



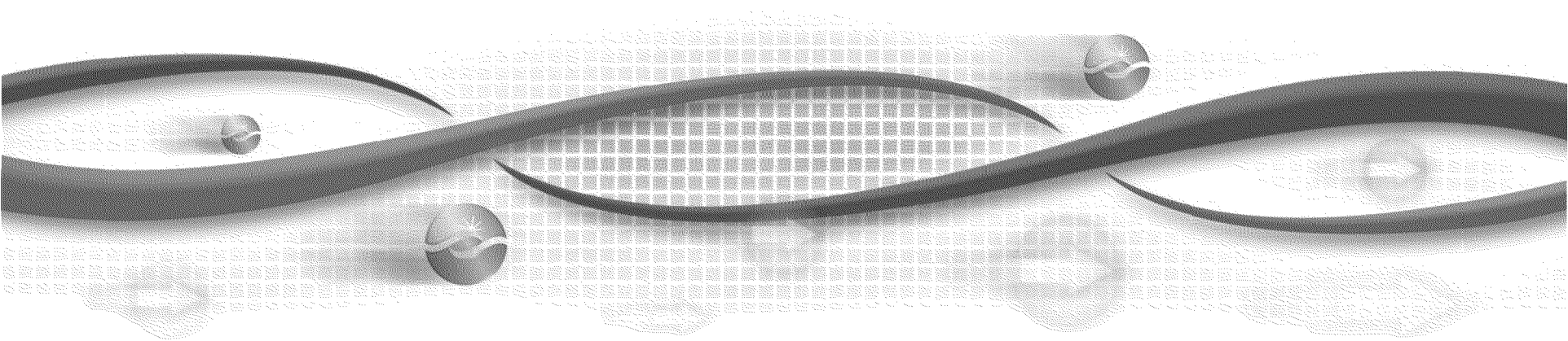
California ISO
Shaping a Renewed Future

Long-Term Local Capacity Needs in the California ISO system

*Robert Sparks
Manager, Regional Transmission— South*

CPUC Workshop: Long-Term Procurement Plan

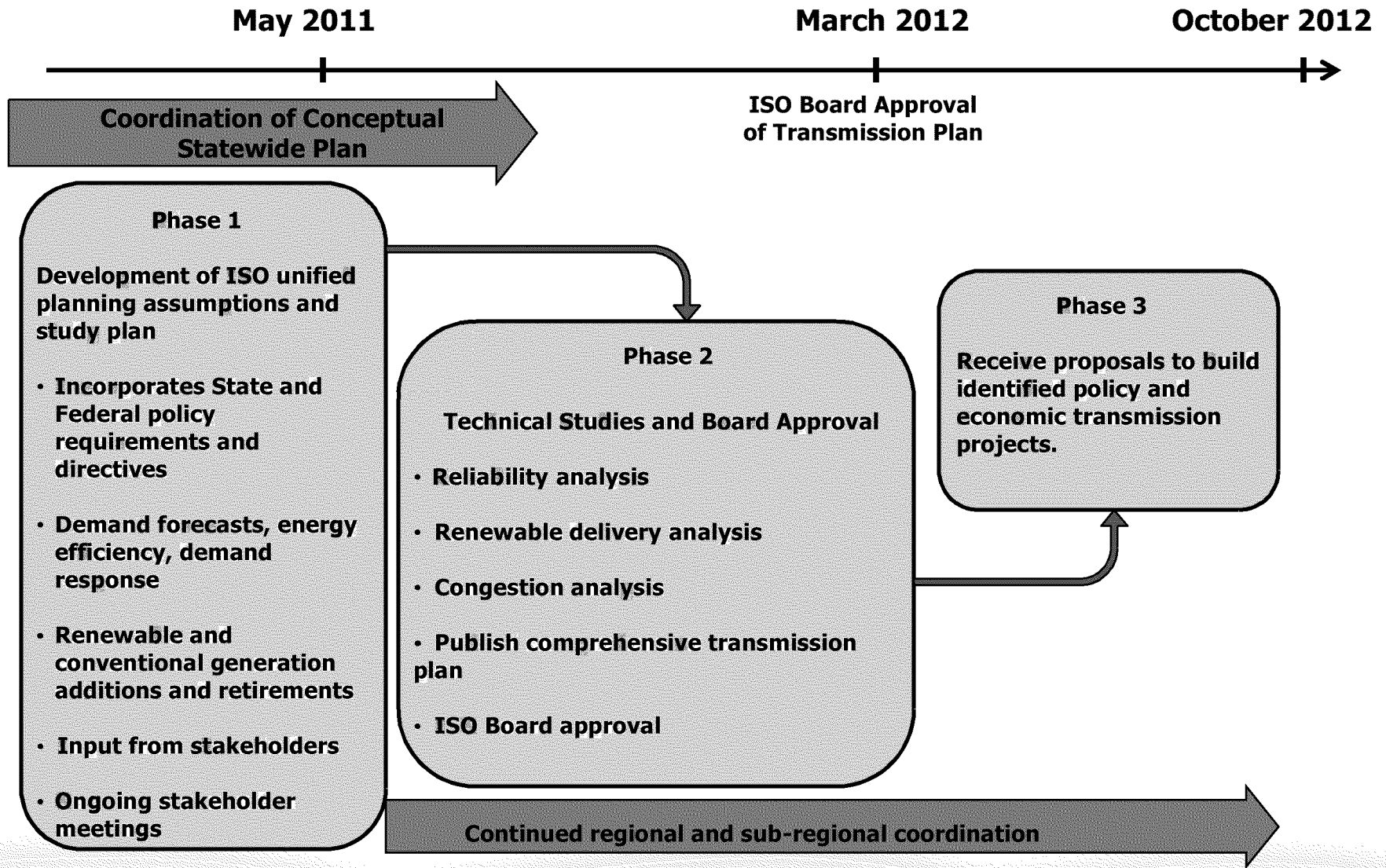
May 3, 2012



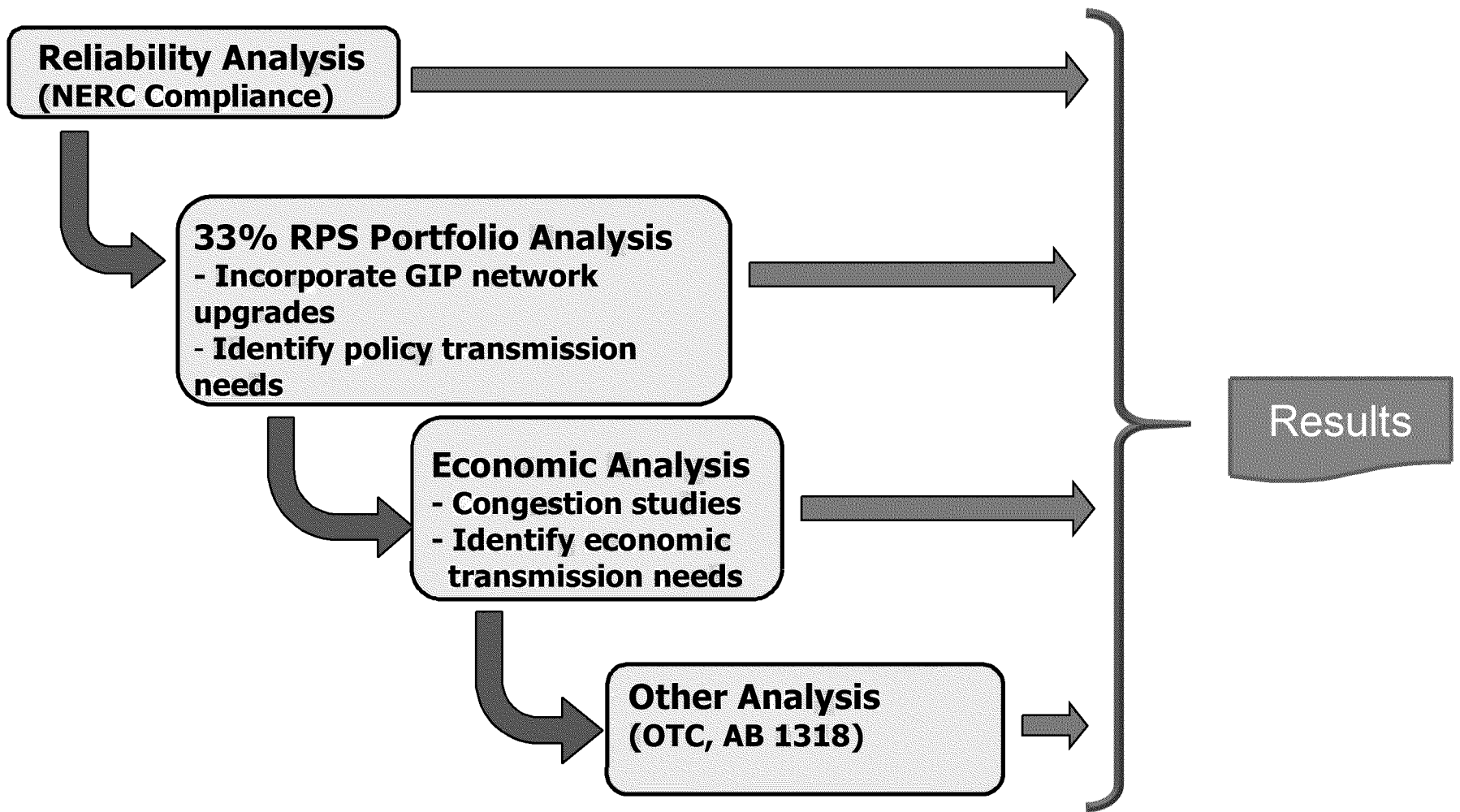
Overview

- **Background**
 - 2011/12 Transmission Planning Process
 - LCR Study Process
 - Overview and objectives of OTC and AB 1318 reliability studies
 - Summary of long-term (2021) local capacity requirement (LCR) study results
 - San Diego local needs addressed in separate proceeding
- **Details of LA Basin OTC study results**
- **Details of Big Creek/Ventura OTC study results**
- Simulation model
- Conclusions

