

Renewable Resource Integration -- Scoping Study of Strategic Transmission, Operations and Reliability Issues

Presented to
**California Energy Commission
IEPR Staff Workshop on Transmission Issues
for 33% Renewables by 2020**

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Context and Key Findings

- Scoping Study to Identify Transmission and Operating Issues for Timely Integration of Renewables
- Resource mix and need scenarios developed for scoping of issues – not meant as a forecast
- California needs to integrate 23,000 to 40,000 MW of new renewables in the next 20-years. Scoping study focus on mid-range number of 30,000 MW of additions
- Major load centers served via transmission gateways surrounding the load centers
- Bulk of new renewables likely to be located remote from load centers
- Renewables integration requires – connection to the backbone grid, upgrades from the backbone grid to transmission gateways, and expansion of transmission gateway capacity for delivery to load centers
- Two-thirds or 20,000 MW likely to be delivered to L.A. Basin transmission gateways
- Scoping Study focus on L.A. basin transmission gateway expansion and delineation of operating issues

Renewable Resource Need

		2020	2030
Energy Requirement (BkWh)		337	383
Renewable Energy Under Alternative RPS Scenarios (BkWh)			
	20%	67	-
	33%	111	126
	50%	-	192
Total Renewable Capacity Requirement Under Alternative Resource Scenarios MW			
	20%	16,500	-
	33%	26,600	30,100
	50%	-	46,700

RPS Target Area

Renewable Capacity Additions

- Existing Renewable Capacity in 2006 – 6,300 MW
- Capacity Additions by 2030 – 23,000 to 40,000 MW
- Mid-range Estimate of Need – 30,000 MW
- Representative mix of renewable resources for 30,000 MW of additions

Resource	MW
Geothermal	3,500
Biomass*	1,500
Wind	16,000
Solar PV*	2,000
Solar Thermal	7,000

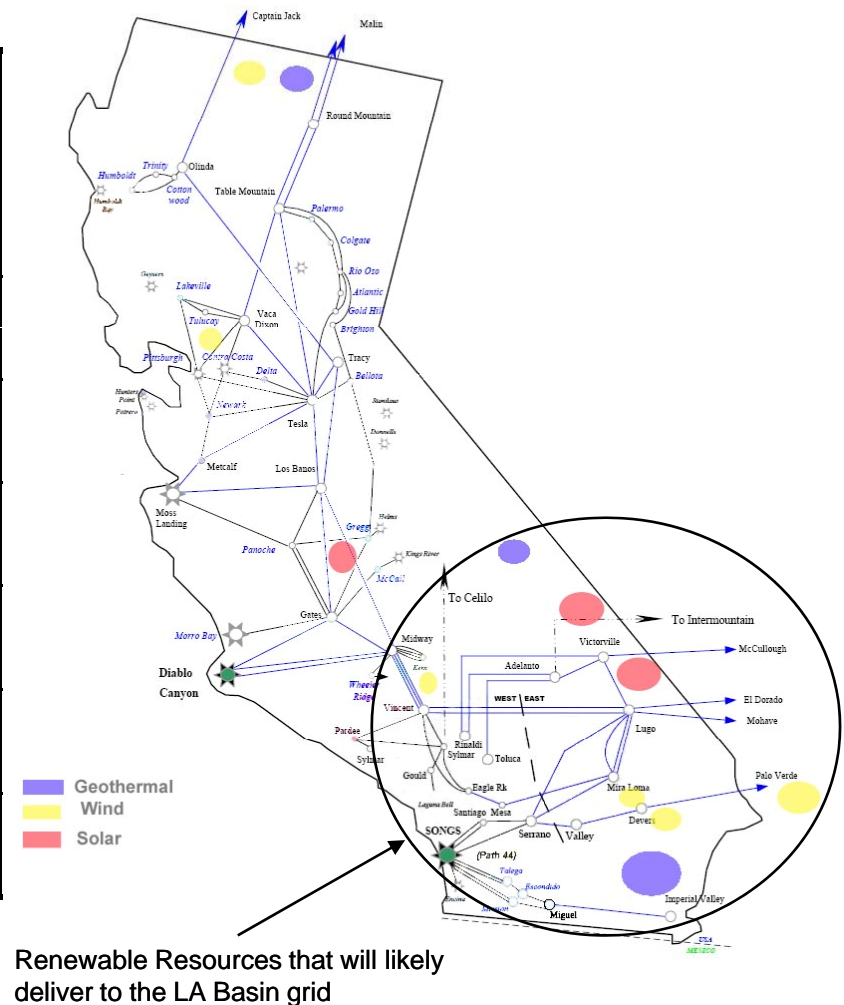
*Likely to be distributed within load centers.

