



# **Proposal for RPS Generation Scenarios to be Studied in 2011-2012 TPP**

and

# **Scenario Construction Methodology**

California Public Utilities Commission

July 8, 2011





# Agenda

- **Background: CPUC responsibilities and efforts to coordinate long-term generation and transmission planning**
- Methodology for constructing LTPP scenarios
- LTPP scenario results
- Scenario proposed by CPUC staff as 2011-2012 TPP base case
- Questions?





# Transmission permitting at the CPUC

- For IOU-proposed transmission facilities, the CPUC must issue:
  - for transmission line facilities 50-200 kV and/or substations 50 to 500 kV, a **Permit to Construct (PTC)**;
  - for transmission line facilities 200 kV and up, a **Certificate of Public Convenience and Necessity (CPCN)**
- Permitting process considers three major questions:
  - Need for the project (CPCN only) – Pub. Util. Code requires consideration of alternatives, including demand-side alternatives
  - Environmental impact – CEQA also requires alternatives analysis
  - Reasonable cost





# Long-term procurement oversight at the CPUC

- CPUC's biennial long-term procurement plan (LTPP) proceeding authorizes IOU procurement of new generation resources
  - 2010 LTPP considers needs to 2020
  - 33% RPS is a key driver of the amount and type of generation utilities may need
- 2010 LTPP (R.10-05-006) has three tracks:
  - Track 1: System – “to identify CPUC-jurisdictional needs for new resources to meet system or local resource adequacy need over the 2011-2020 planning horizon, including issues related to long-term renewables planning”
  - Track 2: Bundled customer procurement
  - Track 3: Rule and policy issues





# RPS planning assumptions in the LTPP

- In consultation with parties, CPUC staff developed four “base case load” renewable generation scenarios, representing possible 33% RPS futures in 2020
  - Scenarios consider transmission constraints, cost, commercial interest, environmental concerns, timing of development
  - Scenarios vary by technology, location, and other characteristics
  - ISO has studied the renewable integration needs of the four scenarios
  - Utilities have filed 10-year plans including the transmission and non-RPS generation needed to accommodate these scenarios
- Decision authorizing new gen. procurement expected late 2011
- LTPP will not direct RPS procurement, but implications of LTPP results may be considered in the CPUC’s RPS proceedings





# Importance of coordinated planning

- “Umbrella” LTPP proceeding considers forecasted levels of energy efficiency, demand response, distributed generation, utility-scale renewables, and fossil generation retirements, to determine overall procurement need
  - CPUC must consider many of these same resource alternatives when evaluating the need for a transmission line in the CPCN process
- Using common renewable scenarios across generation and transmission planning processes could allow for a smoother and coordinated CPUC “need determination” in the permitting process
- Coordinating and aligning assumptions should also reduce the risk of successful legal challenges to CPUC need determination





# Coordinating generation and transmission planning

- CPUC and CAISO signed Memorandum of Understanding on May 13, 2010
- Commits to closer coordination between generation resource planning and transmission planning
  - Desire to “work together to coordinate the ISO’s revised transmission planning process and identification of needed transmission infrastructure with the CPUC’s subsequent siting/permitting processes”
  - Renewable generation scenarios developed by the CPUC “will assist the ISO in identifying transmission projects needed under various renewable generation location assumptions and developing a comprehensive transmission plan”
- CPUC goal: ensure that the transmission planning process includes analysis necessary for permitting phase





# CPUC proposal for RPS Portfolios in 2011-2012 TPP

1. Study three of the four 33% RPS “base case load” scenarios developed for the 2010 LTPP proceeding:
  - Trajectory Scenario
  - Environmentally-Constrained Scenario
  - Time-Constrained Scenario
2. Use an updated version of the LTPP’s Cost-Constrained Scenario as the base case. Updates are as follows:
  1. Added 1,384 MW of solar photovoltaic to the discounted core, to correct an error in the previous scenarios and reflect approval of the Renewable Auction Mechanism
  2. Adjusted assumptions about the cost and capacity of new transmission for several CREZs, based on the ISO’s 2010-2011 plan and FERC filings: Imperial, Kramer, Mountain Pass, Palm Springs, Riverside East, Pisgah, Solano, and Westlands





# Agenda

- Background: CPUC responsibilities and efforts to coordinate long-term generation and transmission planning
- **Methodology for constructing LTPP scenarios**
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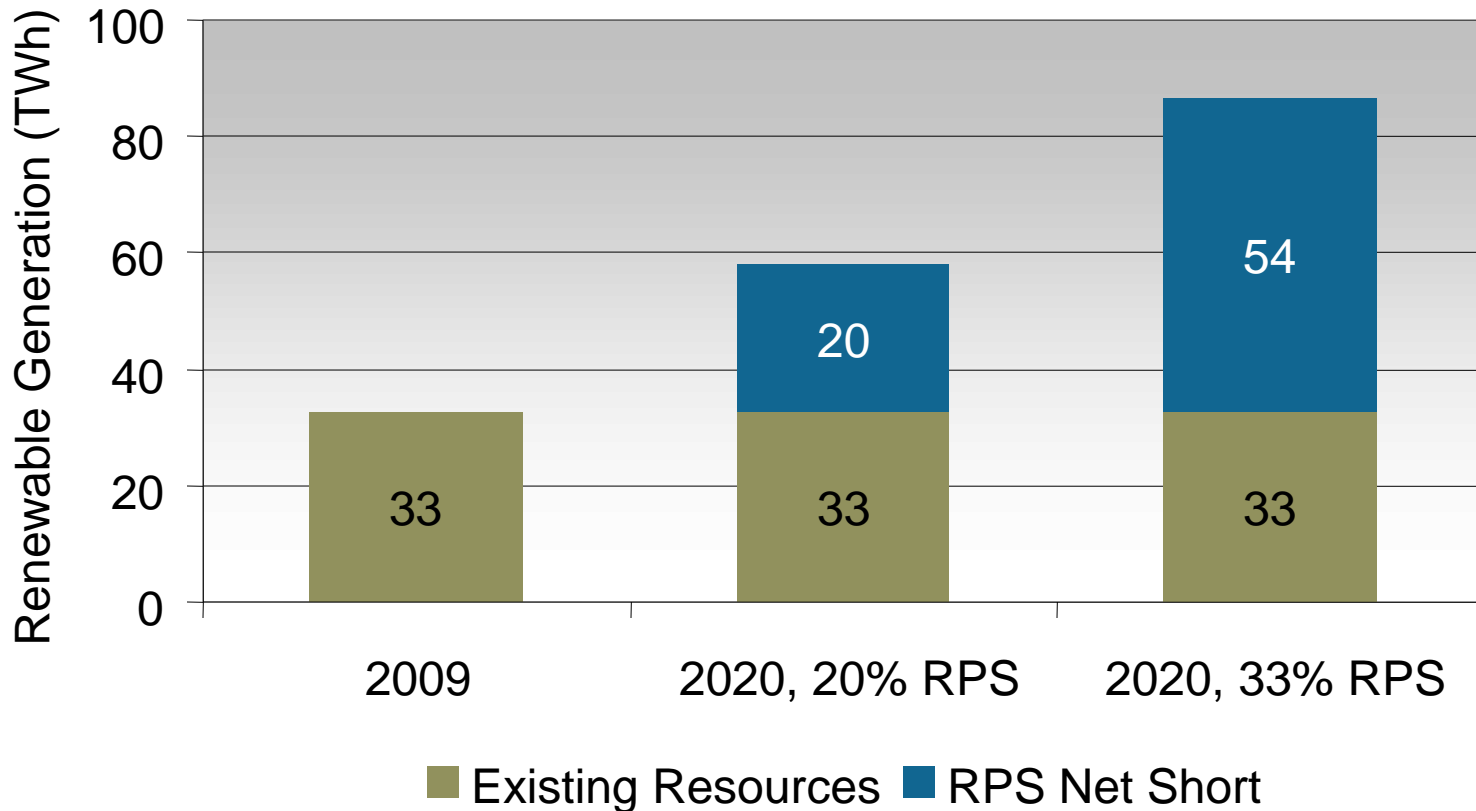
## General approach