Development of 2011/2012 Transmission Plan



Development of 2011/2012 Annual Transmission Plan



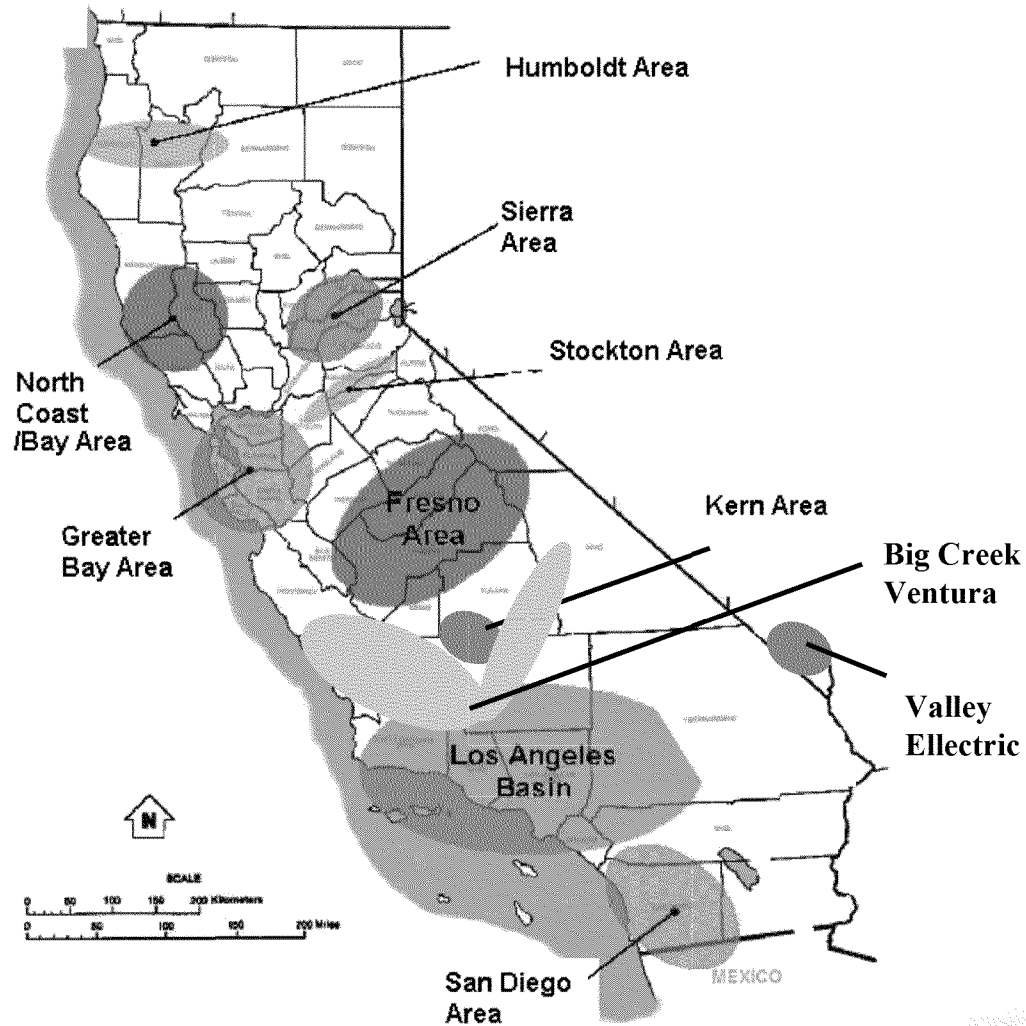
Renewable Portfolios

	Resources Selected by Scenario (MW)				
	33% Trajectory	33% Environ- mentally- Constrained	33% Time- Constrained	33% Updated Cost- Constrained	2011/12 TPP Base Portfolio
Tehachapi	4,445	3,491	4,150	3,489	3,489
Imperial	1,202	347	-	1,693	1,693
Northwest	2,359	838	2,359	711	711
Pisgah	1,775	275	275	275	275
NonCREZ	924	449	930	802	652
Solano	1,129	300	-	535	535
Riverside East	1,192	1,192	1,650	1,042	1,192
Alberta	886	450	886	450	450
Mountain Pass	888	-	-	523	523
Carrizo South	900	900	900	900	900
Utah-Southern Idaho	258	258	258	258	258
San Diego South	400	400	400	699	699
Colorado	420	-	1,371	420	223
Nevada C	450	549	549	450	450
Distributed Solar - PG&E	500	2,000	822	773	773
Montana	300	300	300	300	300
Distributed Solar - SCE	500	2,635	895	750	750
Arizona	290	290	1,390	290	290
Wyoming	96	4	461	461	412

Renewable Portfolios

	Resources Selected by Scenario (MW)				
	33% Trajectory	33% Environ- mentally- Constrained	33% Time- Constrained	33% Updated Cost- Constrained	2011/12 TPP Base Portfolio
New Mexico	32	78	947	947	947
Round Mountain	78	100	100	100	100
Palm Springs	77	178	178	178	178
San Bernardino - Lucerne	49	140	261	261	261
Kramer	62	62	62	62	362
Distributed Solar - SDGE	52	325	77	78	78
British Columbia	2	52	52	50	50
Remote DG (Brownfield) - SDGE	-	78	4	9	9
Remote DG (Brownfield) - PG&E	-	1,842	100	206	206
Remote DG (Brownfield) - SCE	-	564	31	63	63
Distributed Solar - Other	-	1,062	363	-	-
Westlands	-	800	-	-	-
Remote DG (Brownfield) - Other	-	571	31	-	-
Fairmont	-	-	-	-	-
Santa Barbara	-	-	-	-	-
Remote DG (Greenfield) - PG&E	-	-	-	412	412
Remote DG (Greenfield) - SCE	-	-	-	126	126
Remote DG (Greenfield) - SDG&E	-	-	-	17	17

LCR Areas within CAISO



LCR Study Process, Methodology and Criteria

- Year ahead LCR study for procurement purposes
- Five-year ahead LCR study for procurement planning
- OTC study was a ten-year ahead study for long-term procurement planning

2013 LCR Study Manual can be found at:

http://www.caiso.com/Documents/LCR_ManualFinal_2013.pdf

Summary of State Water Board and Generator Owners Implementation Schedule for OTC Plants

