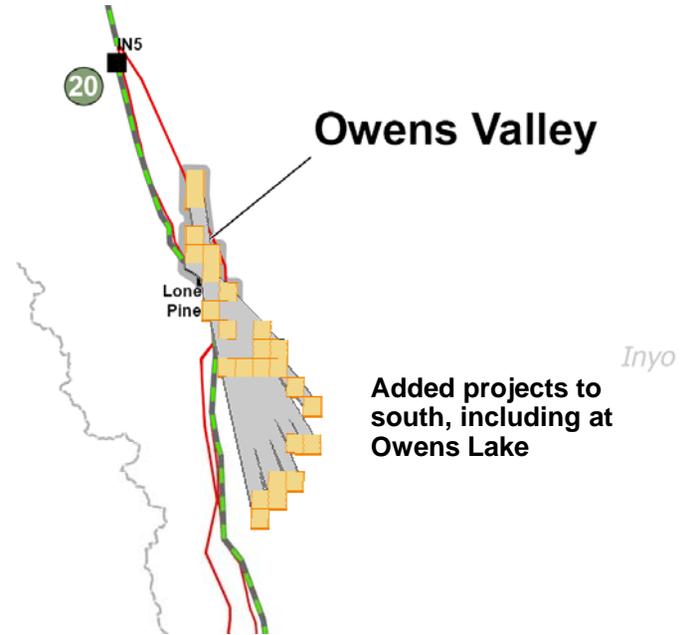


Owens Valley

	Phase 2A	Current	Net Change
Owens Valley	1400	5,000	3,600



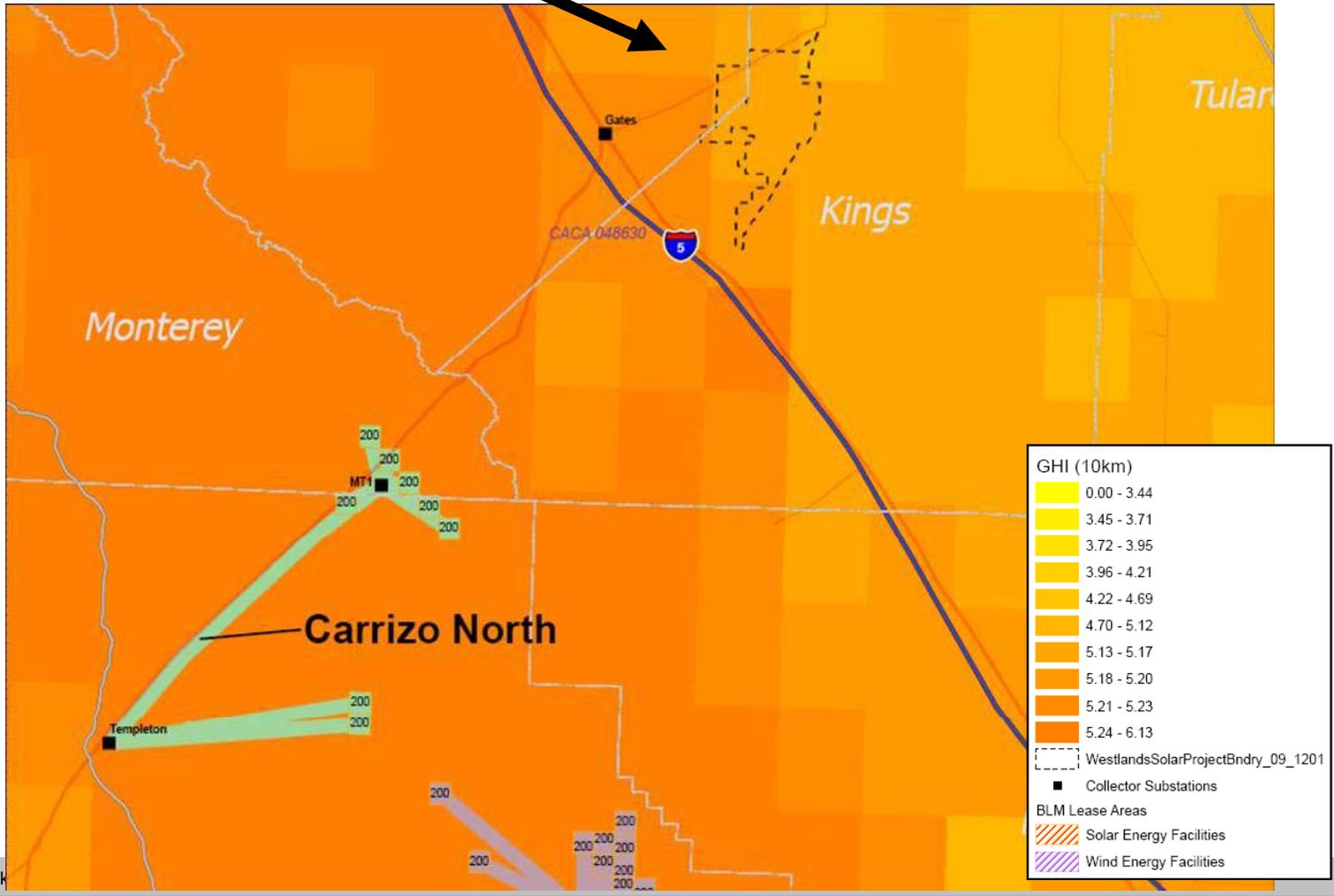
Phase 2A



Current

Westlands Water District

	Phase 2A	Current	Net Change
Westlands	0	5,000	5,000



Black

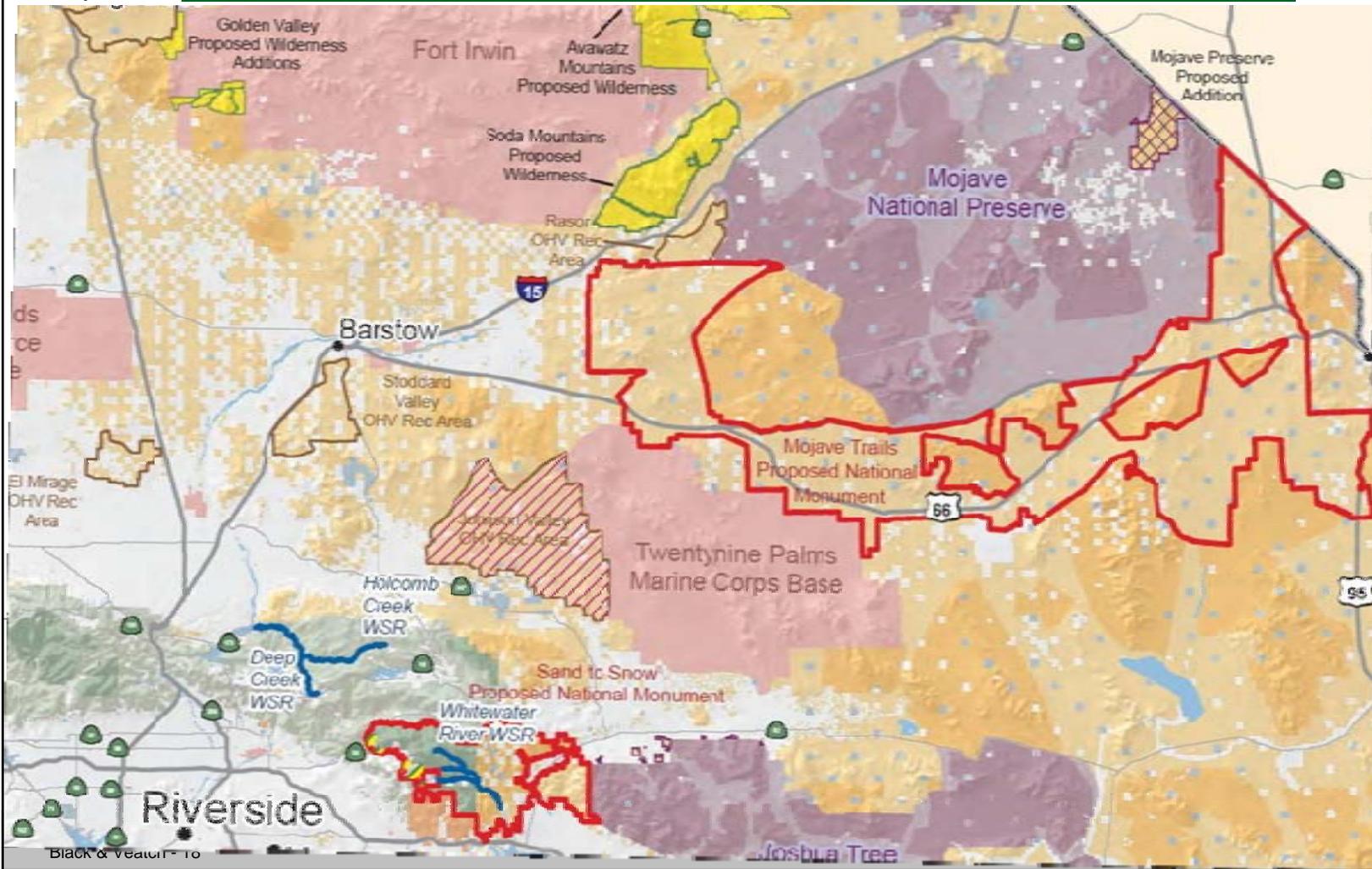
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**Capacity (MW) Estimates
after CREZ Adjustments
(Phase 2A Update)**

CREZ	Phase 1B to Phase 2A			Phase 2A to Phase 2A Update	
	Phase 1B	Phase 2A	Change	2A Update	Change
Barstow	2,136	2,336	200	2,336	0
Carrizo North	1,600	1,600	0	1,600	0
Carrizo South	3,000	3,877	877	3,877	0
Cuyama	400	800	400	800	0
Fairmont	6,918	3,518	-3,400	2,850	-668
Imperial East	1,723	1,623	-100	1,623	0
Imperial North-A	1,370	1,370	0	1,370	0
Imperial North-B	1,830	1,830	0	1,830	0
Imperial South	3,745	3,715	-30	3,715	0
Inyokern	2,887	2,432	-455	2,432	0
Iron Mountain	5,662	4,912	-750	4,912	0
Kramer	6,627	6,412	-215	6,412	0