- Determine renewable resource gap (GWh) in 2020
- Compile database of resources available to meet RPS target
- Rank available resources based on cost, commercial interest, environmental sensitivity and timeline
- Select resources to fill renewable resource gap



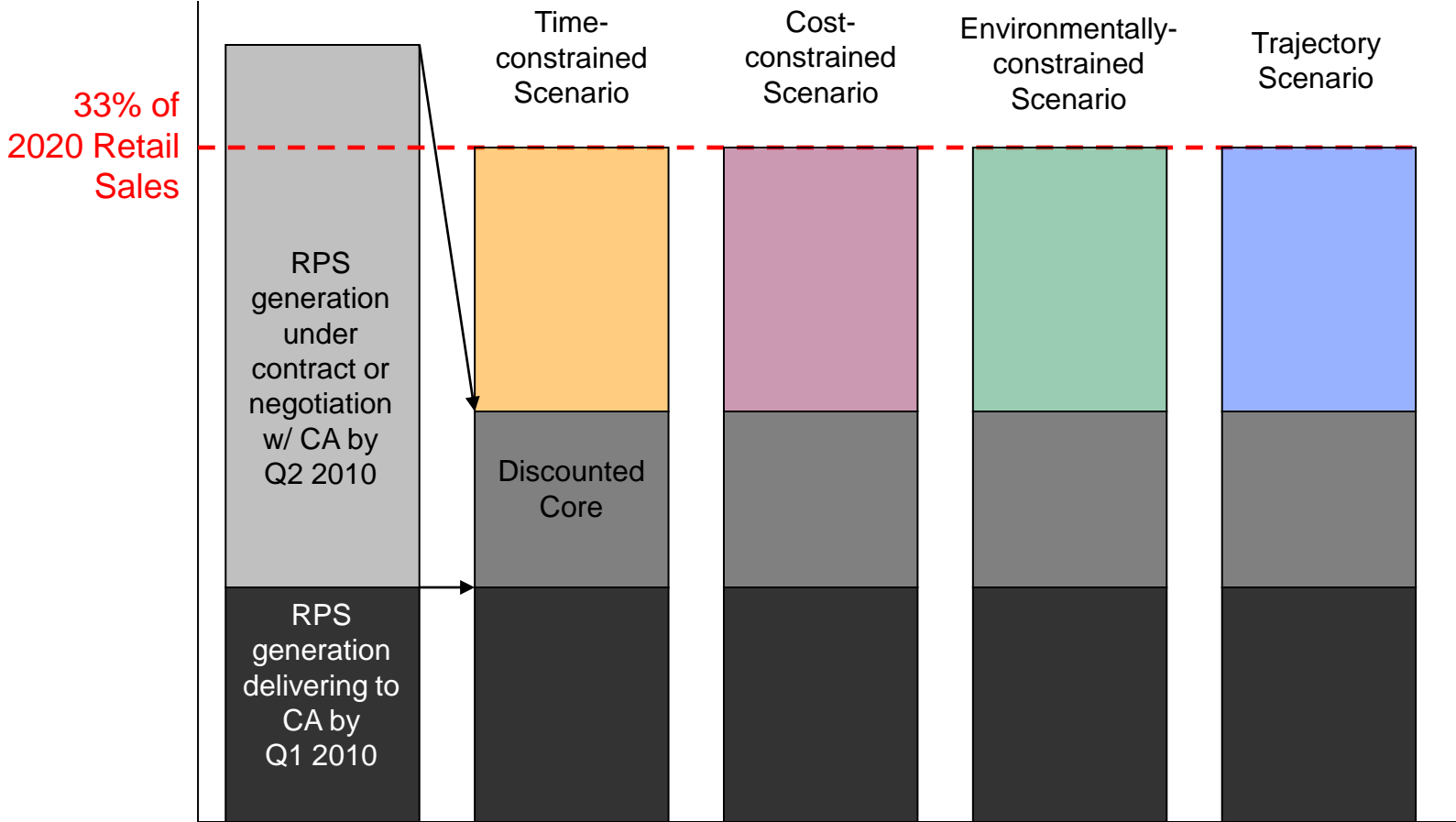


# Renewable Net Short





# Approach to scenario development





## Discounted Core

- Goal is to capture the projects most likely to be online by 2020 using objective, public data
- Includes projects with both:
  - PPA signed and approved or under review by CPUC
  - Major permit filed and deemed data adequate at relevant permitting agency (Energy Commission, County, etc.)
  - Exception – a DC project that would require new transmission in the model is not included unless DC projects would provide at least 67% of the energy accommodated by the transmission
- Tested other cores:
  - All projects with PPAs signed and approved/under review
  - All projects with certain objective level of developer experience
  - Model allows users to test these other cores