Distribution of Renewable Resources

Likely Locations of Renewable Resources

Resource Type	PNW/ Northern Nevada (MW)	Northern/ Central CA (MW)	LA Basin/ Nevada/ Arizona (MW)	Total (MW)
Geothermal	1,000	400	2,100	3,500
Biomass*		*	*	1,500
Wind	2,000	2,000	12,000	16,000
Solar PV*		*	*	2,000
Solar Thermal		1,500	5,500	7,000
Total	3,000	3,900	19,600	30,000

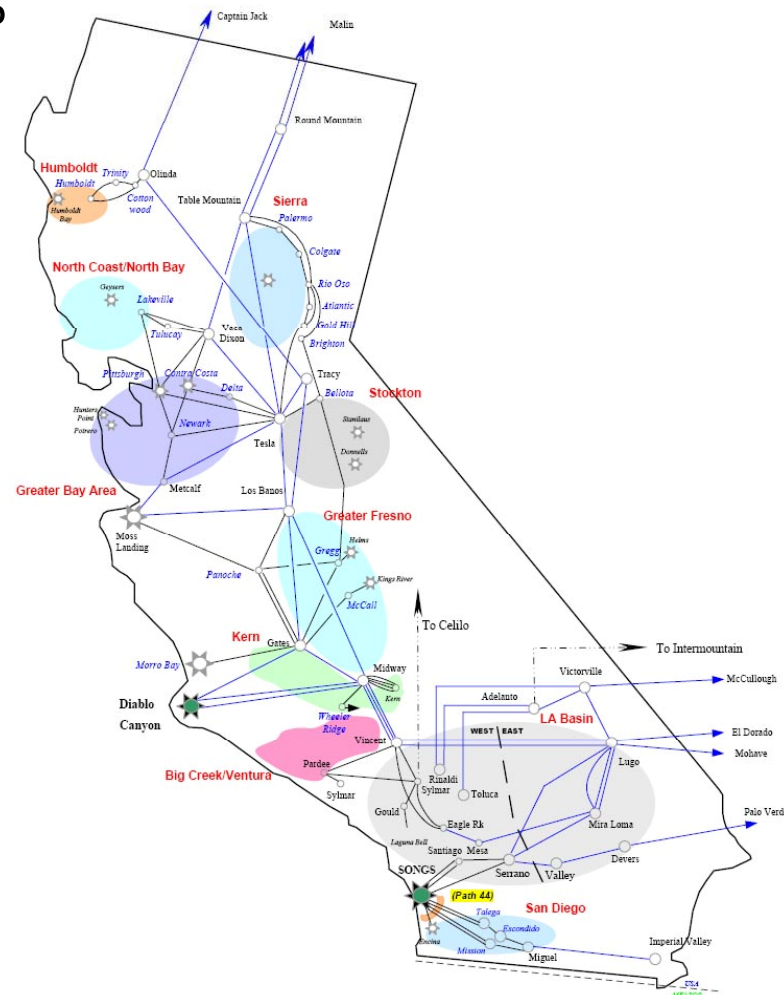
* Biomass and Solar PV assumed distributed within local areas



