



RETI Phase 2 Update Workgroup

**Black & Veatch: Ryan Pletka, Tim
Mason, Sally Maki**

November 19, 2009

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 (Inyo County) 
 - Technology Assumptions 

- Net Short Update 

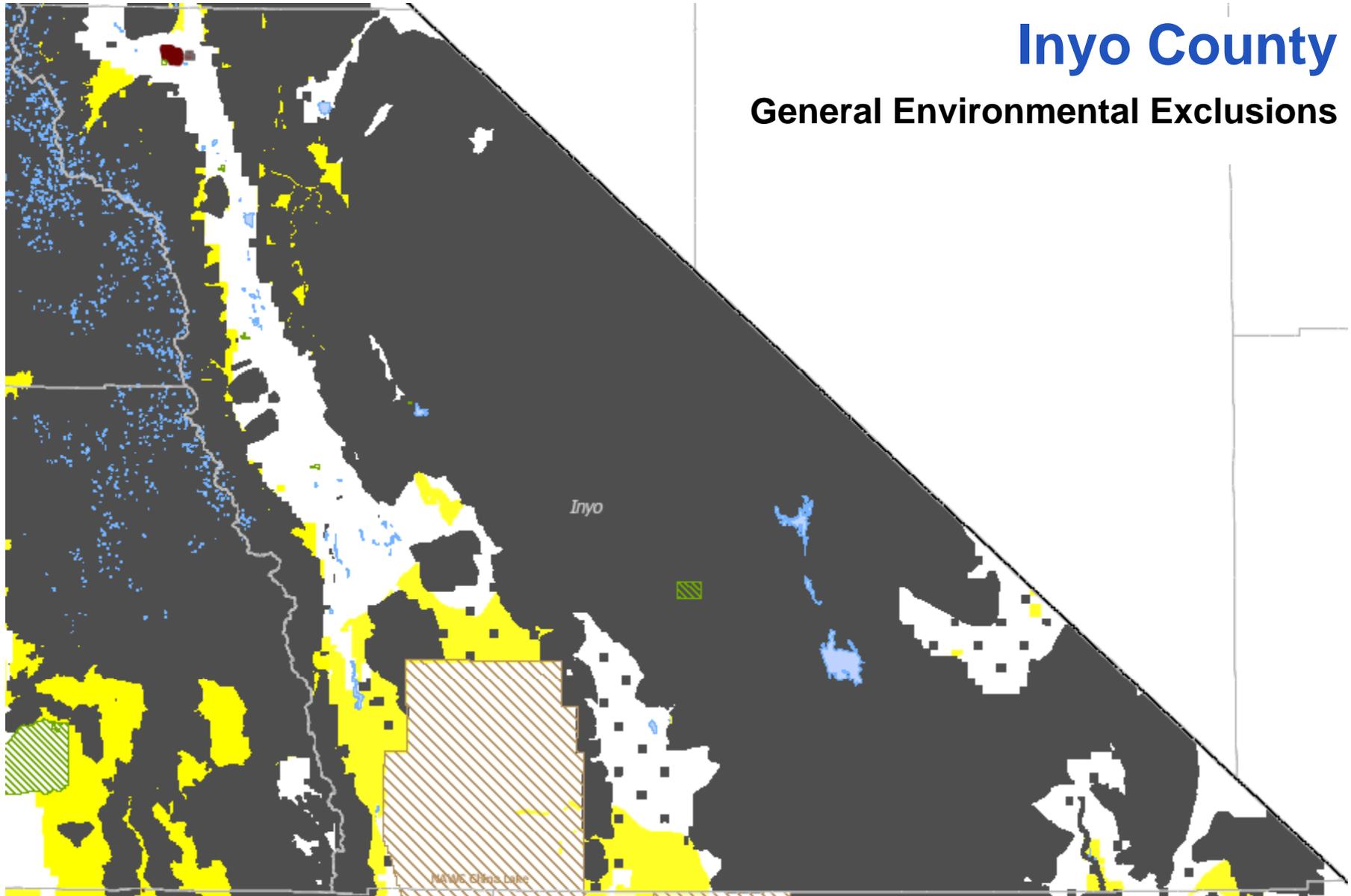
- RPS Implementation Timelines 

Inyo County

- Environmental Exclusions
- Technical Potential
- Economic Screening
- Final Phase 1 Resources