# Sources of new resources to fill net short

## 1. Commercial Projects

- ED Database of IOU projects (including discounted core)
- POU procurement plan data obtained from CARB

## 2. Additional “Theoretical” Projects

- RETI pre-identified and proxy projects for California
- WREZ projects for the rest of the WECC

## 3. Original Renewable DG resource potential estimates

- Developed as part of 2010 LTPP





# Transmission and geographic classification of resources

Each resource is assigned one of three classifications:

1. **CREZ**: resources located within one of the 48 Competitive Renewable Energy Zones (either in California or in other states)
2. **Non-CREZ**: resources in California or directly across the border that are not located within a CREZ and can be delivered with minor transmission upgrades
3. **Out-of-State REC**: out-of-state resources that would deliver energy to the local market





## Estimates of Statewide DG Potential

- For the 2010 LTPP, E3 and Black & Veatch collaborated to develop original estimates of the statewide potential for solar PV  $\leq 20$  MW
- The 33% RPS Calculator integrates these estimates, allowing those resources to compete against others for inclusion in each scenario





## Out-of-State RECs

- Default assumption is no limitation on OOS RECs
- RECs are unbundled
  - Energy and Capacity (if applicable) are sold into the local market
  - Reflects the economic reality of a variety of proposed REC treatments
- REC Resources are assumed to be lower quality, near existing transmission
- Even without restriction, REC penetration topped out at 28% of total 2020 generation (in the Time-Constrained Scenario)





# Existing/Planned Transmission Capacity

- CAISO identified existing and planned transmission that could deliver renewables to load (table shows Dec. 2010 estimates, not updated per June 2011)

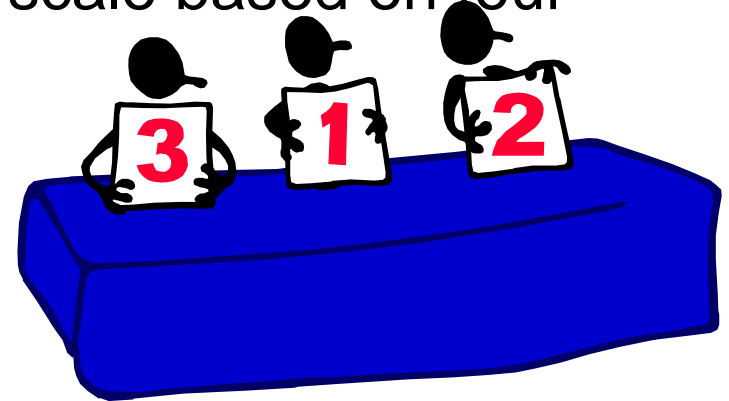
	MW of Available Capacity on Existing Transmission (No Upgrades)	MW of Available Capacity on Existing Transmission (Minor Upgrades)
Carrizo South	300	900
Imperial	0	1125
Kramer	0	62
Palm Springs	1000	1000
Pisgah	0	275
Riverside East	1500	1500
Round Mountain	100	100
San Bernardino - Lucerne	261	261
San Diego South	400	761
Solano	0	300
Tehachapi	4500	5825
Westlands	0	800





# Project Scoring Methodology

- Each project is scored on a 0-100 scale based on four metrics (0 is better):
  - Net Cost Score
  - Environmental Score
  - Commercial Interest Score
  - Timing Score
- Final score used to rank a project for any one scenario is a weighted average of the four individual metrics
  - Weights are user-defined and vary by scenario

