



# **Comparative Reliability Evaluation for Alternative New 500 kV Transmission Lines into San Diego**

Presentation for STEP Group

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## Outline

- Transmission projects
- Base case development
- Study methodology
- Study results
- Summary of comparative reliability benefits of the Transmission projects
- Sensitivities
- Conclusions
- Questions & Comments



## Transmission Projects

### **Imperial Valley- San Diego Expansion Plan (ISEP)**

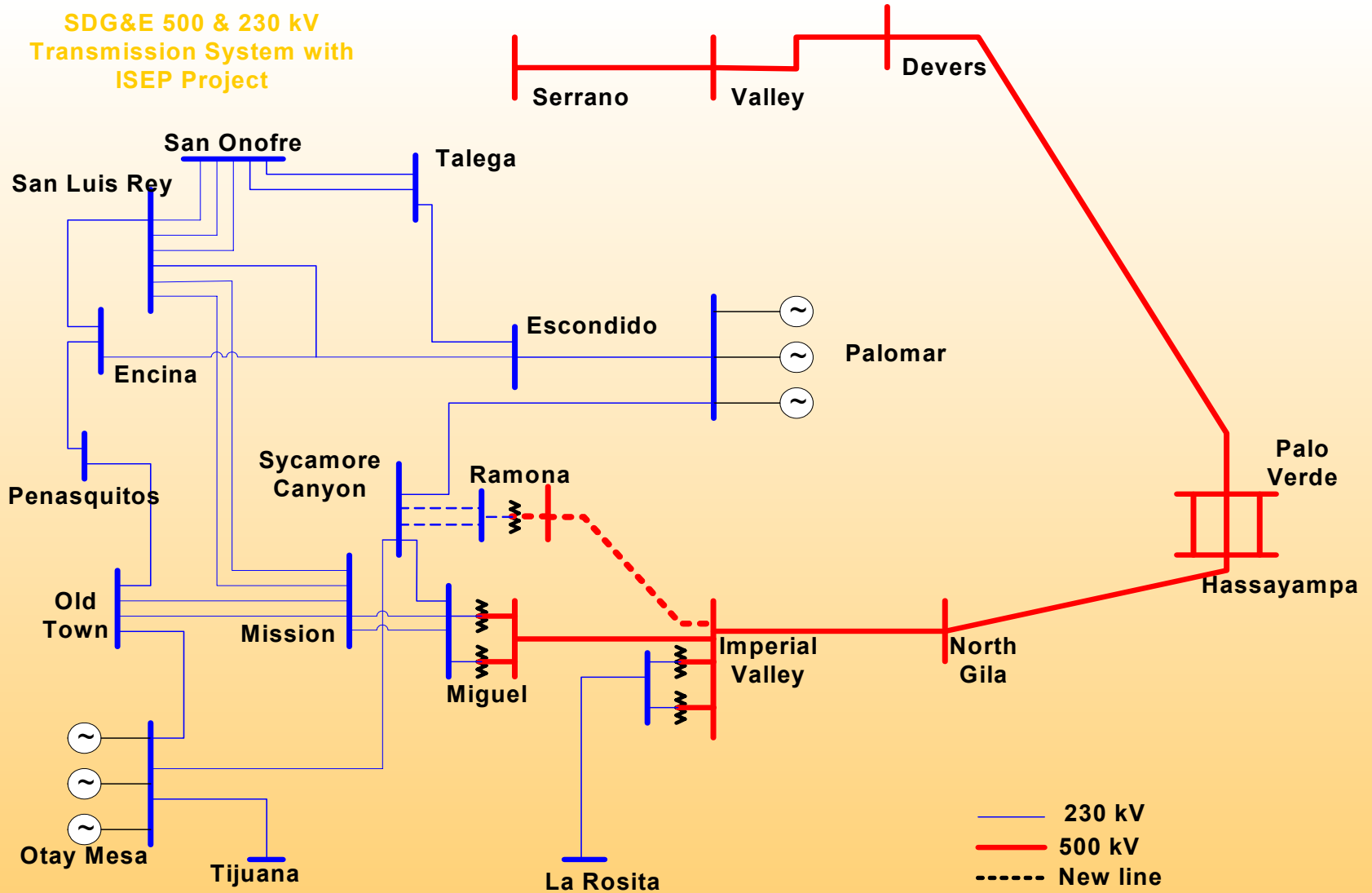
- New Imperial Valley-Ramona 500 kV line (~120 Miles)
- Two new Ramona-Sycamore 230 kV lines (~16 Miles)
- New 500/230 kV Transformer @ Ramona