Lassen North-A	821	1,467	646	1,467	0
Lassen North-B	2,001	0	-2,001	0	0
Lassen South-A	410	410	0	410	0
Lassen South-B	1,200	0	-1,200	0	0
Mountain Pass	2,878	1,658	-1,220	1,658	0
Needles	1,061	461	-600	461	0
Owens Valley	1,400	1,400	0	5,000	3,600
Palm Springs	770	770	0	333	-437
Pisgah-A	1,800	2,550	750	2,550	0
Pisgah-B	3,790	0	-3,790	0	0
Riverside East-A	1,000	10,550	9,550	10,550	0
Riverside East-B	6,800	0	-6,800	0	0
Round Mountain-A	240	384	144	384	0
Round Mountain-B	187	187	0	187	0
San Bernardino - Baker	1,200	3,670	2,470	3,670	0
San Bernardino - Lucerne	4,290	3,030	-1,260	3,030	0
San Diego North Central	281	281	0	281	0
San Diego South	678	678	0	678	0
Santa Barbara	433	433	0	433	0
Solano	894	894	0	894	0
Tehachapi	9,642	10,837	1,195	10,425	-412
Twentynine Palms	800	1,805	1,005	1,805	0
Victorville-A	800	1,636	836	1,636	0
Victorville-B	895	0	-895	0	0
Victorville-C	340	0	-340	0	0
Westlands	0	0	0	5,000	5,000
Total	82,509	77,526	-4,983	84,609	7,083