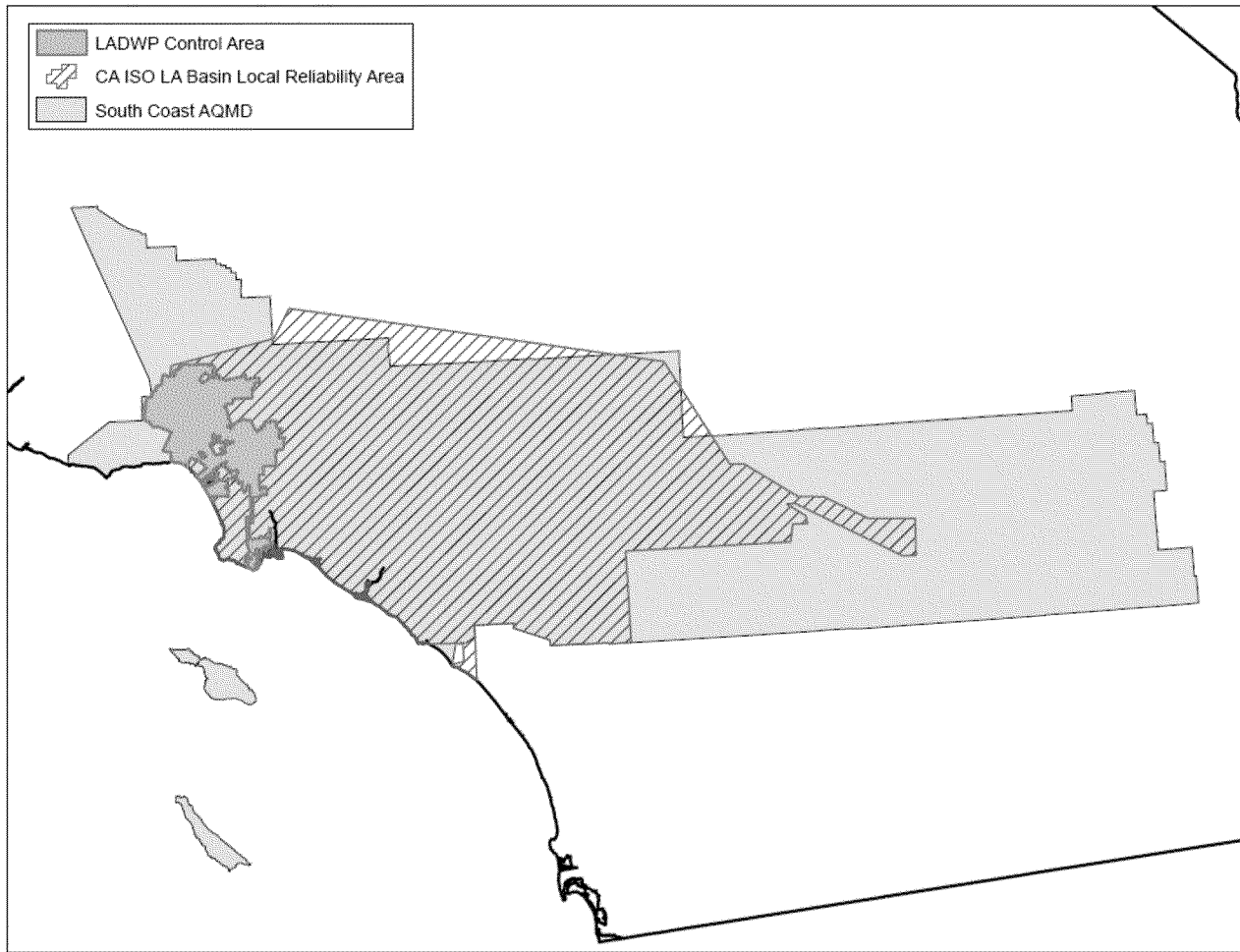
Power Plant	SWRCB's Implementation Date	Generator Owner's Proposed Dates
Humboldt Bay	12/31/2010	Compliant
Potrero	One year after the effective date of policy (10/1/2011)	Compliant
South Bay	12/31/2011	Compliant
El Segundo, Harbor (LADWP), Morro Bay	12/31/2015	ES3 (7/1/2011), ES4 12/31/2017), H5(12/31/2029), MB (12/31/2015)
Encina, Contra Costa, Pittsburg, Moss Landing	12/31/2017	E (12/31/2017), CC (4/30/2013), PTSB (12/31/2017), ML 1&2 (12/31/2032), ML 6&7 (12/31/2017)
Haynes (LADWP)	12/31/2019	Haynes 1&2 (12/31/2029), Haynes 5&6 (12/31/2013), Haynes 8, 9, 10 (12/31/2029)
Huntington Beach, Redondo, Alamitos, Mandalay, Ormond Beach, Scattergood (LADWP)	12/31/2020	HB 1&2 (12/31/2022), HB 3&4 (2012 – sold to EME to transfer emission credits to Walnut Creek Energy Center), RB 5&6 (12/31/2022), RB 7&8 (2018?), OB (12/31/2020), Scattergood 1&2 (12/31/2024), SG 3 (12/31/2015)
San Onofre Nuclear Generating Station	12/31/2022	12/31/2022
Diablo Canyon Power Plant	12/31/2024	12/31/2024

Slide 9

Overview of Assembly Bill 1318 (AB 1318)

- Requires ARB, in consultation with CEC, CPUC, ISO, and SWRCB to:
 - prepare a report for the Governor and Legislature
 - evaluates the electrical system reliability needs of the South Coast Air Basin (SCAB)

Jurisdictional Area for Analyses of the South Coast Air Basin Geographic Area



Study Scope for both OTC and AB 1318 studies

- Determine OTC generation level needed to meet LCR needs by areas within ISO BAA to maintain grid reliability in the local areas for 2021 time frame under the following RPS portfolios:
 - trajectory, environmentally constrained and time constrained portfolios; and base portfolio
 - 2009 CEC adopted load forecast

Note: Diablo Canyon & San Onofre nuclear generating units are assumed in operation

AB 1318 Sensitivity Scenario

- Estimated OTC generation level needed under a sensitivity scenario:
 - Mid net load conditions for environmentally constrained portfolio
 - CPUC and CEC staff provided projected incremental energy efficiency and incremental demand response
 - Considered as sensitivity study by the ISO as there is no basis to assume incremental EE, and DR amounts will materialize

Major New Transmission Projects

- Carrizo – Midway
- South Contra Costa
- Tehachapi transmission project
- Colorado River – Valley 500kV line
- Eldorado – Ivanpah 230kV lines
- Sunrise Powerlink
- East County (ECO) substation
- West of Devers upgrades
- Pisgah – Lugo 500kV lines
- Borden – Gregg
- Path 42 (IID – SCE) upgrades

New conventional generation

- Consistent with renewable integration studies except for Oakley and Avenal
 - Marsh Landing (760 MW)
 - Russell City Energy Center (600 MW)
 - Oakley Generating Station (624 MW)
 - Lodi Energy Center (280 MW)
 - GWF Tracy Combined Cycle (145 MW)
 - Los Esteros Combined Cycle (140 MW)
 - Mariposa Energy Project (184 MW)
 - Walnut Creek Energy Center (500 MW)
 - Canyon Power Plant (200 MW)
 - NRG El Segundo Repowering Project (570 MW)
 - Sentinel Peaker Project (850 MW)

Summary of Long-Term (2021) LCR Study Results

LCR Area	Local Capacity Requirements (MW)				New Generation Need? # If Yes, Range of New Generation Need (MW)			
	Trajectory	Environmentally Constrained	ISO Base Case	Time Constrained	Trajectory	Environmentally Constrained	ISO Base Case	Time Constrained
Greater Bay Area	5,773	4,728	5,778	6,572	No			
Big Creek/Ventura (BC/V) Area	2,371	2,604	2,438	2,653	Yes (for Moorpark, a sub-area of the Big Creek/Ventura LCR area)			
					430	430	430	430
LA Basin (this area includes sub-area below)	13,300	12,567	12,930	13,364	2,370 – 3,741	1,870 – 2,884	2,424 – 3,834	2,460 – 3,896
Western LA Basin (sub-Area of the larger LA Basin)	7,797	7,564	7,517	7,397				