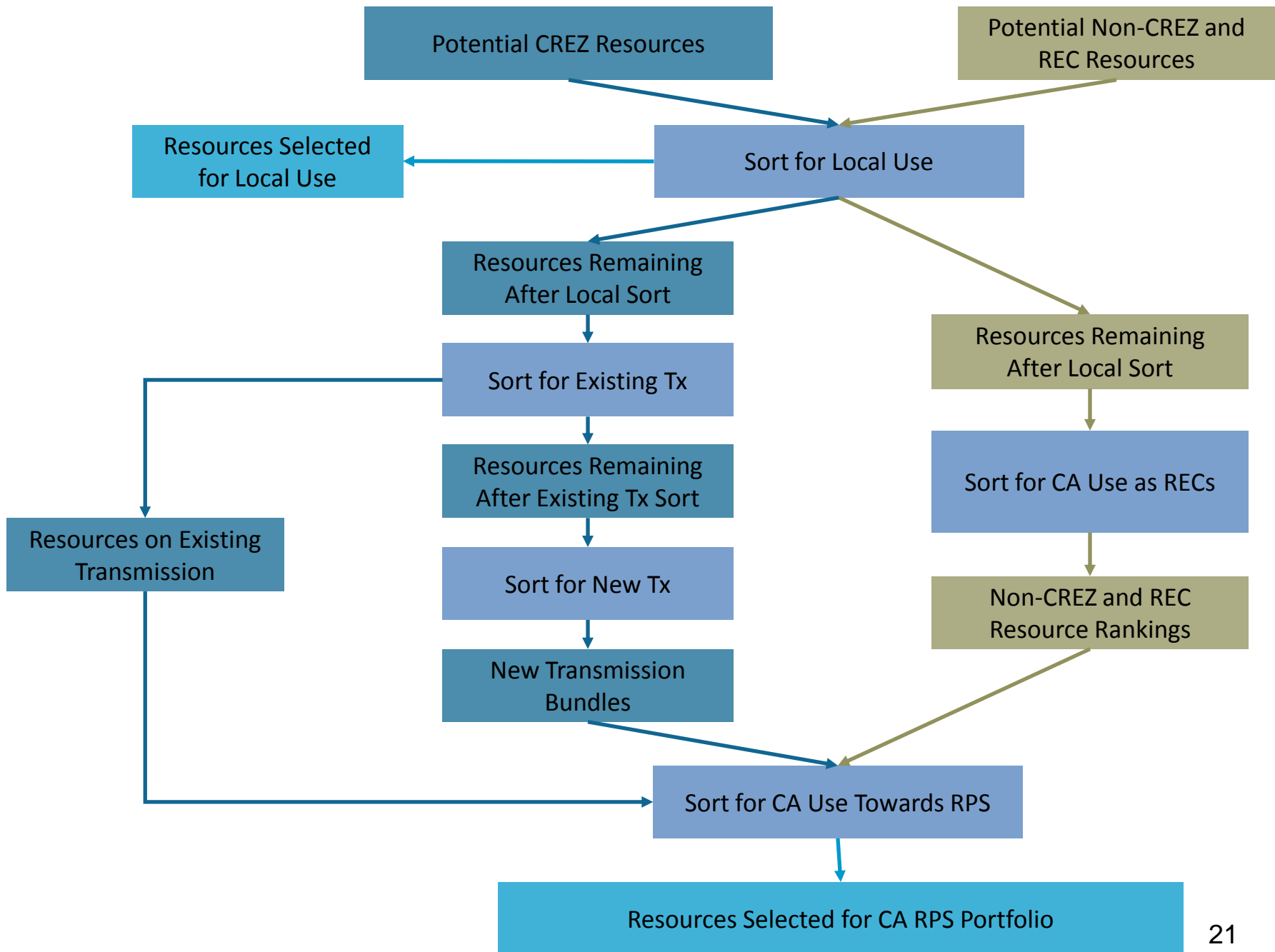




# Resource Selection Methodology

1. Calculate project score for each resource
2. Allocate lowest cost out-of-state theoretical projects to other states until all non-CA WECC RPS targets for 2020 are satisfied
3. Rank remaining CREZ projects and select to fill transmission bundles
4. Calculate aggregate score for each transmission bundle
5. Rank transmission bundles against individual non-CREZ and REC resources
6. Select resources and bundles to meet 33% RPS target in 2020







# Net Cost Score

- Cost score is based on a modified version of the RETI Ranking Cost
- Includes integration and T&D avoided costs
- Scores are converted to 0 – 100 scale, bounded by the model's lowest and highest net cost resources

## Modified RETI Ranking Cost

- + Levelized cost of energy
- + Interconnection (gen-tie) costs
- + Deemed integration costs
- + Levelized, per-MWh incremental transmission costs
- T&D avoided costs
- Energy value
- Capacity value
- = Final project ranking cost





# Environmental Score

- Handicaps resources in areas where environmental issues might hinder development
- Considers a variety of factors:
  - Disturbed lands
  - Right-of-Way
  - Significant species
  - Air quality
  - Others
- Weights scores by land use per GWh generated

CREZ Name	RETI ROW	RETI CREZ Yellow & Black Area	RETI Buffer Yellow & Black Area	RETI Sig Species	RETI Wildlife Corridors	RETI IBA	EPA tracked degraded
Alberta							
Arizona							
Baja							
Barstow	4.3	6.9	2.8	0.7	2.2	0.4	10.0
British Columbia							
Carrizo North	7.8	1.0	0.8	2.3	1.0	0.0	0.0
Carrizo South	5.9	0.0	0.2	2.2	2.2	1.6	10.0
Colorado							
Cuyama	6.4	0.2	2.1	10.0	0.0	0.0	10.0
Distributed Solar - PG&E	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Distributed Solar - SCE	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Distributed Solar - SDGE	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Distributed Solar - Other	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Fairmont	4.9	0.0	0.7	1.3	1.4	1.1	9.9
Imperial-East	4.0	2.1	1.9	1.6	0.9	0.1	10.0
Imperial-North (A)	9.7	3.9	2.3	2.1	2.0	7.0	10.0
Imperial-North (B)	6.5	2.7	2.3	1.8	0.8	4.4	9.9
Imperial-South	6.3	2.1	1.8	1.4	2.2	4.6	10.0
Inyokern	4.2	5.9	2.6	1.1	1.0	0.0	10.0
Iron Mountain	5.6	0.6	0.7	0.5	0.0	0.0	10.0
Kramer	5.4	5.9	3.1	0.5	1.7	0.7	7.6
Lassen North	4.5	0.1	0.4	0.6	0.6	0.0	10.0
Lassen South	3.8	1.9	5.7	3.3	7.6	3.6	8.8
Mountain Pass	3.0	3.6	3.2	1.3	0.0	0.8	10.0
Montana							
Nevada C							
Nevada N							
New Mexico							
NonCREZ							
Northwest							
Owens Valley	5.3	0.0	0.5	1.3	10.0	0.6	10.0
Palm Springs	5.7	7.9	5.3	7.3	0.0	1.6	9.9
Pisgah	0.7	0.2	2.4	3.8	0.0	0.0	10.0
Remote DG (Brownfield) - PG&E	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Remote DG (Brownfield) - SCE	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Remote DG (Brownfield) - SDGE	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Remote DG (Brownfield) - Other	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Remote DG (Greenfield) - PG&E	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Remote DG (Greenfield) - SCE	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Remote DG (Greenfield) - SDGE	4.7	2.4	2.1	2.5	1.9	1.3	9.4
Remote DG (Greenfield) - Other	4.7	2.4	2.1	2.5	1.9	1.3	9.4



# Commercial and Timing Scores

- **Commercial Score:** Scale of 0-100 reflecting contracting activity of California utilities
  - Commercial projects receive a score of 0, while generic projects receive a score of 100
  - POU-planned projects considered “Commercial” and receive score of 0
- **Timing Score:** Gives better score to resources that can be developed on a relatively short time scale
  - Online date < 2010 gets 0, > 2021 gets 100
  - For ED database projects with contracts filed at Commission, dates based on expected Commercial Online Date in contract; if date has passed, assigned 2014
  - For other resources, dates based on size and type of project





## Selection of RPS Portfolio

- Each transmission bundle is assigned an aggregate score based on an average of the constituent resources and compared against individual non-CREZ and RECs resources
- Discounted Core Projects are selected first unless in New Transmission bundle
- After Discounted Core, resources & bundles with the lowest score are selected to fill the 2020 RPS gap