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SDG&E 500 & 230 kV  
Transmission System with  
ISEP Project





## Transmission Projects

### **New 500 kV line associated with Lake Elsinore Advanced Pumped Storage Project (LEAPS)**

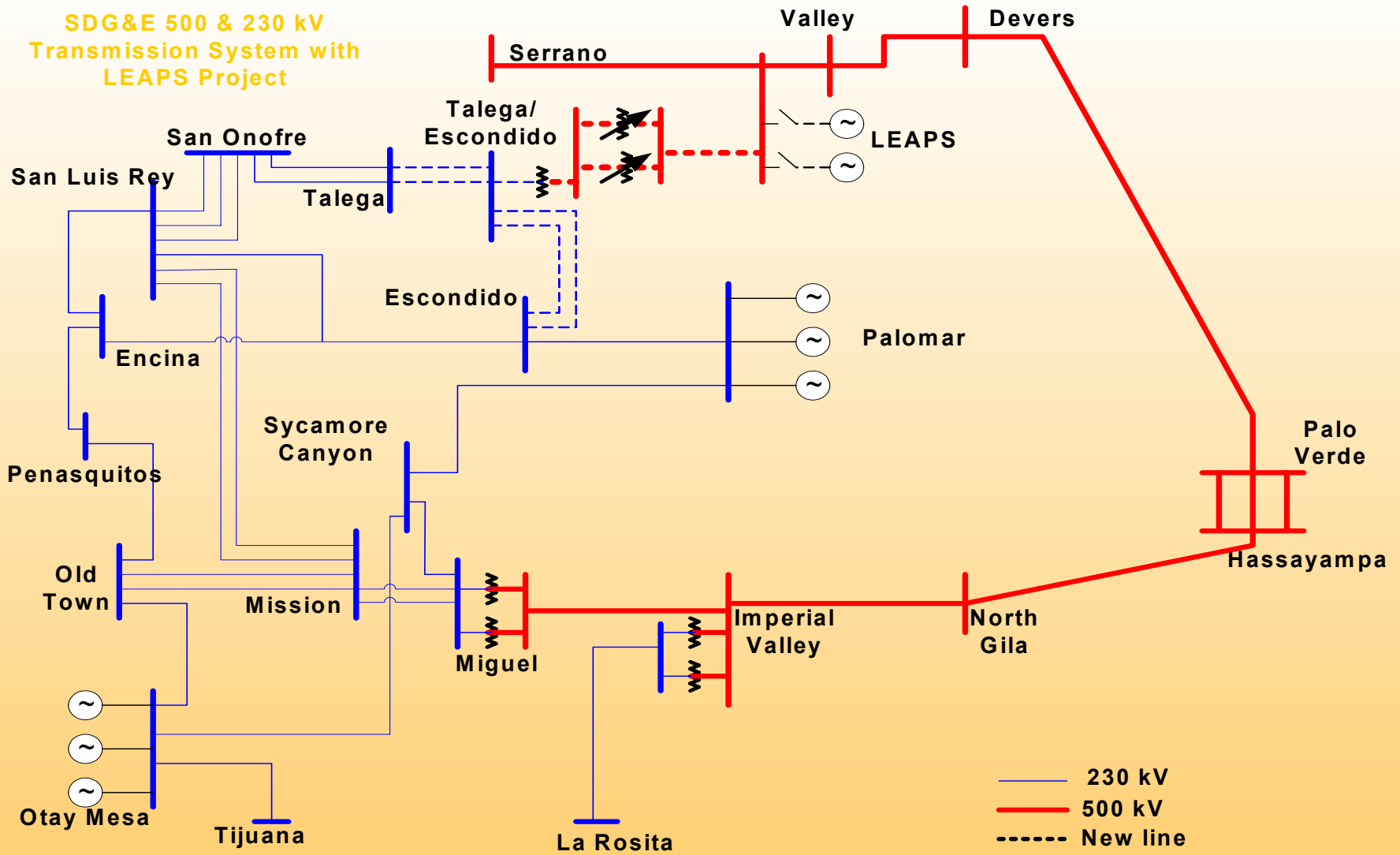
- New Talega/Escondido-Valley/Serrano 500 kV line (~30 Miles)
- New Talega-Escondido 230 kV line that loops into new Talega/Escondido 500 kV substation
- Looping of the existing Talega-Escondido 230 kV line into the new Talega/ Escondido 500 kV substation
- New 500 kV phase shifting transformer @ Talega/Escondido 500 kV substation
- New 500/230 kV transformer @ Talega/Escondido 500 kV substation