Summary of Long-Term (2021) OTC Generation Need

LCR Area	Trajectory (MW)	Environmentally Constrained (MW)	ISO Base Case (MW)	Time Constrained (MW)	Notes
Greater Bay Area	0	0	0	0	No OTC generation need identified
Big Creek/Ventura (Moorpark Sub-area)	430	430	430	430	
West LA Basin / LA Basin	2,370 – 3,741	1,870 – 2,884	2,424 – 3,834	2,460 – 3,896	W. LA Basin is part of larger LA Basin

Sensitivity LCR assessment of mid net load environmentally constrained case for L.A. Basin

- Studies requested by state energy agencies.
- The ISO agreed to perform these studies as sensitivities to evaluate the impact of the state agencies' assumptions for incremental energy efficiency (EE) and demand response.
 - Incremental EE assumptions are beyond committed programs incorporated in the CEC's adopted demand forecast for high net load projections

Load Serving Entities	2021 Incremental EE (MW)	2021 Demand Response (MW)
SCE	2,461	2,829

Summary of Long-Term (2021) **sensitivity** assessment of the CPUC environmentally constrained portfolio for **mid net load**

Portfolios	Area	LCR			Existing OTC Units Needed?
		Non-D.G. (MW)	D.G. (Mw)	Total (MW)	
Environmentally Constrained (Mid Net Load Condition)	LA Basin Overall	9,242	1,519	10,761	No
	Western LA	5,589	869	6,458	Yes
	Western LA OTC Range			802 - 1,275 MW	
	Ellis	470	124	594	Yes
	El Nido	336	91	427	No

Consideration of **sensitivity** assessment:

- Could potentially reduce local capacity needs during summer peak load period
- Incremental EE, DR, and DG assumptions are highly uncertain
- Reductions in local capacity procurement would likely need to be replaced by system flexible capacity procurement in order to integrate inflexible renewable generation

Consideration of **sensitivity** assessment: Does not cover seasonal operational needs

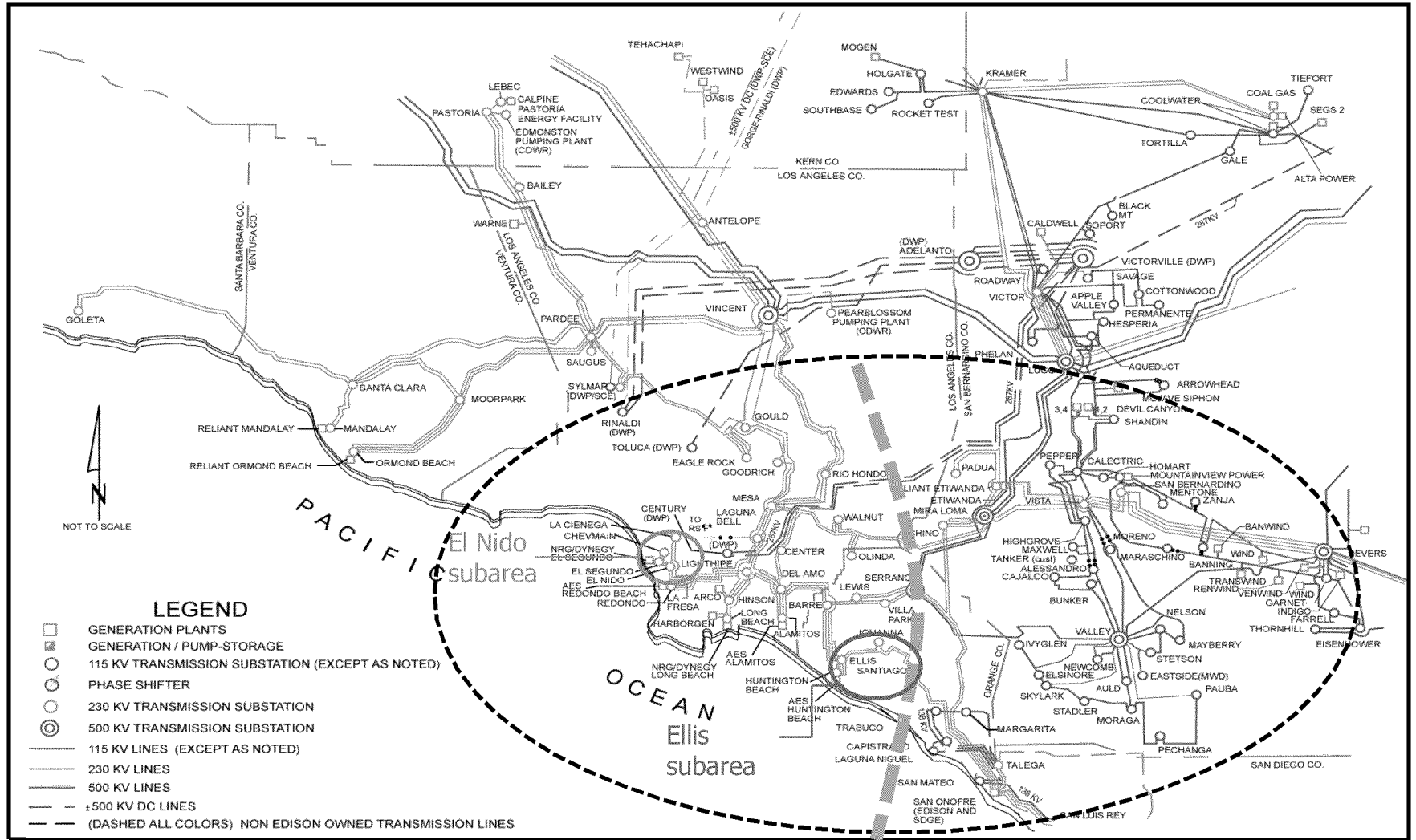
- We need local capacity during non-summer seasons to allow for maintenance and construction outages of generation and transmission
- Local capacity needs during other seasons are equivalent to summer peak needs before adding large amounts of DR, DG
- DR and PV based DG are not available most of time and don't help during typical maintenance and construction periods
- Local capacity needs under the base portfolio DG and committed EE and DR amounts in the following slides are the basis for prudent long-term procurement decisions