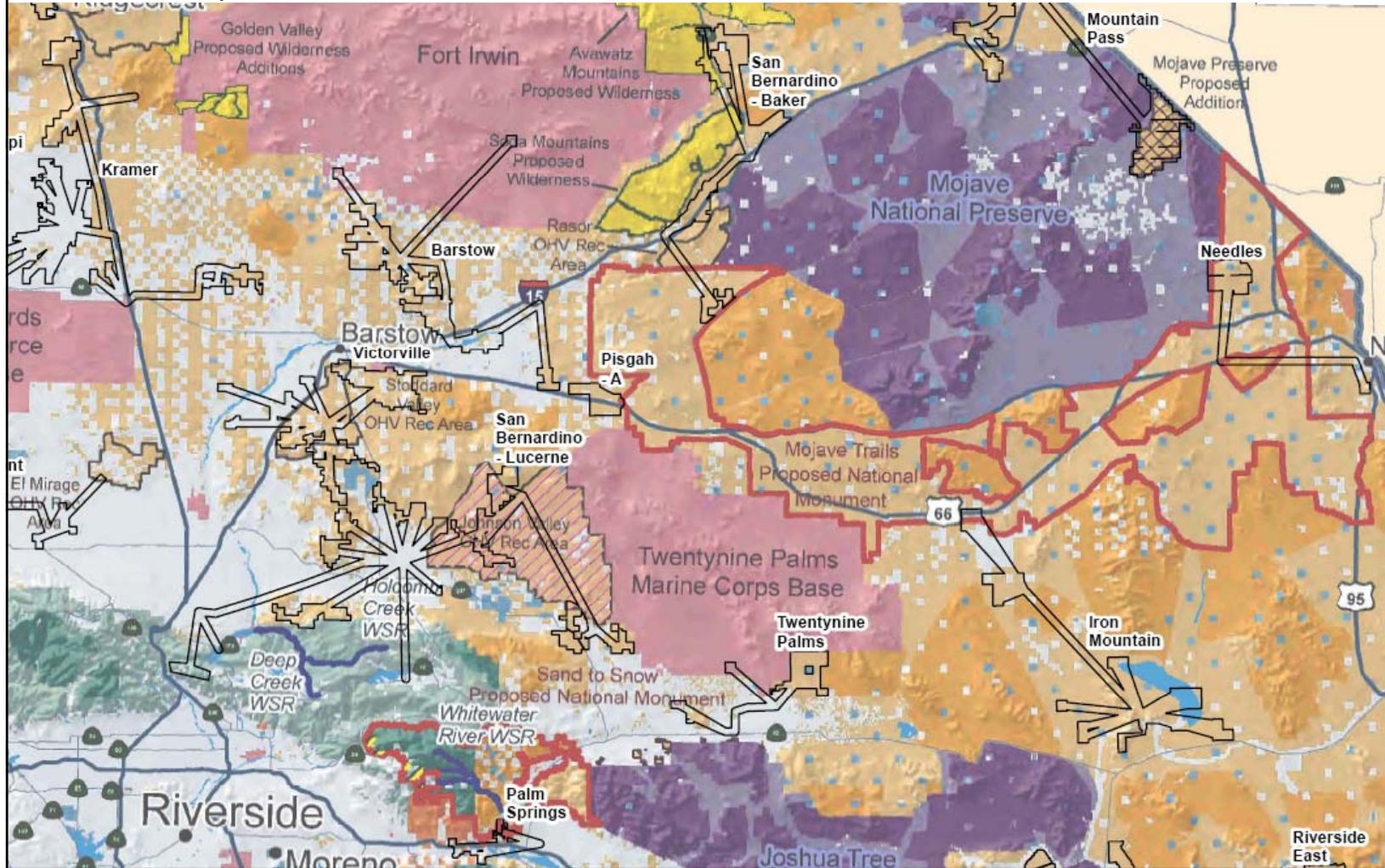
Impacts of 2010 California Desert Protection Act

Map Source: http://feinstein.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=14d49cae-7398-4d7e-8693-40ed19b44299



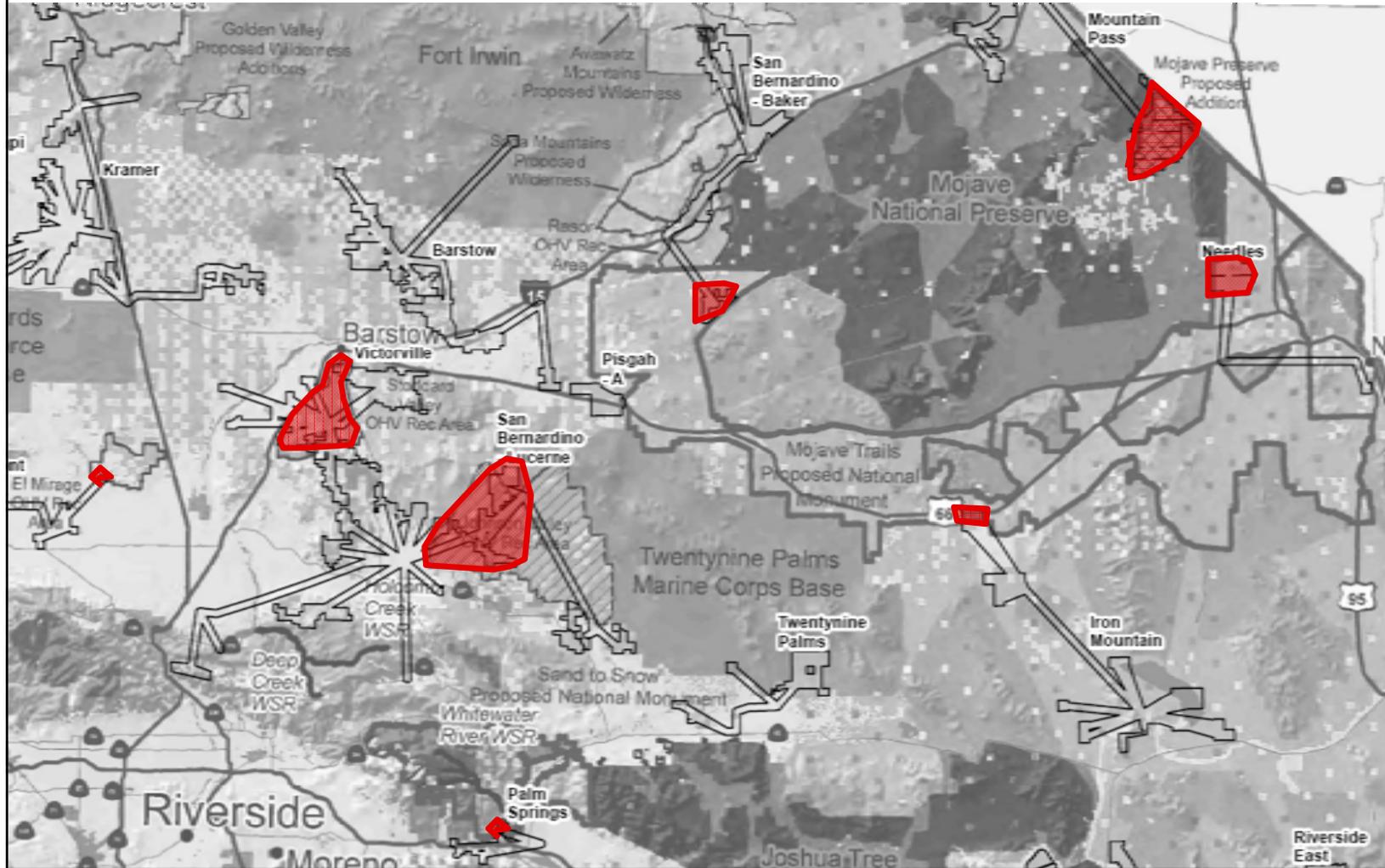
Impacts of 2010 California Desert Protection Act