# Scenario Score Weightings

Scenario	Cost Weight	Commercial Weight	Environmental Weight	Timing Weight
Trajectory	20%	60%	20%	0%
Cost-Constrained	100%	0%	0%	0%
Environmentally-Constrained	0%	0%	100%	0%
Time-Constrained	0%	0%	5%	95%



# Model Schematic

## Input Data and Parameters

a – ProFormaCalcPV

a – ProFormaCalc

a – ProForma

a – Control Panel

b - Controls

c – Financing Inputs

e – LoadsAndResources

f – RPSNetShortCalc

d – General Inputs

i – CommProjData

j – GenericProjData

g – TxInputs

h – EnviroScores

## Resource Sorts

## Results

s – BundleBuildup\_NoTx

t – BundleSupplySortCalcs

u – SupplyCurve\_byBundle

v – SelectedAllResources

w – SelectedCommProj

x – SelectedDiscCore

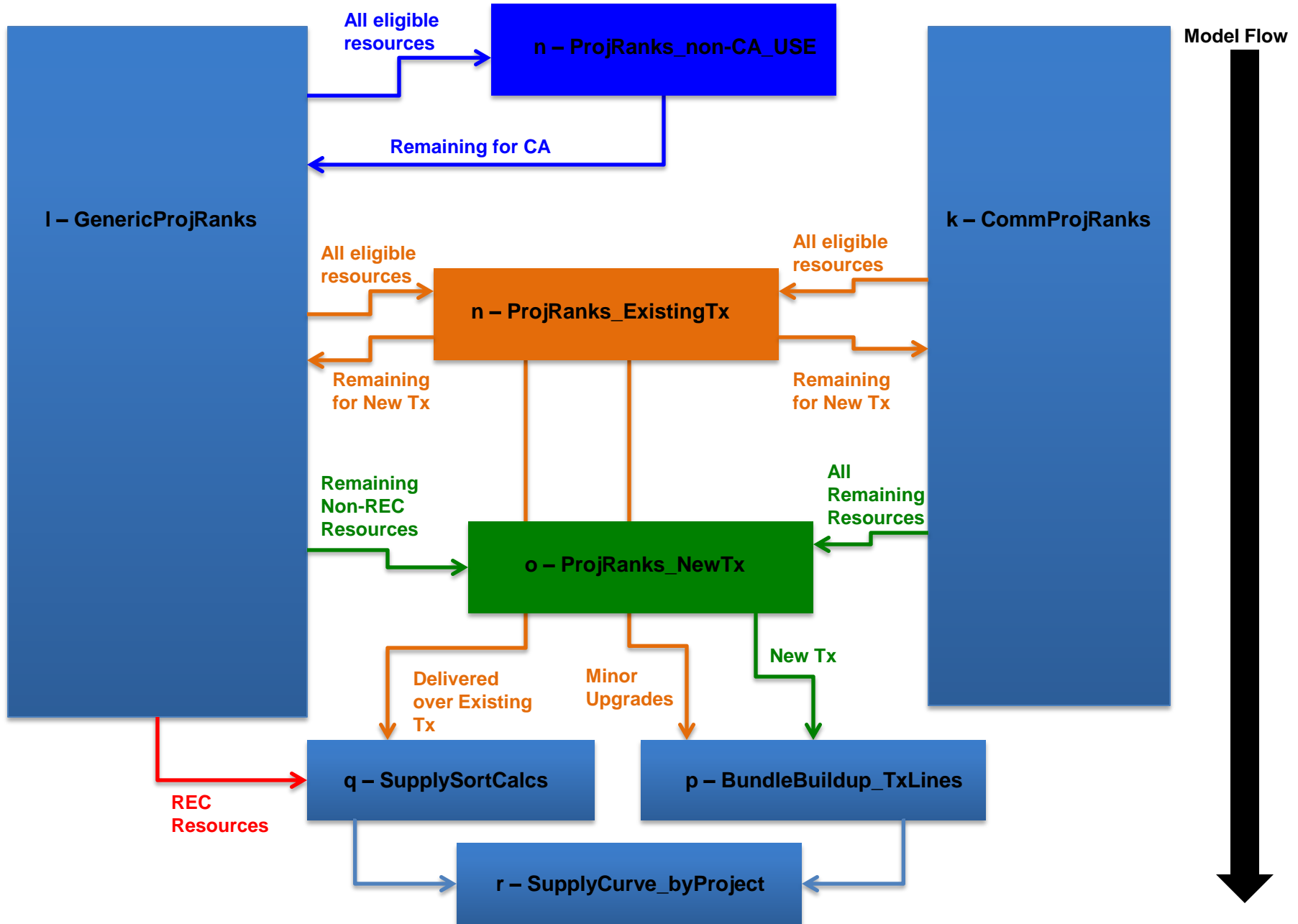
y – DeliveredAndNQC\_byYear

y – Selected\_byYear

z - Results

zz – Cost Impacts

# Resource Sorts





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	Resources Selected by Scenario (MW)			
	33% Trajectory	33% Environ- mentally- Constrained	33% Cost- Constrained	33% Time- Constrained
Tehachapi	4,445	3,491	3,491	4,150
Imperial	1,202	347	1,125	-
Northwest	2,359	838	2,359	2,359
Pisgah	1,775	275	275	275
NonCREZ	1,074	599	1,211	1,080
Solano	1,129	300	300	
Riverside East	1,042	1,042	1,042	1,500
Alberta	886	450	450	886
Mountain Pass	888	-	-	-
Carrizo South	900	900	900	900
Utah-Southern Idaho	258	258	258	258
San Diego South	400	400	699	400
Colorado	420	-	600	1,371
Nevada C	450	549	500	549
Distributed Solar - PG&E	500	1,757	500	790
Montana	300	300	300	300
Distributed Solar - SCE	500	2,345	500	895
Arizona	290	290	872	1,390