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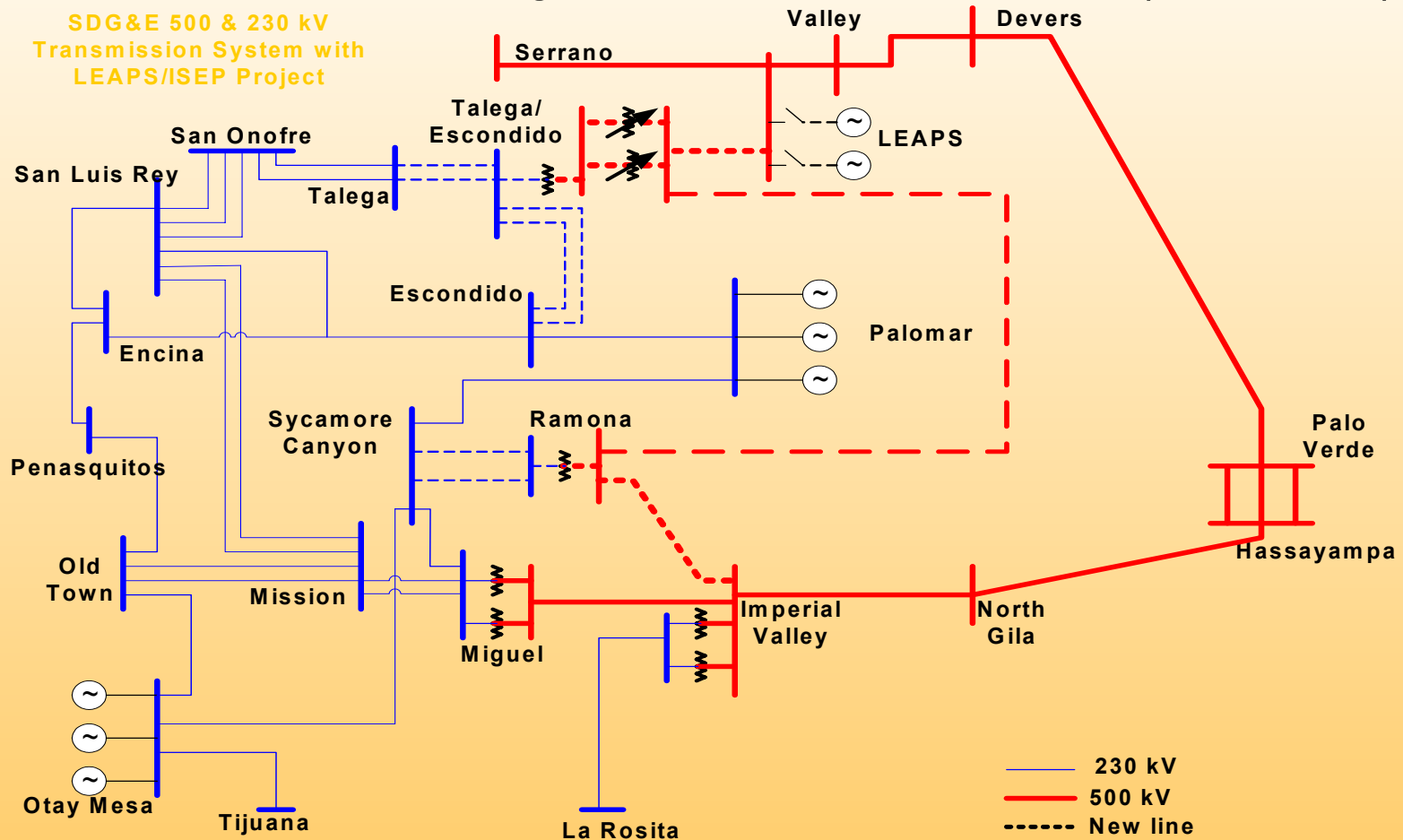