CREZ boundaries per Black & Veatch – to be reconciled with CEC

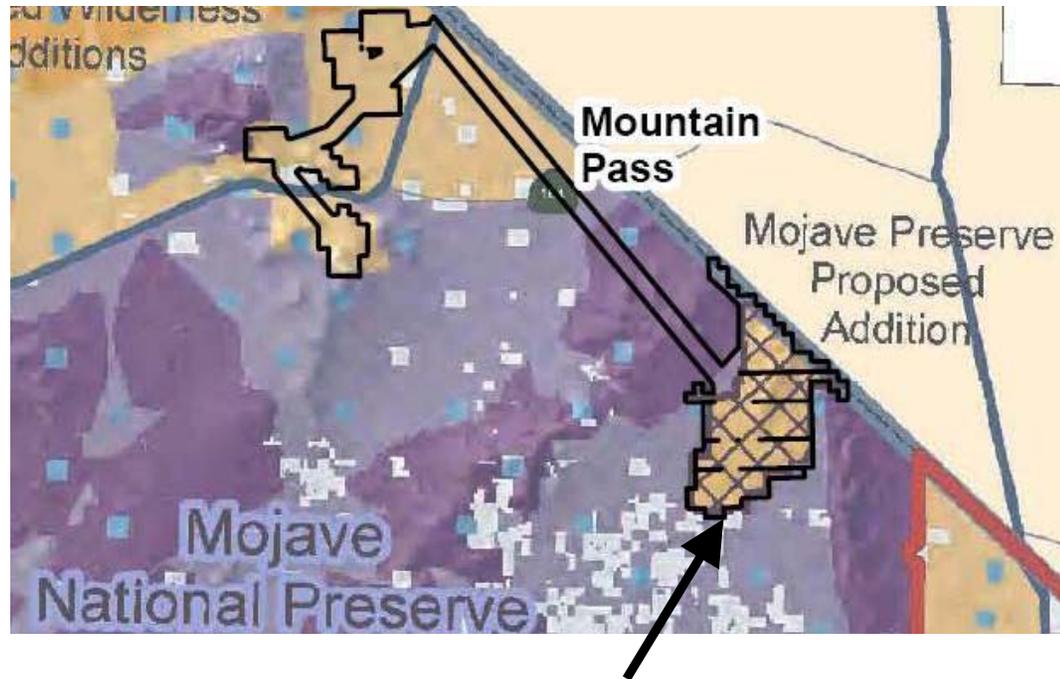


Impacts of 2010 California Desert Protection Act

Affected CREZ areas



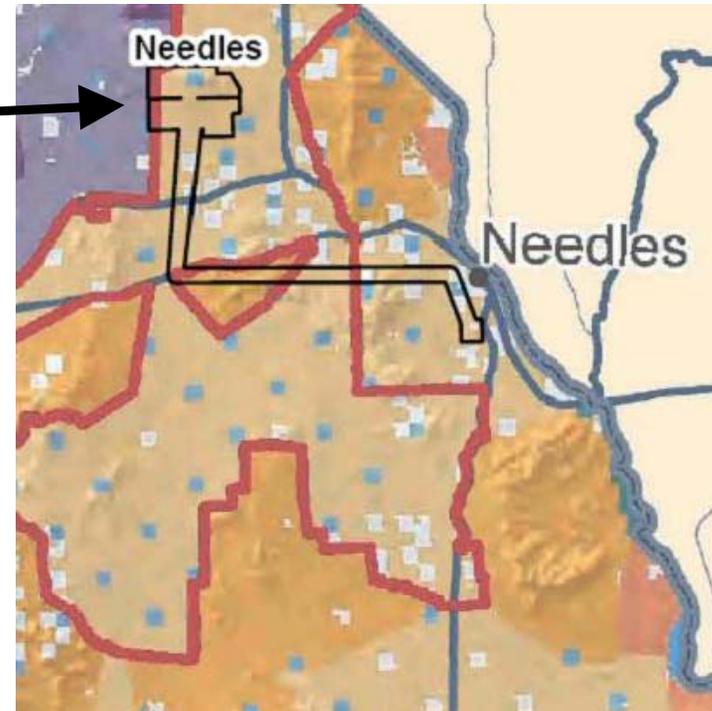
Mountain Pass



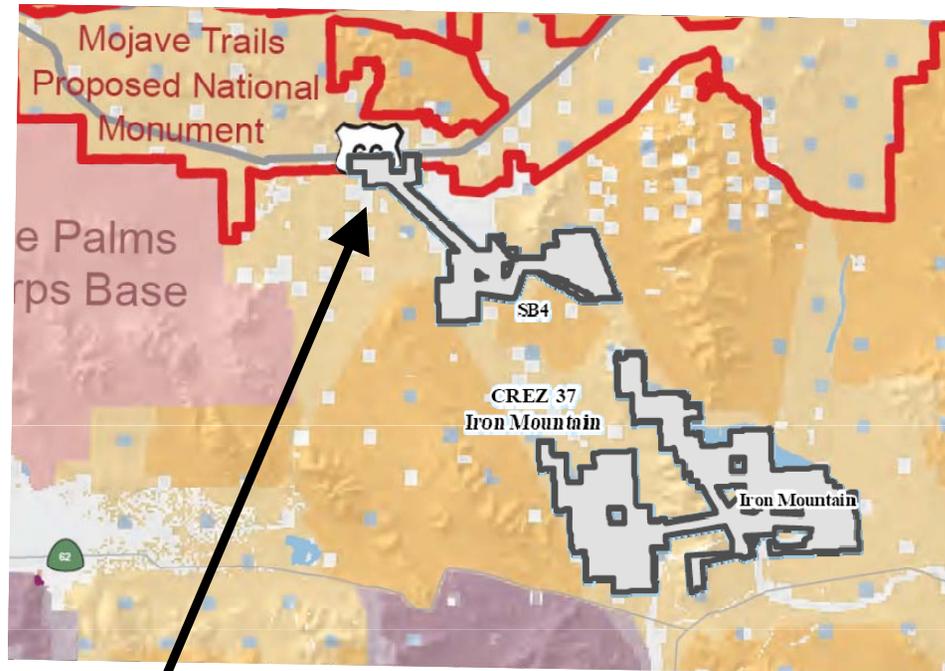
- 5 wind projects affected
- Total of 699 MW of wind removed by expansion of Mojave National Preserve

Needles

- 2 wind projects affected by proposed Mojave Trails National Monument
- 262 MW of wind resources removed