LA Basin OTC Study

Overview

- Overview of the LA Basin
- Long-term (2021) local capacity requirement (LCR) study results
- Generation effectiveness factors
 - For mitigating LCR area's primary loading constraint
- Conclusions
 - Range of LCR requirements (for areas with thermal constraints)

Overview of LA Basin



LA Basin Area Long-Term (2021) Load and Resources Summary

Itemized Details	Trajectory (MW)	Environmentally Constrained (MW)	ISO Base Case (MW)	Time Constrained (MW)
Generation				
Existing OTC Capacity (2012)			5,166	

Areas studied

- Los Angeles Basin
 - Larger LA Basin
 - Western LA Basin
 - El Nido
 - Ellis

Trajectory Portfolio Long-Term (2021) LCR Study Results

Portfolios	Area	LCR			Existing OTC Units Needed?	Constraint	Contingency
		Non-D.G. (MW)	D.G. (MW)	Total (MW)			
Trajectory	Overall LA Basin	12,961	339	13,300	Yes	Mira Loma West 500/230 Bank #1 (24-Hr rating) **	Chino-Mira Loma East #3 230 kV line + Mira Loma West 500/230 kV Bank #2
		10,404	339	10,743	Yes	Eagle Rock-Sylmar S 230 kV line	Sylmar S-Gould 230 kV line + Lugo-Victorville 500 kV line
	Western	7,529	268	7,797	Yes	Serrano-Villa PK #1	Serrano-Lewis #1 / Serrano-Villa PK #2
	Ellis	472	59	531	Yes	Voltage Collapse	Barre-Ellis 230 kV line + SONGS - Santiago #1 and #2 230 kV lines
	El Nido	614	5	619	No	La Fresa-Hinson 230 kV line	La Fresa-Redondo #1 and #2 230 kV lines

** Mira Loma 500/230kV Bank #2 has a 1-Hr emergency rating that that can be utilized by assuming up to 600 MW load shed/transfer after 1-Hr.

Environmentally Constrained Portfolio Long-Term (2021) LCR Study Results

Portfolios	Area	LCR			Existing OTC Units Needed?	Constraint	Contingency
		Non-D.G. (MW)	D.G. (MW)	Total (MW)			
Environmentally Constrained	Overall LA Basin	11,048	1,519	12,567	Yes	Mira Loma West 500/230 bank #1 (24-Hr rating)**	Chino-Mira Loma East #3 230kV line + Mira Loma West 500/230 kV bank #2
		9,727	1,519	11,246	Yes	Eagle Rock-Sylmar S 230 kV line	Sylmar S - Gould 230 kV line + Lugo - Victorville 500 kV line
	Western	6,695	869	7,584	Yes	Serrano-Villa PK #1	Serrano-Lewis #1 / Serrano-Villa PK #2
	Ellis	473	124	597	Yes	Voltage Collapse	Barre-Ellis 230kV Line + SONGS - Santiago #1 and #2 230 kV lines
	El Nido	494	91	585	No	La Fresa-Hinson 230 kV line	La Fresa-Redondo #1 and #2 230 kV lines

** Mira Loma 500/230kV Bank #2 has a 1-Hr emergency rating that can be utilized by assuming up to 600 MW load shed/transfer after 1-Hr.

ISO Base Case Portfolio Long-Term (2021) Study Results

Portfolios	Area	LCR			Existing OTC Units Needed?	Constraint	Contingency
		Non-D.G. (MW)	D.G. (MW)	Total (MW)			
Base	Overall LA Basin	12,659	271	12,930	Yes	Mira Loma West 500/230 Bank #1 (24-Hr rating) **	Chino-Mira Loma East #3 230 kV line + Mira Loma West 500/230 kV bank #2
		10,739	271	11,010	Yes	Eagle Rock-Sylmar S 230 kV line	Sylmar S-Gould 230kV line + Lugo-Victorville 500 kV line
	Western	7,325	192	7,517	Yes	Serrano-Villa PK #1	Serrano - Lewis #1 / Serrano - Villa PK #2
	Ellis	472	39	511	Yes	Voltage Collapse	Barre-Ellis 230kV Line + SONGS-Santiago #1 and #2 230 kV lines
	El Nido	544	94	568	No	La Fresa-Hinson 230 kV line	La Fresa-Redondo #1 and #2 230 kV lines

** Mira Loma 500/230kV Bank #2 has a 1-Hr emergency rating that can be utilized by assuming up to 600 MW load shed/transfer after 1-Hr.

Time Constrained Portfolio Long-Term (2021) LCR Study Results

Portfolios	Area	LCR			Existing OTC Units Needed?	Constraint	Contingency
		Non-D.G. (MW)	D.G. (MW)	Total (MW)			
Time-Constrained	Overall LA Basin	12,677	687	13,364	Yes	Mira Loma West 500/230 bank #1 (24-Hr rating) **	Chino - Mira Loma East #3 230 kV line + Mira Loma West 500/230 kV bank #2
		11,478	687	12,165	Yes	Eagle Rock-Sylmar S 230 kV Line	Sylmar S-Gould 230 kV line + Lugo-Victorville 500kV line
	Western	6,954	443	7,397	Yes	Serrano-Villa PK #1	Serrano-Lewis #1 / Serrano-Villa PK #2
	Ellis	495	61	556	Yes	Voltage Collapse	Barre - Ellis 230 kV line + SONGS-Santiago #1 and #2 230 kV lines
	El Nido	589	31	620	No	La Fresa-Hinson 230 kV line	La Fresa-Redondo #1 and #2 230 kV lines

** Mira Loma 500/230kV Bank #2 has a 1-Hr emergency rating can be utilized by assuming up to 600 MW load shed/transfer after 1-Hr.