33% RPS Scenarios  
adopted in December 2010  
for planning in the  
2010 LTPP

	Resources Selected by Scenario (MW)			
	33% Trajectory	33% Environ- mentally- Constrained	33% Cost- Constrained	33% Time- Constrained
Wyoming	96	4	461	461
New Mexico	32	78	947	947
Round Mountain	78	100	100	100
Palm Springs	77	178	178	178
San Bernardino - Lucerne	49	140	261	261
Kramer	62	62	62	62
Distributed Solar - SDGE	52	397	52	127
British Columbia	2	52	50	52
Remote DG (Brownfield) - SDGE	-	78	-	4
Remote DG (Brownfield) - PG&E	-	1,842	-	100
Remote DG (Brownfield) - SCE	-	564	-	31
Distributed Solar - Other	-	1,522	-	344
Westlands	-	800	-	-
Remote DG (Brownfield) - Other	-	571	-	31
Fairmont	-	-	-	-
Total In-State	14,173	17,711	10,696	11,228
Total Out-of-State	5,093	2,818	6,798	8,574
<b>Total</b>	<b>19,266</b>	<b>20,530</b>	<b>17,493</b>	<b>19,802</b>

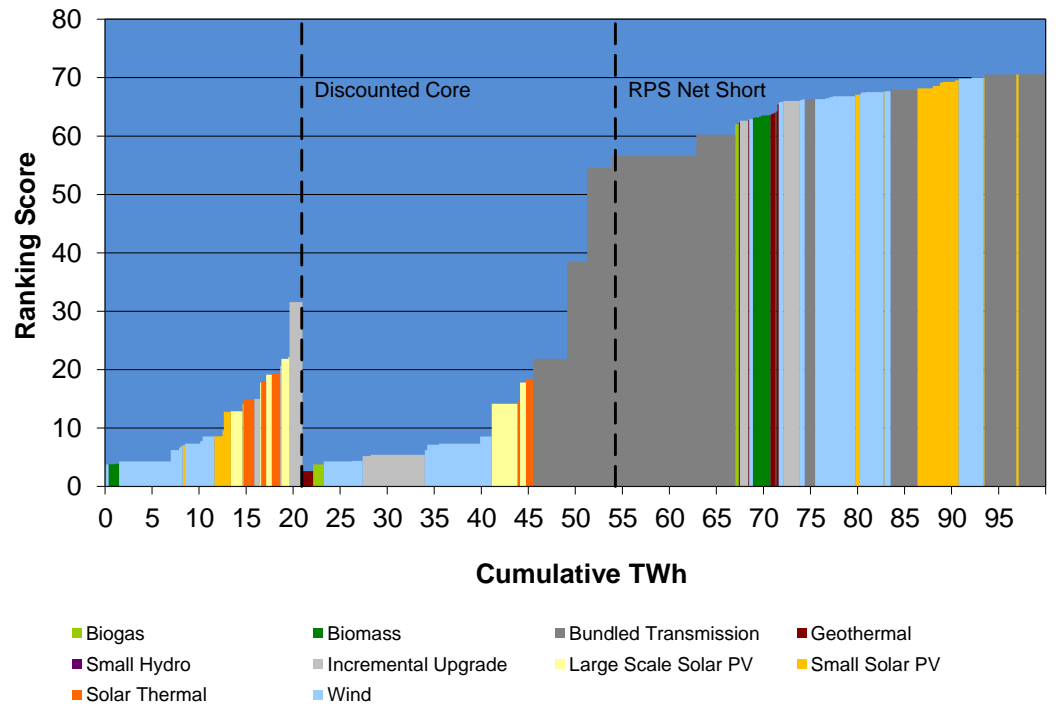
	Scenario Composition by Technology and Location (MW)							
	33% Trajectory		33% Environmentally-Constrained		33% Cost-Constrained		33% Time-Constrained	
	In-State	Out-of-State	In-State	Out-of-State	In-State	Out-of-State	In-State	Out-of-State
<b>Biogas</b>	178	-	178	66	168	73	172	73
<b>Biomass</b>	126	34	404	156	291	129	212	103
<b>Geothermal</b>	667	154	240	270	797	202	-	158
<b>Hydro</b>	-	16	-	132	-	14	-	223
<b>Large Scale Solar PV</b>	3,527	340	2,315	340	1,549	340	2,543	340
<b>Small Solar PV</b>	1,052	-	9,077	-	1,052	-	2,322	-
<b>Solar Thermal</b>	3,589	400	1,072	400	1,279	400	1,084	400
<b>Wind</b>	5,034	4,149	4,426	1,454	5,559	5,639	4,895	7,276
<b>Total</b>	<b>14,173</b>	<b>5,093</b>	<b>17,711</b>	<b>2,818</b>	<b>10,696</b>	<b>6,798</b>	<b>11,228</b>	<b>8,574</b>

Scenario	Scenario Composition by Generation Project Status (MW)			
	Discounted Core	Commercial Non-Core	Generic	Total
33% Trajectory	9,013	9,192	1,061	19,266
33% Environmentally-Constrained	8,109	1,991	10,429	20,530
33% Cost-Constrained	8,378	3,864	5,251	17,493
33% Time-Constrained	7,951	4,747	7,104	19,802

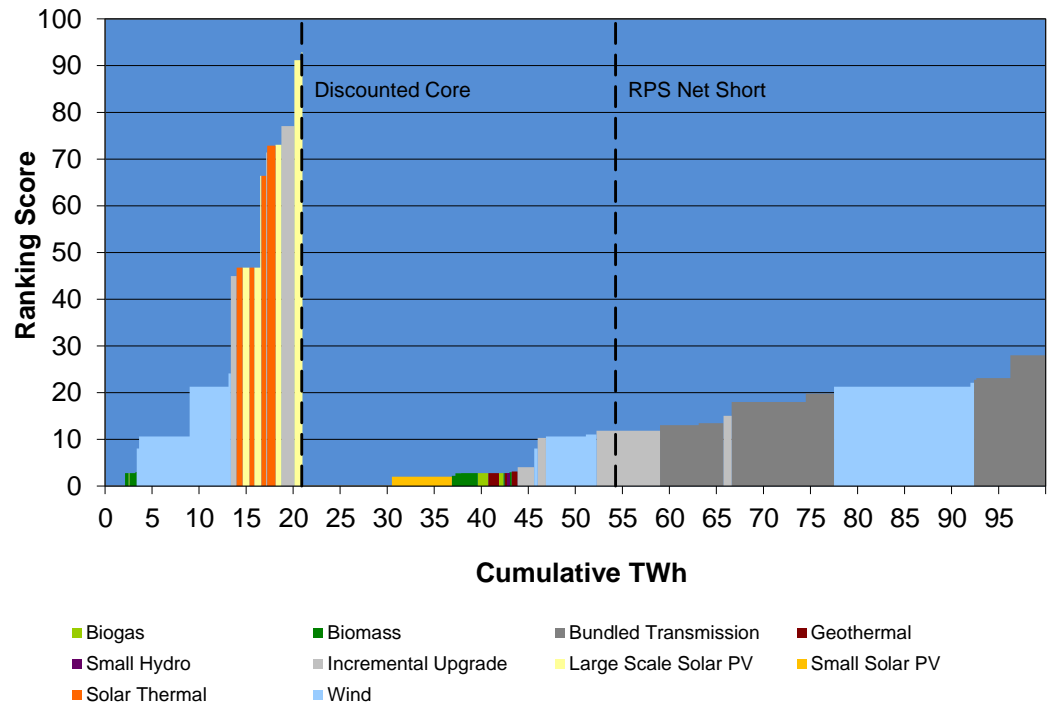
Scenario	Scenario Composition by Transmission Delivery Type (MW)				
	Accommodated on Existing System	Minor Upgrades	New Lines	Out-of-State Undelivered RECs	Total
33% Trajectory	8,517	2,362	3,295	5,093	19,266
33% Environmentally-Constrained	15,327	2,384	-	2,818	20,530
33% Cost-Constrained	8,034	2,661	-	6,798	17,493
33% Time-Constrained	10,291	937	-	8,574	19,802