- Would reduce Needles to single proxy solar project



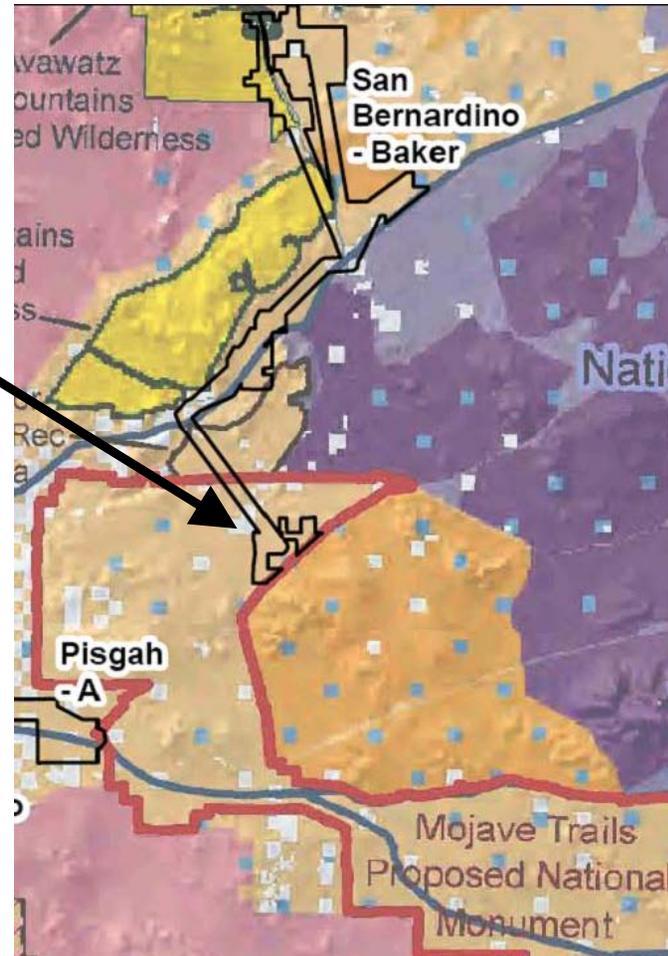
Iron Mountain



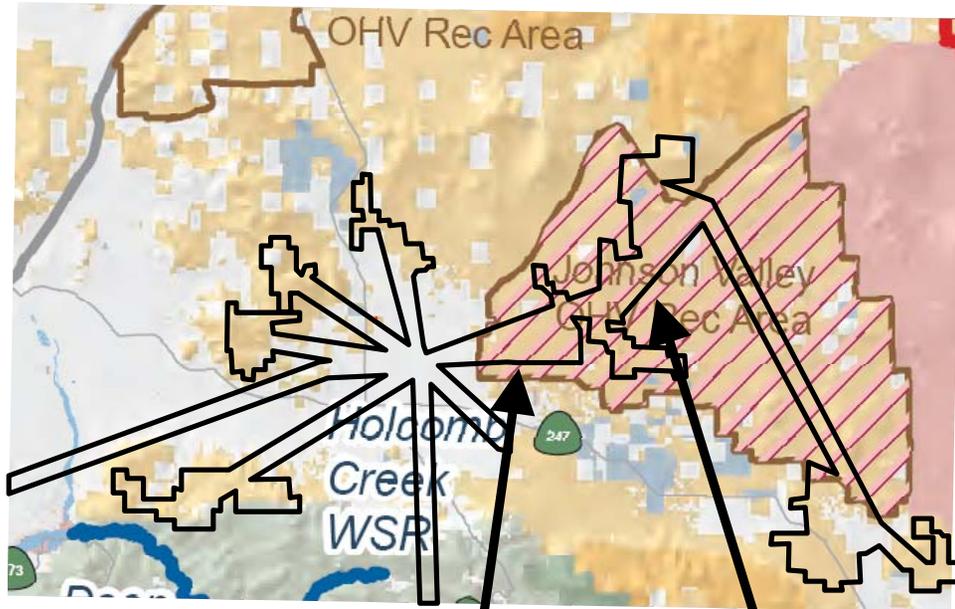
- 1 solar project affected by proposed Mojave Trails National Monument
- Approximately half (400 MW) of a 800 MW project by PG&E impacted
- Image shows CEC Shapefile
- ***Note that this project was actually moved to the Pisgah CREZ in RETI Phase 2A. This will be updated

San Bernardino - Baker

- 1 solar project affected by proposed Mojave Trails National Monument
- 320 MW removed