## Transmission Projects Combination of ISEP and LEAPS

- New Ramona-Talega/Escondido 500 kV line (~60 Miles)

SDG&E 500 & 230 kV  
Transmission System with  
LEAPS/ISEP Project





## Base Case Development

- Base Cases
  - Heavy Summer 2007 and 2013 (SDG&E 2003 Transmission Expansion Plan cases)
- SDG&E load and losses
  - 4720 MW (2007) and 5400 MW (2013)
- SDG&E Generation Scenarios
  - Palomar (541 MW)
  - Otay Mesa (596 MW)
  - South Bay (assumed retired in 2013 case)
- SDG&E Import
  - 2850 MW
  - Net interchange with CFE set to 0 MW



## Study Methodology

- Pre-project cases tested to ensure compliance with California ISO, NERC and WECC standards
- Pre-project cases screened to determine if higher San Diego imports are feasible
- Transfers to San Diego increased until limits are reached for the post-project cases
- To accommodate the increase in imports, the following order for generation reductions were applied:
  - South Bay generation
  - Encina generation
  - San Diego area peaking units
  - Pro-rata reductions at Palomar and Otay Mesa
- Performed regular power flow and post-transient studies



## Study Results

<b>ISEP Project</b>	<b>SDG&amp;E Import</b>	<b>Limiting Facility</b>
No Additional facility	2550 MW	Sycamore #1 &2 230/69 kV transformers
New Penasquitos- Sycamore 230 kV line	3000 MW	Sycamore #1 &2 230/69 kV transformers
New Penasquitos-Sycamore 230 kV line New Sycamore 230/69 kV transformer	3350 MW	Penasquitos #2 230/69 kV transformer
New Penasquitos-Sycamore 230 kV line New Sycamore 230/69 kV transformer New Penasquitos 230/69 kV transformer	3600 MW	Miguel 230/138 kV transformer



## Study Results

<b>LEAPS Project</b>	<b>SDG&amp;E Import</b>	<b>Limiting Facility</b>
No Additional facility	3050 MW	Miguel 230/138 kV transformer
New Miguel 230/138 kV transformer	3600 MW	Mission 230/69 kV transformer

<b>LEAPS/ISEP Project</b>	<b>SDG&amp;E Import</b>	<b>Limiting Facility</b>
No Additional facility	3400 MW	Sycamore #1&2 230/69 kV transformers
New Sycamore 230/69 kV transformer	3800 MW	Mission 230/69 kV transformer Miguel 230/138 kV transformer