Approximate Generation Effectiveness Factors for Western LA

Gen Name	Serrano _ villa Park 230kV line
BARPKGEN 13.8 #1	32
BARRE 66.0 #11	32
ANAHEIMG 13.8 #1	31
LWISANM 69.0 #RT	30
ALAMT5 G 20.0 #5	24
HUNT1 G 13.8 #1	23
ORCOGEN 13.8 #1	22
ELLIS 66.0 #D7	22
JOHANNA 66.0 #D6	20
SANTIAGO 66.0 #10	17
COYGEN 13.8 #1	17
LITEHIPE 66.0 #10	15
ICEGEN 13.8 #D1	15
DELAMO 66.0 #D9	15
BRIGEN 13.8 #1	15
LBEACH5G 13.8 #R5	15
HARBOR 230.0 #F1	15
HINSON 66.0 #D8	15
CARBGEN1 13.8 #1	15
SERRFGEN 13.8 #D1	15
THUMSGEN 13.8 #1	15
CARBGEN2 13.8 #1	15

Gen Name	Serrano _ villa Park 230kV line
ARCO 6G 13.8 #6	15
CENTER 66.0 #D3	15
SIGGEN 13.8 #D1	15
CTRPGEN 13.8 #1	15
LCIENEGA 66.0 #D9	14
VENICE 13.8 #1	14
EL NIDO 66.0 #D5	14
LA FRESA 66.0 #D2	14
MOBGEN1 13.8 #1	14
OUTFALL1 13.8 #1	14
PALOGEN 13.8 #D1	14
REDON1 G 13.8 #R1	14
CHEVGEN2 13.8 #2	14
ELSEG4 G 18.0 #4	14
NRG ELS7 18.0 #7	14
LAGUBELL 66.0 #RT	12
FEDGEN 13.8 #1	12
REFUSE 13.8 #D1	12
MALBRG3G 13.8 #S3	12
MESA CAL 66.0 #D7	10
RIOHONDO 66.0 #RT	9
GOODRICH 33.0 #RT	9
BRODWYSC 13.8 #1	9

Gen Name	Serrano _ villa Park 230kV line
PASADNA2 13.8 #1	9
GOULD 66.0 #D1	7
EAGLROCK 66.0 #D1	7
OLINDA 66.0 #D7	7
WALNUT 66.0 #D1	7
HILLGEN 13.8 #D1	7
EME WCG2 13.8 #1	6

Conclusions – Long-Term (2021) LCR and OTC Requirements

LCR Area	Trajectory		Environmental		ISO Base Case		Time-Constrained	
	High	Low	High	Low	High	Low	High	Low
	(MW)	(MW)	(MW)	(MW)	(MW)	(MW)	(MW)	(MW)
LA Basin	10,743	10,263	11,246	10,891	11,010	10,516	12,165	11,663
Western LA Basin	9,168	7,797	8,482	7,468	8,831	7,421	8,833	7,397
Ellis	531		597		511		556	
El Nido	619		585		568		620	
OTC	3,741	2,370	2,884	1,870	3,834	2,424	3,896	2,460

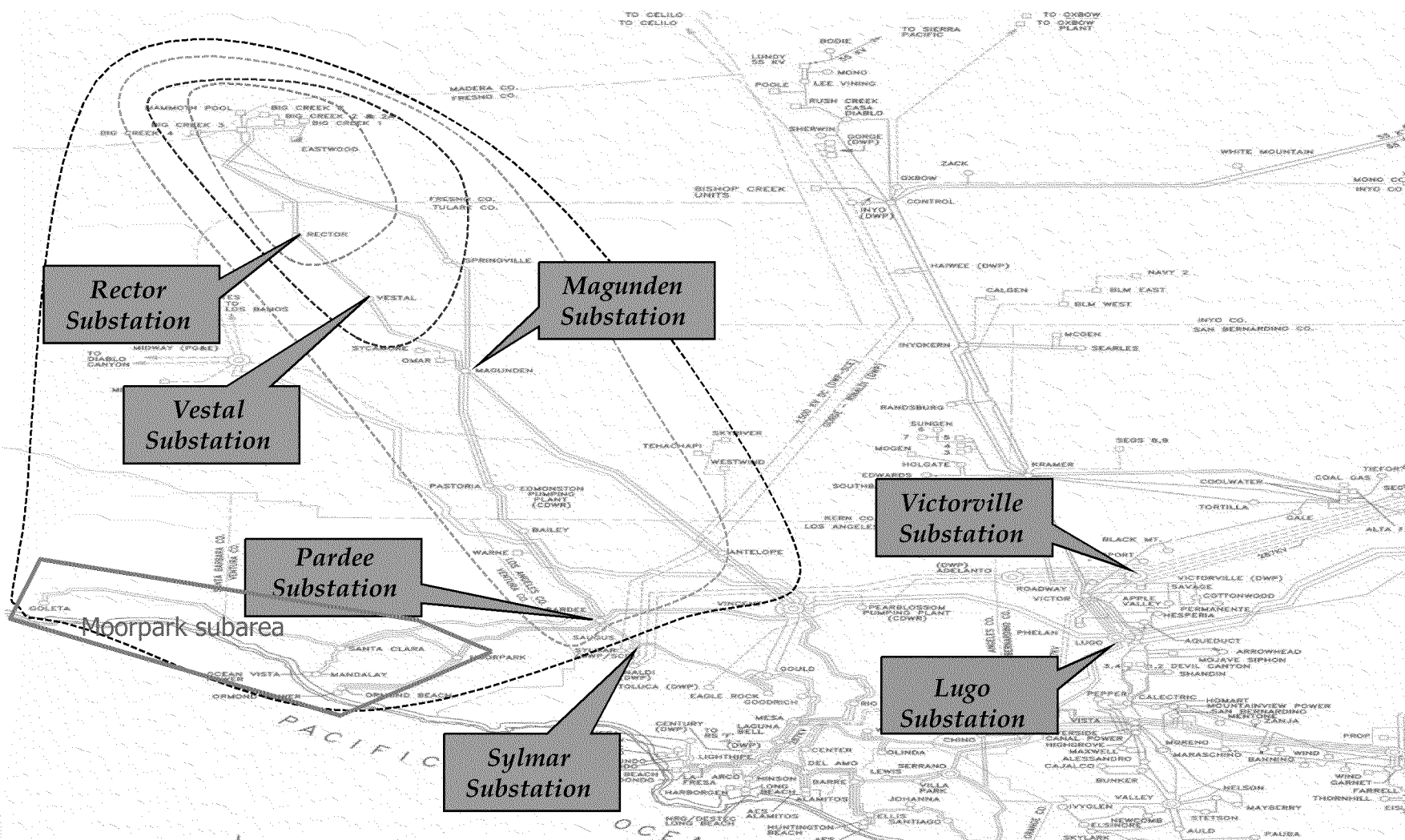
Note: Mira Loma 500/230kV Bank #2 has a 1-Hr emergency rating that can be utilized by assuming up to 600 MW load shed/transfer after 1-Hr.