San Bernardino - Lucerne



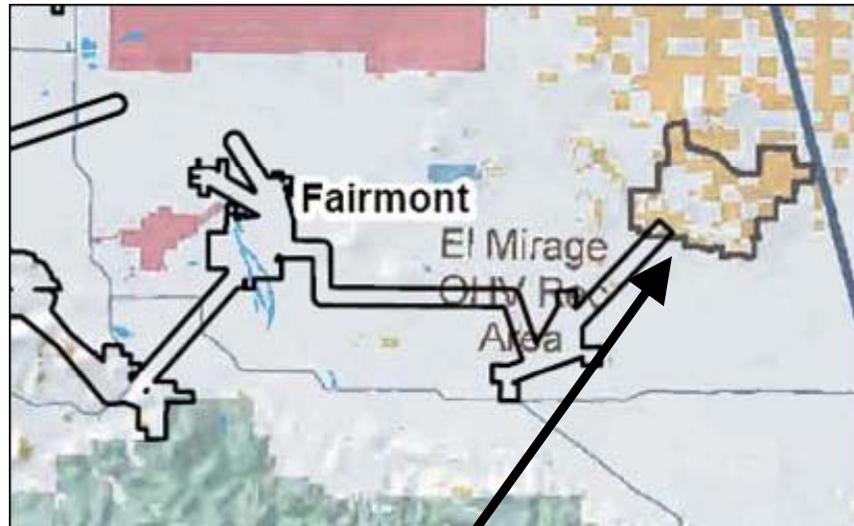
- 4 proxy solar projects and 2 wind projects affected by Johnson Valley Off-Highway Vehicle Recreation Area
- 292 MW of wind and 800 MW of solar removed
 - Checking to see if wind is considered compatible with OHV use. May retain 2 wind projects. Assumed that solar is not compatible.
- CREZ shape file to be reconciled with CEC

Victorville



- Stoddard Valley Off-Highway Vehicle Recreation Area is in the center of the Victorville CREZ
- 1 wind project substantially affected (2 others are only slightly impacted)
- One 86 MW project in B&V dataset removed
 - Checking to see if wind is considered compatible with OHV use. May retain project.
- BLM CACA 049204 would also be materially impacted, but this project not explicitly modeled in B&V dataset, thus B&V estimated available capacity is not impacted

Fairmont



- 1 proxy solar affected by El Mirage Off-Highway Vehicle Recreation Area Rec Area
- 200 MW removed

Palm Springs



- 2 wind projects potentially affected by proposed Sand to Snow National Monument
- However, these projects already removed in Palm Springs CREZ refinement

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Capacity Estimates after CDPAct Adjustments

Assuming all are made – checking to see if wind in OHV areas can be kept

CREZ	Phase 1B to Phase 2A			Phase 2A to Phase 2A Update		Ph 2A Update to CDPAct	
	Phase 1B	Phase 2A	Change	2A Update	Change	After CDPAct	Change
Barstow	2,136	2,336	200	2,336	0	2,336	0
Carrizo North	1,600	1,600	0	1,600	0	1,600	0
Carrizo South	3,000	3,877	877	3,877	0	3,877	0
Cuyama	400	800	400	800	0	800	0
Fairmont	6,918	3,518	-3,400	2,850	-668	2,650	-200
Imperial East	1,723	1,623	-100	1,623	0	1,623	0
Imperial North-A	1,370	1,370	0	1,370	0	1,370	0
Imperial North-B	1,830	1,830	0	1,830	0	1,830	0
Imperial South	3,745	3,715	-30	3,715	0	3,715	0
Inyokern	2,887	2,432	-455	2,432	0	2,432	0
Iron Mountain	5,662	4,912	-750	4,912	0	4,512	-400
Kramer	6,627	6,412	-215	6,412	0	6,412	0
Lassen North-A	821	1,467	646	1,467	0	1,467	0
Lassen North-B	2,001	0	-2,001	0	0	0	0
Lassen South-A	410	410	0	410	0	410	0
Lassen South-B	1,200	0	-1,200	0	0	0	0
Mountain Pass	2,878	1,658	-1,220	1,658	0	959	-699
Needles	1,061	461	-600	461	0	199	-262
Owens Valley	1,400	1,400	0	5,000	3,600	5,000	0
Palm Springs	770	770	0	333	-437	333	0
Pisgah-A	1,800	2,550	750	2,550	0	2,550	0
Pisgah-B	3,790	0	-3,790	0	0	0	0
Riverside East-A	1,000	10,550	9,550	10,550	0	10,550	0
Riverside East-B	6,800	0	-6,800	0	0	0	0
Round Mountain-A	240	384	144	384	0	384	0
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San Bernardino - Baker	1,200	3,670	2,470	3,670	0	3,350	-320
San Bernardino - Lucerne	4,290	3,030	-1,260	3,030	0	1,938	-1,092
San Diego North Central	281	281	0	281	0	281	0
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Santa Barbara	433	433	0	433	0	433	0
Solano	894	894	0	894	0	894	0
Tehachapi	9,642	10,837	1,195	10,425	-412	10,425	0
Twentynine Palms	800	1,805	1,005	1,805	0	1,805	0
Victorville-A	800	1,636	836	1,636	0	1,550	-86
Victorville-B	895	0	-895	0	0	0	0
Victorville-C	340	0	-340	0	0	0	0
Westlands	0	0	0	5,000	5,000	5,000	0
Total	82,509	77,526	-4,983	84,609	7,083	81,550	-3,059



Out-of-State Capacity Updates

Original Phase 1 RETI MW Estimates

		CA	OR	WA	NV	AZ	Baja	BC
Bio		1,725	454	449				1,520
PV		27,460						
ST		65,200			7,429	7,129		
Wind		16,208	4,688	3,762	1,475		5,000	2,405
Geo		1,918	520		1,283			244

CA values to be replaced with updated 2A

WREZ MW Estimates (in RED)

		CA	OR	WA	NV	AZ	Baja	BC
Bio		1,725	454	449				1,520
		147	646	101	300	327		939
PV		27,460						
ST		65,200						
		16,069			18,582	19,780		
Wind		16,208	4,688	3,762	1,475		5,000	2,405
		6,042	2,897	3,260	431	3,717	2,937	13,943
Geo		1,918	520		1,283			244
		1,434	832		1,408			340

CA values to be replaced with updated 2A

Notes: PV and ST not differentiated in WREZ, assumed all ST

Summary of Recommended Resource Assessments to Use (RETI vs. WREZ) MW Estimates

Discussing Potential Update with BC

		CA	OR	WA	NV	AZ	Baja	BC
Bio 		1,725	454	449				1,520
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PV 		27,460						
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		1,434	832		1,408			340