## Summary of Comparative Reliability Benefits

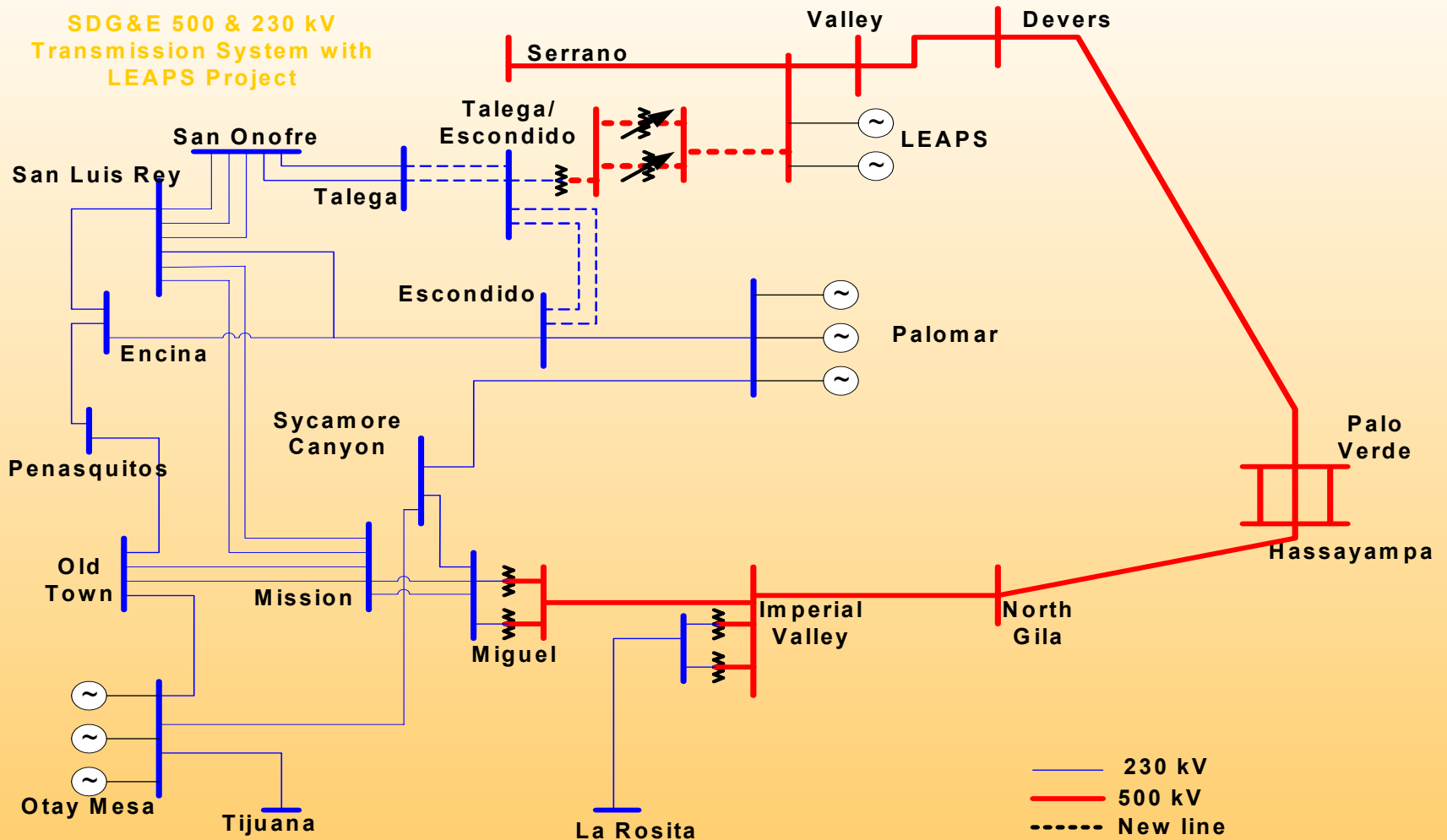
Items	Projects		
	ISEP	LEAPS	Combined ISEP and LEAPS
San Diego Import limit	3600 MW	3600 MW	3800 MW
Import limit with Hassyampa-N.Gila out- of- service	3000 MW	3450 MW	3450 MW
Import limit with IV-Miguel out-of-service	3300 MW	3300 MW	3450 MW
New facilities required	Penasquitos –Sycamore 230 kV line	Miguel 230/138 kV transformer	Sycamore 230/69 kV transformer
	Sycamore 230/69 kV transformer		
	Penasquitos 230/69 kV transformer		
Common facility upgrades	Old Town #1 & 2 230/69 kV transformer		
	Sycamore-Carlton Hills Tap 138 kV line		
	Scripps-Sycamore 69 kV line		
	Kettner-B 69 kV line		
	Old Town–Kettner 69 kV line		
Additional facility upgrades required	Pomerado-Poway 69 kV line	Penasquitos #2 230/69 kV transformer	Penasquitos #2 230/69 kV transformer
	Sycamore-Elliot 69 kV line	Sycamore #1 & 2 230/69 kV transformer	Elliot-Sycamore 69 kV line
		Rincon-Warners 69 kV line	Sycamore-Chicarita 138 kV line
	Navstmr-Division 69 kV line	Miguel-Proctor Valley 138 kV line	Navstmr-Division 69 kV line
South Bay-Telegraph Canyon 138 kV line			
SPS required	SPS to trip load for Miguel –Mission #1 & 2 230 kV lines outages	Existing SPS deployed to trip generation for IV-Miguel Outage	SPS to trip load for Miguel – Mission #1 & 2 230 kV outages
G-1/N-1 satisfied	Yes	Yes	Yes
Voltage Support required	~300 Mvar at South Bay	~350 Mvar at South Bay ~400 Mvar at Devers 500 kV	~350 Mvar at South Bay ~400 Mvar at Devers 500 kV
West of Devers flow	1140 MW	1386 MW	1200 MW
South of Lugo flow	4935 MW	5182 MW	4968 MW