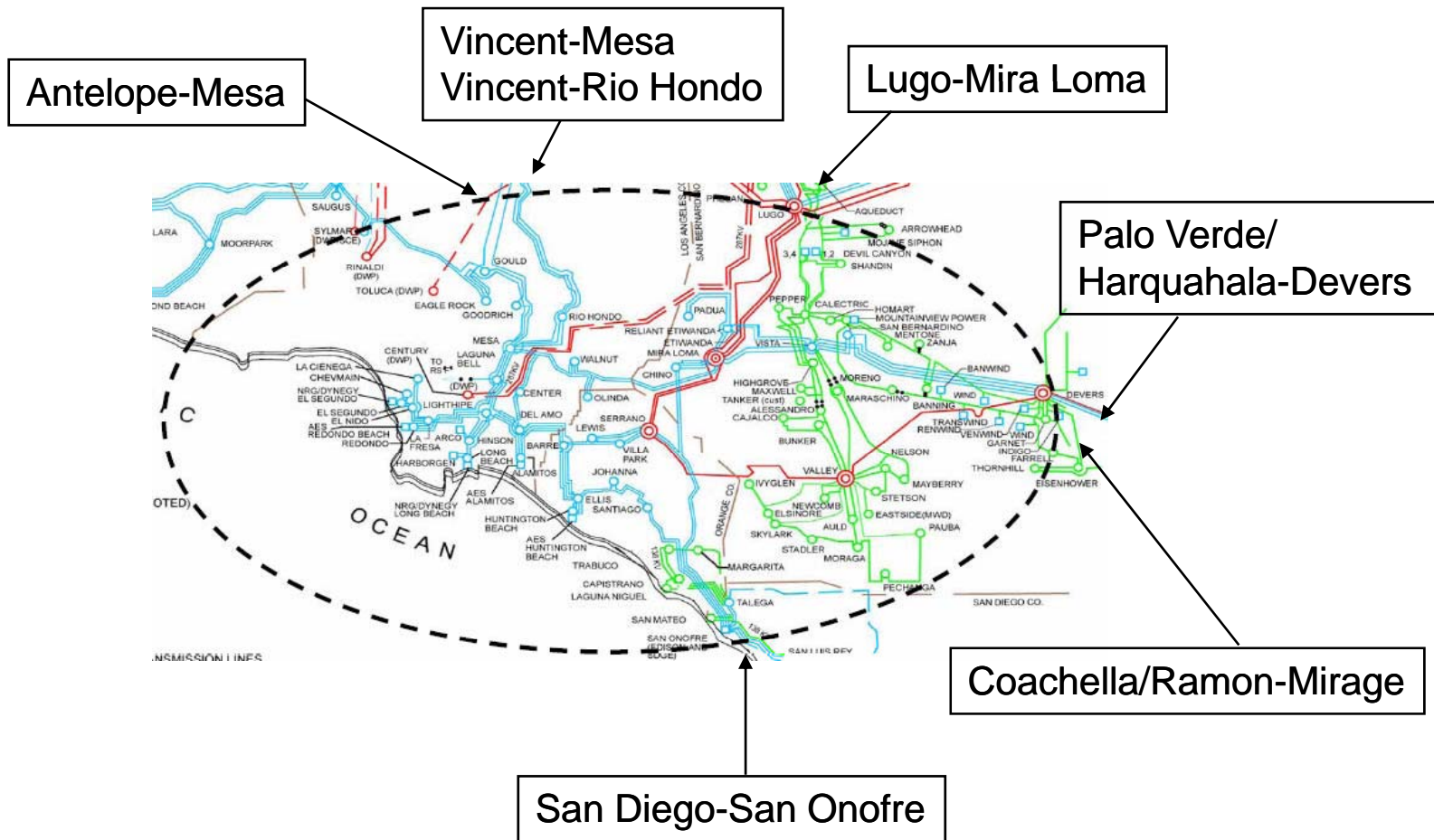
Locally Constrained Load Areas Served by Transmission Gateways

- Five major load areas comprise 87% of CAISO load
- Two-thirds of renewable additions likely to deliver via L.A. Basin Transmission Gateways

Local Area	2008 Forecast Peak Load (MW)
Humboldt	199
North Coast/North Bay	1,295
Sierra	2,091
Stockton	1,333
Greater Bay Area	9,870
Greater Fresno	3,260
Kern	1,324
LA Basin	19,648
Big Creek/Ventura	4,911
San Diego	4,992
Total	49,123



20,000 MW of Renewable Capacity Additions Delivered via L.A. Basin Gateways



Renewable Additions for Delivery to L.A. Basin -- Illustrative

Potential renewable deliveries into or through the L.A. Basin will require expansion of the L.A. Basin Gateways:

Renewable Delivery (MW)	Renewable Type	Likely LA Basin Gateway Delivery Point
1,500*	Wind	Vincent/Antelope Gateway
4,000	Geothermal & Wind	Mirage Gateway
5,500 - 7,500	Solar Thermal & Nevada/Arizona Wind	Lugo Gateway
2,000 - 4,000	Wind	Devers Gateway

- Current Transmission Gateway Capability will have to be tripled to integrate renewable capacity additions
- Shutdown of local generation will increase need to expand transmission gateway capability

* Delivery expansion in addition to Tehachapi Transmission Project (4,500 MW)

Issues and Action Items for L.A. Basin

Issue	Action Item
Add New Renewables	▪ Addition of 20,000 MW of Renewables – Base Case
Transmission Gateway Capacity	▪ Expand by 10,000 to 20,000 MW ▪ 5-15 year lead time
Local Network Reinforcements	▪ Upgrade lines, fault current limiters, breakers, remedial action schemes
Nomogram Capacity Import Limits	▪ Expand by 10,000 to 20,000 MW
Regulation and Ramping	▪ Need additional Regulation and Ramping ▪ Utilize storage, demand management, automatic load control
Local Voltage Support	▪ Add capacitors and dynamic voltage control devices

- Shutdown of existing local generation adversely impacts the above list of issues
- Same issues will need to be addressed for all load centers
- Transmission links between regions will need to be expanded, e.g., L.A. Basin to Northern California and San Diego

Summary Recommendations

- Transmission gateway capacity needs to be expanded for timely integration of renewables
- Transmission owners and CAISO need to move the planning horizon out to 15-20 years
 - Define long-term transmission gateway requirements
 - Define long-term transmission requirements from gateways into load centers
 - Define interregional transmission requirements, e.g., L.A. Basin to San Diego and Northern California
- CAISO needs to provide utilities and CPUC with guidance on resource attributes needed for operability of the power system
- Policymakers need to support early planning and upgrades of transmission gateway capacity and deliverability to load centers (in advance of renewable development). This effort will be aided by the RETI effort currently underway