CA values to be replaced with updated 2A

New assessments performed

Notes: PV and ST not differentiated in WREZ, assumed all ST

Summary of Recommended Resource Assessments to Use (RETI vs. WREZ) MW Estimates

Discussing Potential Update with BC

		CA	OR	WA	NV	AZ	Baja	BC
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Wind 		16,208	4,688	3,762	1,475		5,000	2,405
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Geo 		1,918	520		1,282			244
		1,434	832		1,587 1,408			340

CA values to be replaced with updated 2A

Notes: PV and ST not differentiated in WREZ, assumed all ST

Nevada Geothermal

- RETI Phase 1B 1,450 MW
- WREZ 1,408 MW
- **RETI Phase 2A Update 1,587 MW**
 - RETI Phase 2A includes new 2009 BLM lease auction results
 - Note that some of these resources are already contracted to NVEnergy
 - Multiple transmission possibilities on existing and new lines. For purpose of estimating cost for new transmission, NV geothermal assumed to be transmitted to Owens Valley CREZ “gateway”, which has the shortest path per the WREZ model

Nevada Wind

- RETI Phase 1B 1,475 MW
- WREZ 431 MW
- **RETI Phase 2A Update 1,753 MW**
 - 1,322 MW - Southern Nevada from original RETI Phase 1 analysis
 - Removed one project to avoid double counting with WREZ NV_SW QRA (windnvaz_33 – 153 MW)
 - 233 MW - Southwestern Nevada Wind from WREZ
 - 198 MW - Western Nevada Wind from WREZ

 - Multiple transmission possibilities on existing and new lines. For purpose of estimating cost for new transmission, NV wind assumed to be transmitted to Mt. Pass CREZ “gateway”, which has the shortest path per the WREZ model

RETI: Baja Wind Energy Assessment

History

- RETI Phase 1B
 - Preliminary assessment of resource
 - 25,000 MW of technical potential
 - No consideration for developmental constraints
 - Identified ~5,000 MW of developable wind
 - Based on CAISO queue
 - 2,368 MW of “cost competitive” resource identified

RETI: Baja Wind Energy Assessment

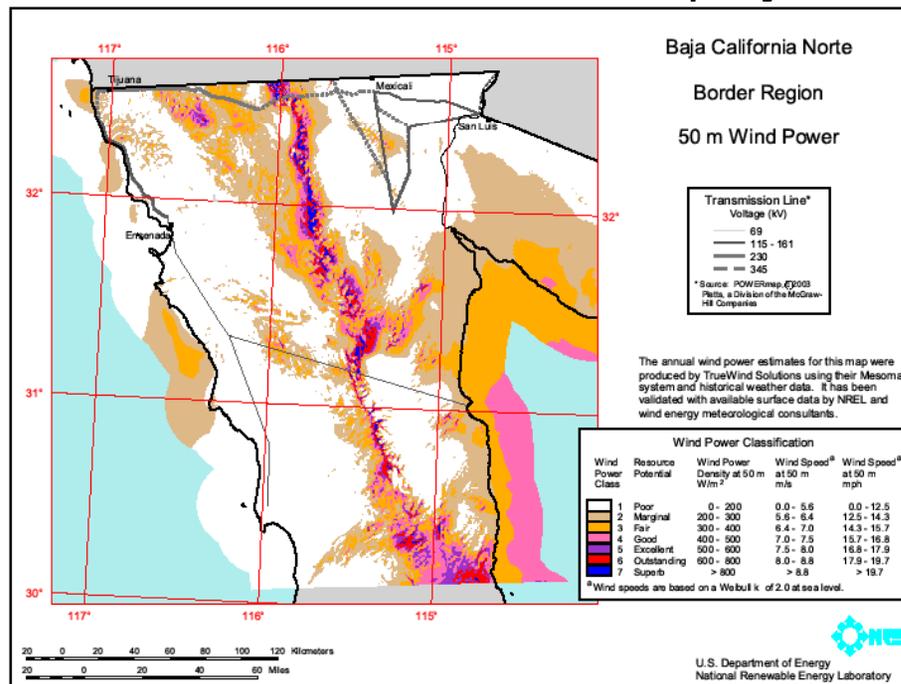
Phase 2

- Reassessment of wind in Baja California Norte
- Projects based approach
 - Similar to the RETI assessment in California:
 1. Identify resource
 2. Create exclusions
 3. Identify project boundaries
 4. Characterize projects

RETI: Baja Wind Energy Assessment

Step 1: Identify Resource

- NREL Wind Power Density Map circa 2004
 - AWS TrueWind via their Mesomap system



RETI: Baja Wind Energy Assessment

Step 2: Create Exclusions

- Wind energy development is not prudent everywhere. For example:
 - National Parks and protected lands
 - Population centers
 - Rugged terrain

RETI: Baja Wind Energy Assessment

Step 3: Identify Project Boundaries

- Project boundaries are drawn around remaining resource.
- Two major types:
 - Project following a ridgeline
 - Project composed of multiple rows of turbines
 - This type is further characterized as flat, rolling hills or rough terrain.