## Sensitivity Study- LEAPS with 500 MW Pump

### Storage Plant

SDG&E 500 & 230 kV Transmission System with LEAPS Project





## Sensitivity study results-LEAPS with 500 MW Pump Storage Plant

- Import limit, new facility requirements, existing facility upgrades are the same as LEAPS project without the Pump Storage Plant
- Benefits from the Pump Storage Plant
  - Additional VAR support at Valley 500 kV
  - Additional MW for dispatch during the generation cycle
  - About 130 MW reduction on West of Devers flow during the generation cycle
  - About 250 MW reduction on South of Lugo flow during the generation cycle
- Impact of pumping cycle on reliability of the California ISO grid
  - Not studied



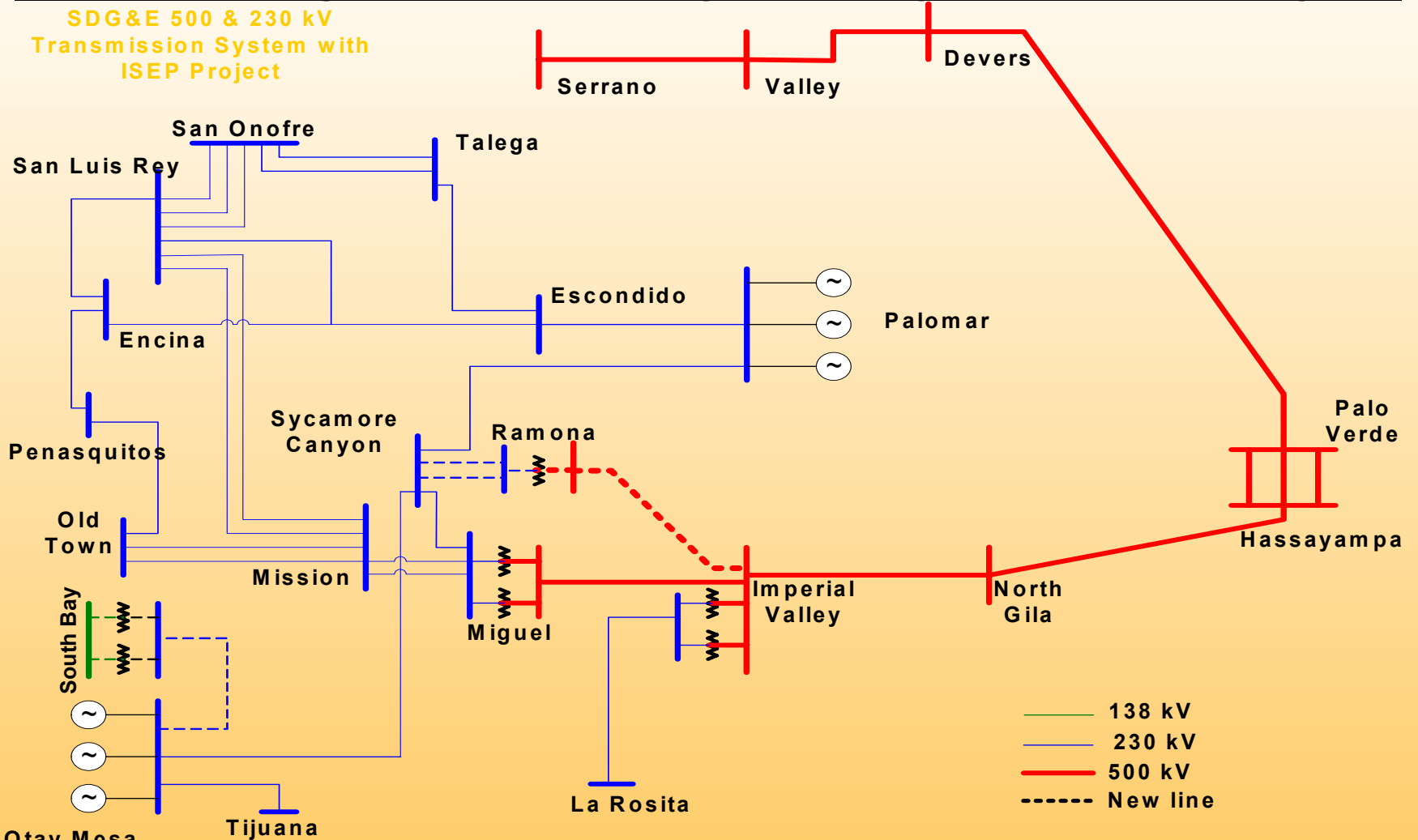
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## ISEP Project Sensitivity Study-Otay Mesa