Scenario	Scenario Score, by Ranking Metric			
	Cost	Environmental Concern	Commercial Interest	Timing
33% Trajectory	20.3	29.2	6.3	50.7
33% Environmentally-Constrained	28.6	14.3	47.9	53.0
33% Cost-Constrained	15.4	20.9	37.8	47.5
33% Time-Constrained	19.0	23.2	36.9	42.3

# Trajectory Scenario

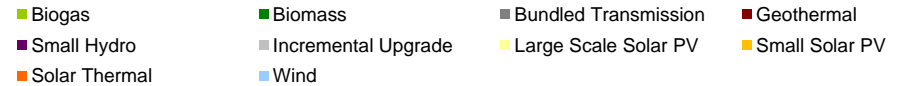
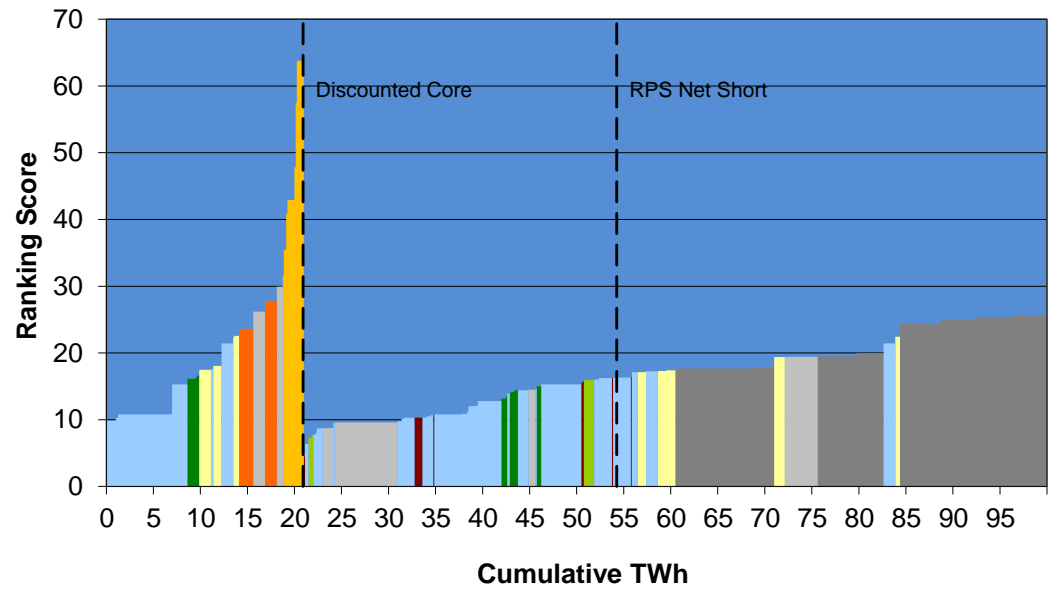


# Environmentally-Constrained Scenario

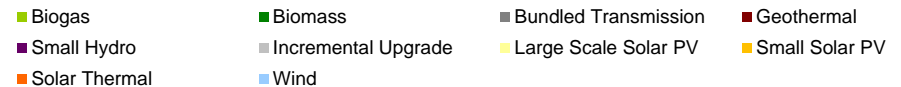
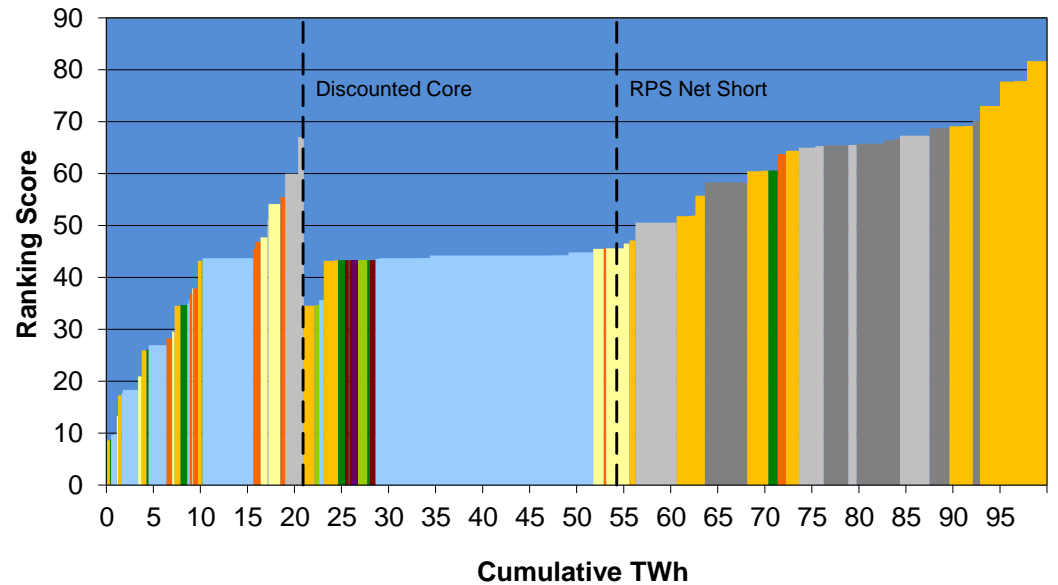