Landscape



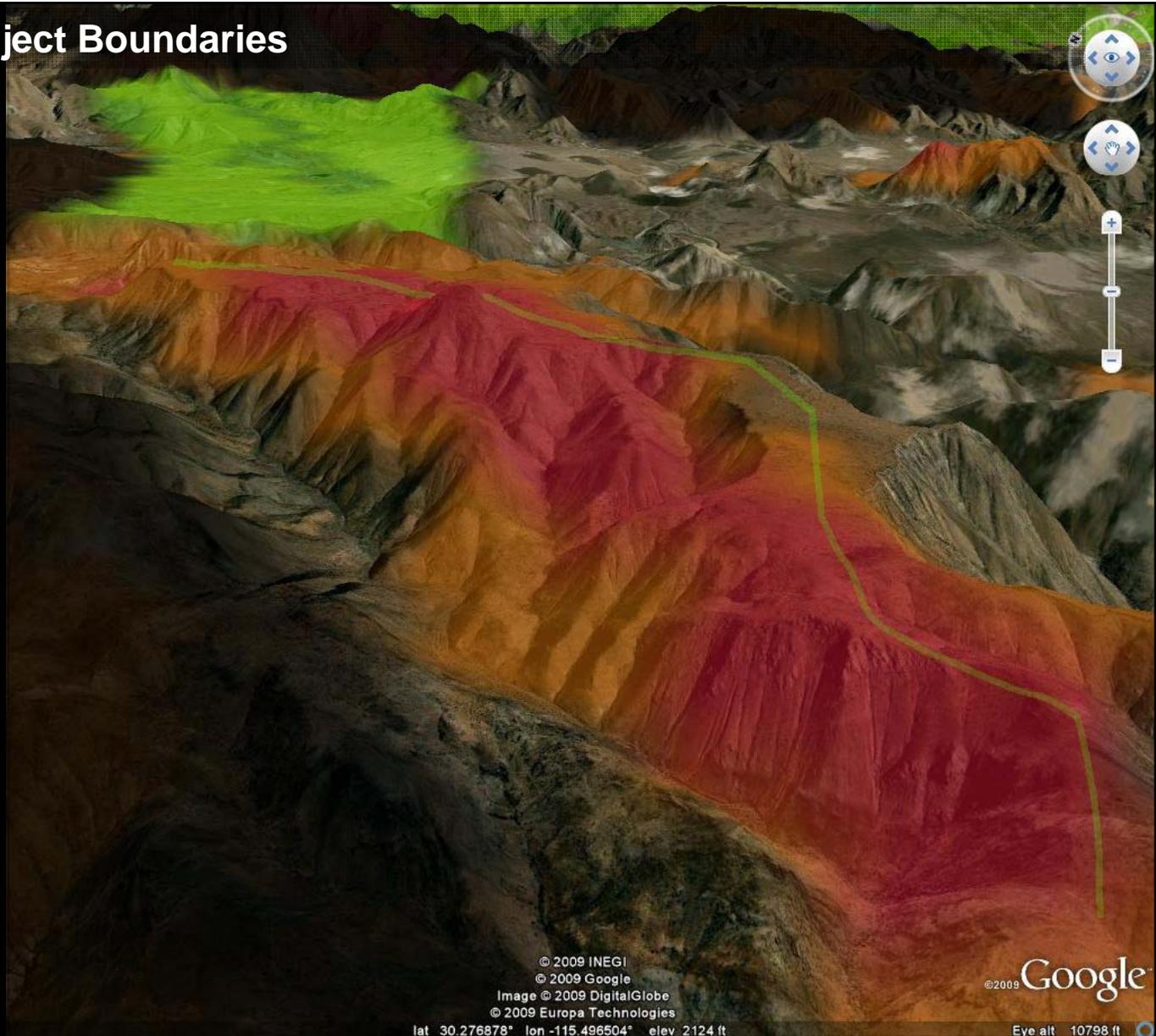
Wind Resource



Exclusions



Identify Project Boundaries



Wind Projects



Imagery Dates: Feb 12, 2003 - Jul 26, 2007

lat 30.276878° lon -115.496504° elev 2124 ft

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Image © 2009 DigitalGlobe
© 2009 Europa Technologies

©2009 Google

Eye alt 10798 ft

RETI: Baja Wind Energy Assessment

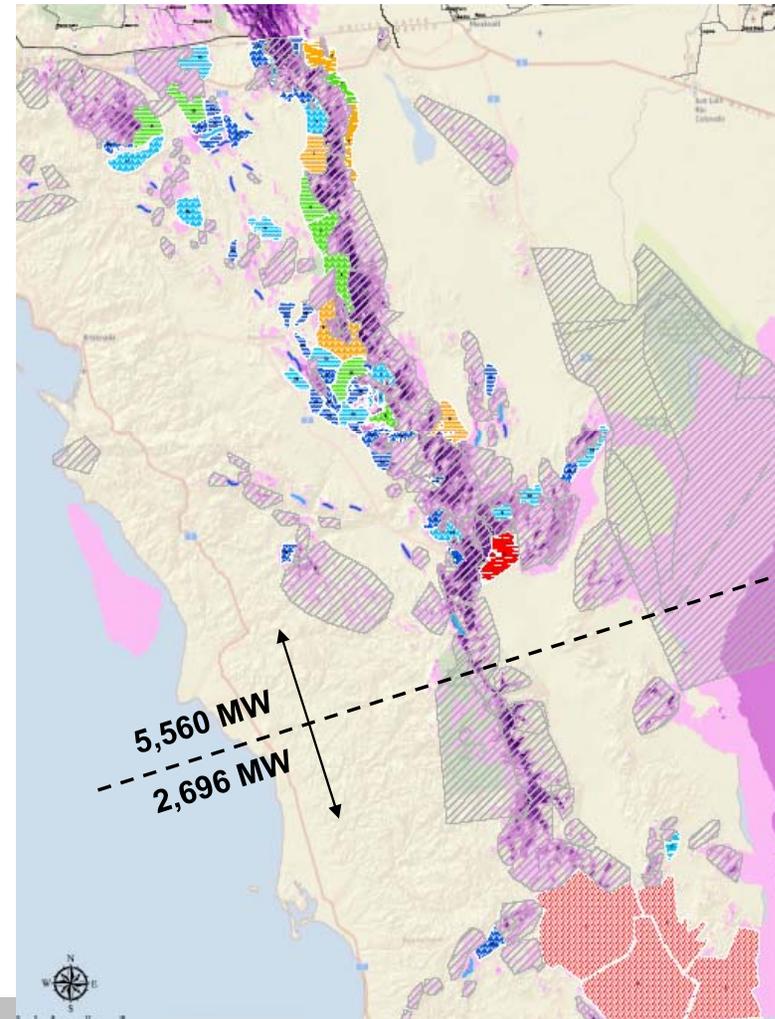
Step 4: Characterize Projects

- Projects are described on four major levels
 1. Capacity (MW)
 2. Annual Energy Production (GWh)
 3. Installed Capital Cost (\$ / kW)
 4. Levelized Cost of Electricity (\$ / MWh)

RETI: Baja Wind Energy Assessment

Results

- 33,285 MW of technical potential
- Quantified 8,256 MW as developable potential (25% of technical)
- 89 projects
- Average capacity factor: 36%
- Average capital cost: \$2,560 / kW



Additional Out-of-State Resource Estimates from WREZ (MW)

	Wind	Geothermal	Biomass
Idaho	1,603	329	358
New Mexico	13,184		
Utah	1,678	375	91
Wyoming	14,854		