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### terminating at South Bay and Sycamore Canyon

SDG&E 500 & 230 kV  
Transmission System with  
ISEP Project





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## Sensitivity Study Results-ISEP Project

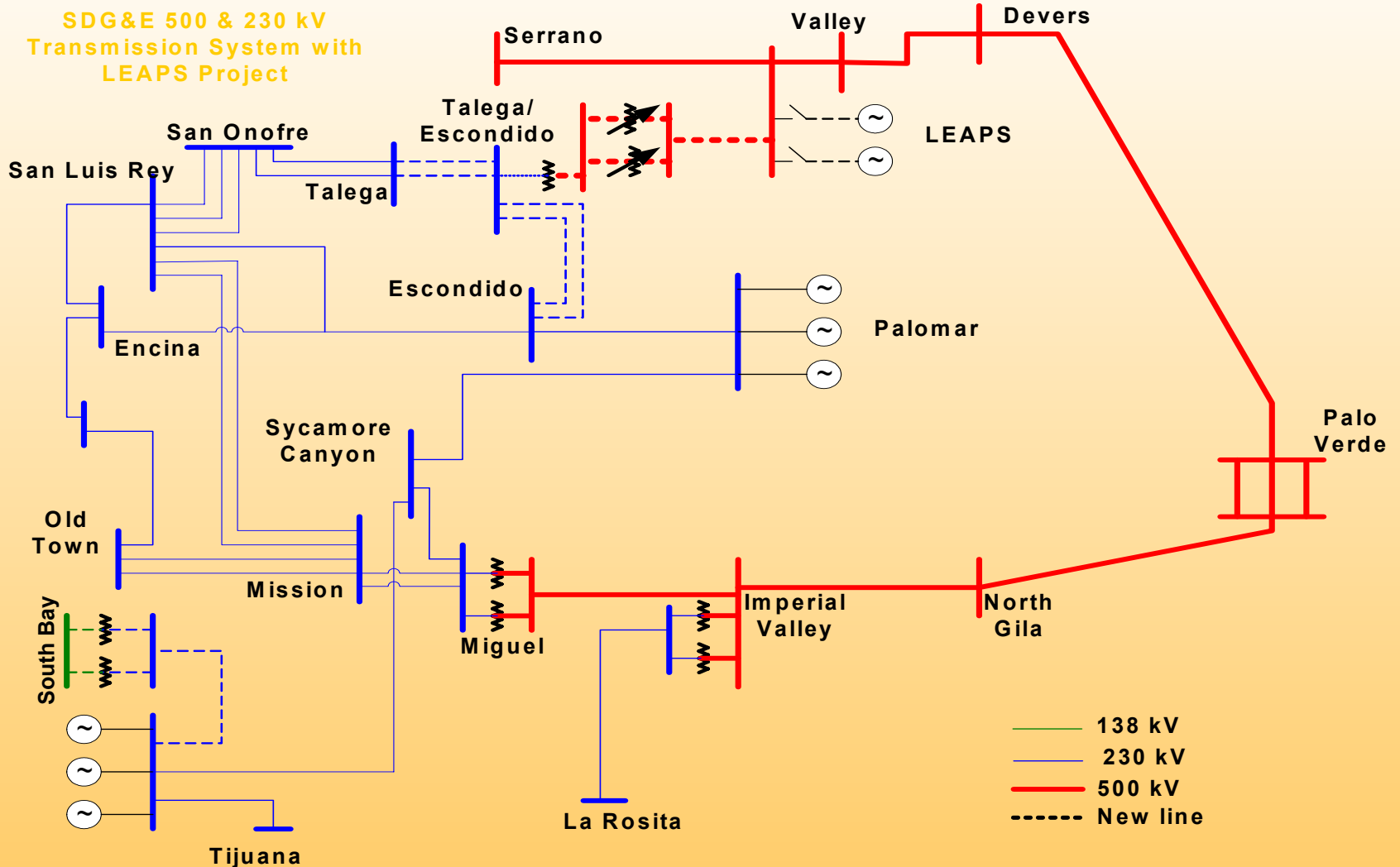
California Independent  
System Operator