# Cost-Constrained Scenario

(as of December 2010, not as updated in June 2011)



# Time-Constrained Scenario





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## Proposed Base Case

- Updated LTPP's Cost-Constrained Scenario to reflect:
  - CPUC approval of the Renewable Auction Mechanism – 1,000 MW of resources  $\leq 20$  MW in IOUs' service territories, assumed online by beginning of 2016. Change = 1,000 MW of small-scale solar PV shifted from generic potential to discounted core.
  - Correction to consideration of 384 MW existing IOU, discounted core PPAs with small-scale solar projects - had erroneously been counted towards IOUs' PV programs. Change = 384 MW of small-scale solar PV added to the discounted core.
  - Correction to error in distribution of small-scale PV resources by location and type
  - New information from the ISO's 2010-2011 plan and FERC filings about the cost and capacity of new transmission for several CREZs: Imperial, Kramer, Mountain Pass, Palm Springs, Riverside East, Pisgah, Solano, and Westlands





# Changes to transmission assumptions

- Cells highlighted in orange were updated on the “g – TxInputs” tab of the Calculator before re-running the Cost-Constrained Scenario to create the proposed base case:

	MW of Available Capacity on Existing Transmission (No Upgrades)	MW of Available Capacity on Existing Transmission (Minor Upgrades)	Cost of Minor Upgrades (\$M)	Segment Size (MW)	Segment Capital Cost (\$ millions)
Imperial	1125	2125	\$690	1,500	\$1,252
Kramer	62	62	\$0	700	\$542
Mountain Pass	1400	1400		1,500	\$1,287
Palm Springs	283	283		1,000	\$668
Pisgah	275	275	\$0	1,475	\$740
Riverside East	1317	1317		2,400	\$0.000001
Solano	0	535	\$40	1,000	\$538
Westlands	220	800	\$10	1,500	\$1,058



# Proposed Base Case

## MW, by Zone and Technology

Zone	Biogas	Biomass	Geo-thermal	Hydro	Large Scale Solar PV	Small Scale Solar PV	Solar Thermal	Wind	Total
Imperial	-	-	1,247	-	49	-	300	97	1,693
Tehachapi	-	37	-	-	-	-	-	3,452	3,489
NonCREZ	14	168	-	-	50	-	150	420	802
New Mexico	-	32	20	-	-	-	-	895	947
Riverside East	-	-	-	-	550	-	492	-	1,042
Northwest	-	97	-	-	-	-	-	614	711
San Diego South	-	21	-	-	-	-	-	678	699
Carrizo South	-	-	-	-	900	-	-	-	900
Solano	-	-	-	-	-	-	-	535	535
Distributed Solar - PG&E	-	-	-	-	-	773	-	-	773
Distributed Solar - SCE	-	-	-	-	-	750	-	-	750
Wyoming	2	-	-	-	-	-	-	459	461
Utah-Southern Idaho	21	-	134	13	-	-	-	90	258
Mountain Pass	-	-	-	-	-	-	410	113	523
Alberta	-	-	-	-	-	-	-	450	450
Colorado	-	-	-	-	-	-	-	420	420
Nevada C	-	-	-	-	50	-	400	-	450
Montana	-	-	-	-	-	-	-	300	300
Remote DG (Greenfield) - PG&E	-	-	-	-	-	412	-	-	412
San Bernardino - Lucerne	-	-	-	-	-	-	-	261	261
Arizona	-	-	-	-	290	-	-	-	290
Pisgah	-	-	-	-	-	-	275	-	275
Palm Springs	-	-	-	-	-	-	-	178	178
Remote DG (Brownfield) - PG&E	-	-	-	-	-	206	-	-	206
Round Mountain	-	-	22	-	-	-	-	78	100
British Columbia	50	-	-	-	-	-	-	-	50
Remote DG (Greenfield) - SCE	-	-	-	-	-	126	-	-	126
Distributed Solar - SDGE	-	-	-	-	-	78	-	-	78
Kramer	-	-	-	-	-	-	62	-	62
Remote DG (Brownfield) - SCE	-	-	-	-	-	63	-	-	63
Remote DG (Greenfield) - SDG&E	-	-	-	-	-	17	-	-	17
Remote DG (Brownfield) - SDG&E	-	-	-	-	-	9	-	-	9
<b>Total In-State</b>	<b>14</b>	<b>226</b>	<b>1,269</b>	<b>0</b>	<b>1,549</b>	<b>2,436</b>	<b>1,689</b>	<b>5,812</b>	<b>12,995</b>
<b>Total Out-of-State</b>	<b>73</b>	<b>129</b>	<b>154</b>	<b>13</b>	<b>340</b>	<b>0</b>	<b>400</b>	<b>3,229</b>	<b>4,338</b>
<b>Total</b>	<b>87</b>	<b>355</b>	<b>1,423</b>	<b>13</b>	<b>1,889</b>	<b>2,436</b>	<b>2,089</b>	<b>9,041</b>	<b>17,332</b>



# Agenda

- Background: CPUC responsibilities and efforts to coordinate long-term generation and transmission planning
- Methodology for constructing LTPP scenarios
- LTPP scenario results
- Scenario proposed by CPUC staff as 2011-2012 TPP base case
- **Questions?**





# Contact Information and Resources

<http://www.cpuc.ca.gov/PUC/energy/Renewables/transmission.htm>

- Updated Calculator (v1.5) used to create the proposed base case and “Output Module” that lists the individual projects chosen under any scenario run
- June 6, 2011 Energy Division letter to ISO detailing the proposed base case

[http://www.cpuc.ca.gov/PUC/energy/Procurement/LTPP/ltpg\\_history.htm](http://www.cpuc.ca.gov/PUC/energy/Procurement/LTPP/ltpg_history.htm)

- 2010 LTPP Scoping Memo and attachments detailing the RPS scenario development and other inputs and assumptions;
- Calculator (v1.4) used to develop the LTPP scenarios and Output Module

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