Big Creek/Ventura OTC Study

Overview

- Overview of the Big Creek / Ventura
- Long-term (2021) local capacity requirement (LCR) study results
- Generation effectiveness factors
 - For mitigating LCR area's primary loading constraint
- Conclusions
 - Range of LCR requirements (for areas with thermal constraints)

Overview of Big Creek / Ventura



Big Creek / Ventura Area Long-Term (2021) Load and Resources Summary

Itemized Details	Trajectory (MW)	Environmentally Constrained (MW)	ISO Base Case (MW)	Time Constrained (MW)
Generation				
Existing OTC Capacity (2012)			2075	

Areas studied

- Big Creek / Ventura
 - Larger Big Creek / Ventura
 - Moorpark
 - Rector
 - Vestal

Trajectory Portfolio Long-Term (2021) LCR Study Results

Portfolios	Area	LCR			Existing OTC Units Needed?	Constraint	Contingency
		Non-D.G. (MW)	D.G. (MW)	Total (MW)			
Trajectory	Overall Big Creek Ventura	2,367	4	2,371	No	Remaining Sylmar-Pardee 230 kV line	Sylmar-Pardee #1 and #2 + Pastoria Generation
	Moorpark	735	0	735	Yes	Voltage Collapse	Pardee-Moorpark #1 230kV + Pardee-Moorpark #2 and #3 230 kV lines
	Rector	653	0	653	No	Vestal-Rector #1 or #2 line	Vestal-Rector #1 or #2 line + Eastwood gen
	Vestal	786	0	786	No	Magunden-Vestal 230 kV #1 or #2 line	Magunden-Vestal 230 kV #1 or #2 line + Eastwood gen

Environmentally Constrained Portfolio Long-Term (2021) LCR Study Results

Portfolios	Area	LCR			Existing OTC Units Needed?	Constraint	Contingency
		Non-D.G. (MW)	D.G. (MW)	Total (MW)			
Environmentally constrained	Overall Big Creek Ventura	2,185	419	2,604	No	Antelope 500/230 kV bank #1 or #2	Antelope 500/230 kV Bank #1 or #2 + Magunden-Omar 230 kV line (and the associated generation)
	Moorpark	502	140	642/857	Yes	Voltage Collapse	Pardee-Moorpark #1 230 kV + Pardee-Moorpark #2 and #3 230 kV lines
	Rector	489	129	618	No	Vestal - Rector #1 or #2 line	Vestal - Rector #1 or #2 line + Eastwood gen
	Vestal	677	158	835	No	Magunden-Vestal 230 kV #1 or #2 line	Magunden-Vestal 230 kV #1 or #2 line + Eastwood gen

ISO Base Case Portfolio Long-Term (2021) Study Results

Portfolios	Area	LCR			Existing OTC Units Needed?	Constraint	Contingency
		Non-D.G. (MW)	D.G. (MW)	Total (MW)			
Base	Overall Big Creek Ventura	2,377	61	2,794	No	Antelope 500/230 kV Bank #1 or #2	Antelope 500/230kV bank #1 or #2 + Magunden- Omar 230 kV line (and the associated generation)
	Moorpark	637	14	651	Yes	Voltage Collapse	Pardee-Moorpark #1 230kV + Pardee-Moorpark #2 and #3 230 kV lines
	Rector	584	16	600	No	Vestal-Rector #1 or #2 line	Vestal-Rector #1 or #2 line + Eastwood gen
	Vestal	755	18	773	No	Magunden-Vestal 230 kV #1 or #2 line	Magunden-Vestal 230 kV #1 or #2 line + Eastwood gen

Time Constrained Portfolio Long-Term (2021) LCR Study Results

Portfolios	Area	LCR			Existing OTC Units Needed?	Constraint	Contingency
		Non-D.G. (MW)	D.G. (MW)	Total (MW)			
Time	Overall Big Creek Ventura	2,558	95	2,653	No	Antelope 500/230 kV Bank #1 or #2	Antelope 500/230 kV bank #1 or #2 + Magunden-Omar 230kV line (and the associated generation)
	Moorpark	632	41	673/803	Yes	Voltage Collapse	Pardee-Moorpark #1 230 kV + Pardee-Moorpark #2 and #3 230 kV lines
	Rector	555	18	573	No	Vestal-Rector #1 or #2 line	Vestal-Rector #1 or #2 line + Eastwood gen
	Vestal	785	21	806	No	Magunden-Vestal 230 kV #1 or #2 line	Magunden-Vestal 230kV #1 or #2 line + Eastwood gen

Conclusions – Long-Term (2021) LCR and OTC Requirements

LCR Area	Trajectory (MW)	Environmental (MW)	ISO Base Case (MW)	Time- Constrained (MW)
Big Creek / Ventura	2,371	2,604	2,794	2,653
Moorpark	735	642/857	651	673/803
Rector	474	597	511	556
Vestal	638	585	568	620
OTC	430	430	430	430

Simulation Tools

Simulation Tools

- The GE Positive Sequence Load Flow (PSLF)
 - for studying power system transmission networks and equipment performance
 - in both the steady-state and dynamic environments.
 - used by most transmission providers in WECC
 - Used for NERC compliance studies

Conclusions

- These assessments were performed to determine capacity needs to maintain local reliability.
- For local capacity requirement needs, the following LCR areas were determined to continue needing generation at the existing OTC power plant locations (or electrically equivalent locations):
 - LA Basin
 - Big Creek/Ventura
 - (San Diego area needs are being assessed in a separate proceeding)