Items	ISEP Project	
	Otay Mesa-Old Town Connection	Otay Mesa-South Bay Connection
San Diego Import limit	3600 MW	3600 MW (Could increase to 3820 MW)
Import limit with SWPL out- of- service	3000 MW for Hassyampa-N. Gila section	3000 MW for Hassyampa-N. Gila section
	3300 MW for IV-Miguel section	3100 MW for IV-Miguel section
New facilities required	Penasquitos –Sycamore 230 kV line	Sycamore 230/69 kV transformer
	Sycamore 230/69 kV transformer	
	Penasquitos 230/69 kV transformer	
Common facility upgrades	Scripps-Sycamore 69 kV line	
	Pomerado-Poway 69 kV line	
	Elliot–Sycamore 69 kV line	
	Sycamore-Carlton Hills Tap 138 kV line	
Additional facility upgrades required	Old Town #1 &2 230/69 kV transformer	None
	Old Town-Kettner 69 kV line (N-1)	
	Kettner-B 69 kV line	
	Navstmtr-Division 69 kV line (N-1)	
SPS required	SPS to trip load for Miguel –Mission #1 &2 230 kV lines outages	SPS to trip load for Talega-S. Onofre #1 &2 230 kV outages
G-1/N-1 satisfied	Yes	Yes
Voltage Support required	~300 Mvar at South Bay	~150 Mvar at South Bay
Miguel Import	1356 MW	1351 MW



## LEAPS Project Sensitivity Study-Otay Mesa terminating at South Bay and Sycamore Canyon

SDG&E 500 & 230 kV Transmission System with LEAPS Project





## Sensitivity Study Results-LEAPS Project

Items	LEAPS Project	
	Otay Mesa-Old Town Connection	Otay Mesa-South Bay Connection
San Diego Import limit	3600 MW	3600 MW
Import limit with SWPL out- of- service	3450 MW for Hassyampa-N. Gila section	3600 MW for Hassyampa-N. Gila section
	3300 MW for IV-Miguel section	3600 MW for IV-Miguel section
New facilities required	Miguel 230/138 kV transformer	None
Common facility upgrades	Sycamore #1 &2 230/69 kV transformer	
	Scripps-Sycamore 69 kV line	
	Sycamore-Carlton Hills Tap 138 kV line	
Additional facility upgrades required	Old Town #1 &2 230/69 kV transformer	Sycamore-Chicarita 138 kV line
	Penasquitos #2 230/69 kV transformer	
	Old Town-Kettner 69 kV line	
	Kettner-B 69 kV line	Mira Sorrento-Penasquitos 138 kV line
	Rincon-Warners 69 kV line	
	Miguel-Proctor Valley 138 kV line	
	South Bay-Telegraph Canyon 138 kV line	
SPS required	Existing SPS deployed to trip generation for IV-Miguel 500 kV line Outage	Existing SPS deployed to trip generation for IV – Miguel 500 kV line outage
G-1/N-1 satisfied	Yes	Yes
Voltage Support required	~350 Mvar at South Bay	~150 Mvar at South Bay
	~400 Mvar at Devers 500 kV	~400 Mvar at Devers 500 kV
West of Devers flow	1386 MW	1400 MW
South of Lugo flow	5182 MW	5198 MW



## Conclusions

- **Similarity in Benefits -ISEP vs. LEAPS**
  - Both will provide significant increase in San Diego Import capability from 2850 MW to 3600 MW
  - Both will require additional facilities or upgrades beyond the basic project scope to achieve the 3600 MW import limit
- **Differences in Operational Flexibility -ISEP vs. LEAPS**
  - ISEP would lead to the elimination of the existing SPS for an outage of Imperial Valley –Miguel 500 kV line, would require less voltage support additions and would result in lower loadings on West of Devers and South of Lugo paths
  - LEAPS would support a relatively higher import limit with a section of Southwest Power Link (SWPL) out of service



## Conclusions

- Combination of ISEP and LEAPS projects would
  - Provide 3800 MW San Diego import capability
  - Provide relatively higher import capability to San Diego for SWPL out of service
- Point of interconnection of Otay Mesa generating facility significantly impacts the new facility requirements for both the ISEP and LEAPS projects
  - Otay Mesa-South Bay connection results in lower number of new facility requirements to achieve 3600 MW import capability for either ISEP or LEAPS project



## Questions/Comments

*Thank you all.*