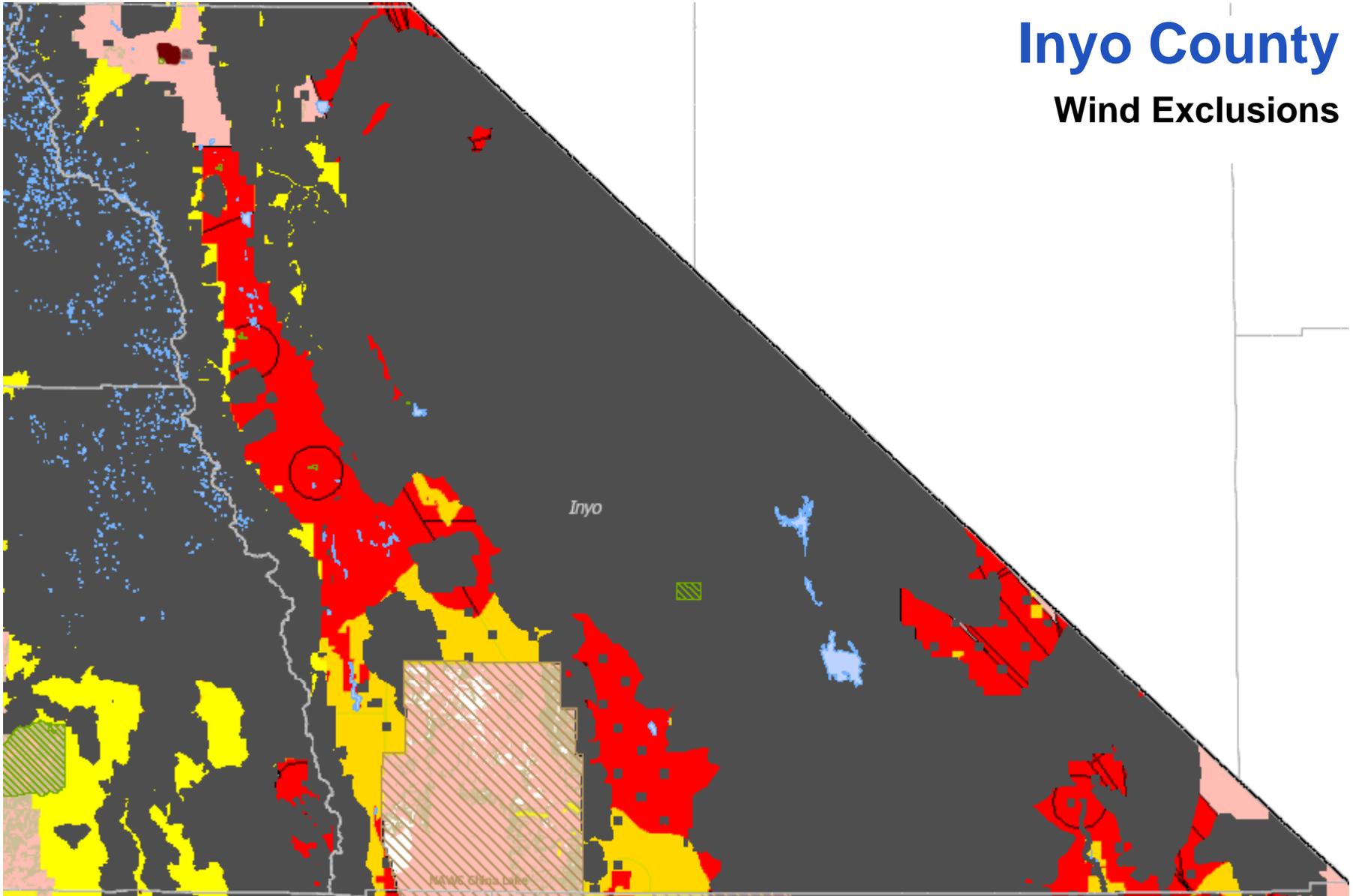
Inyo County

General Environmental Exclusions



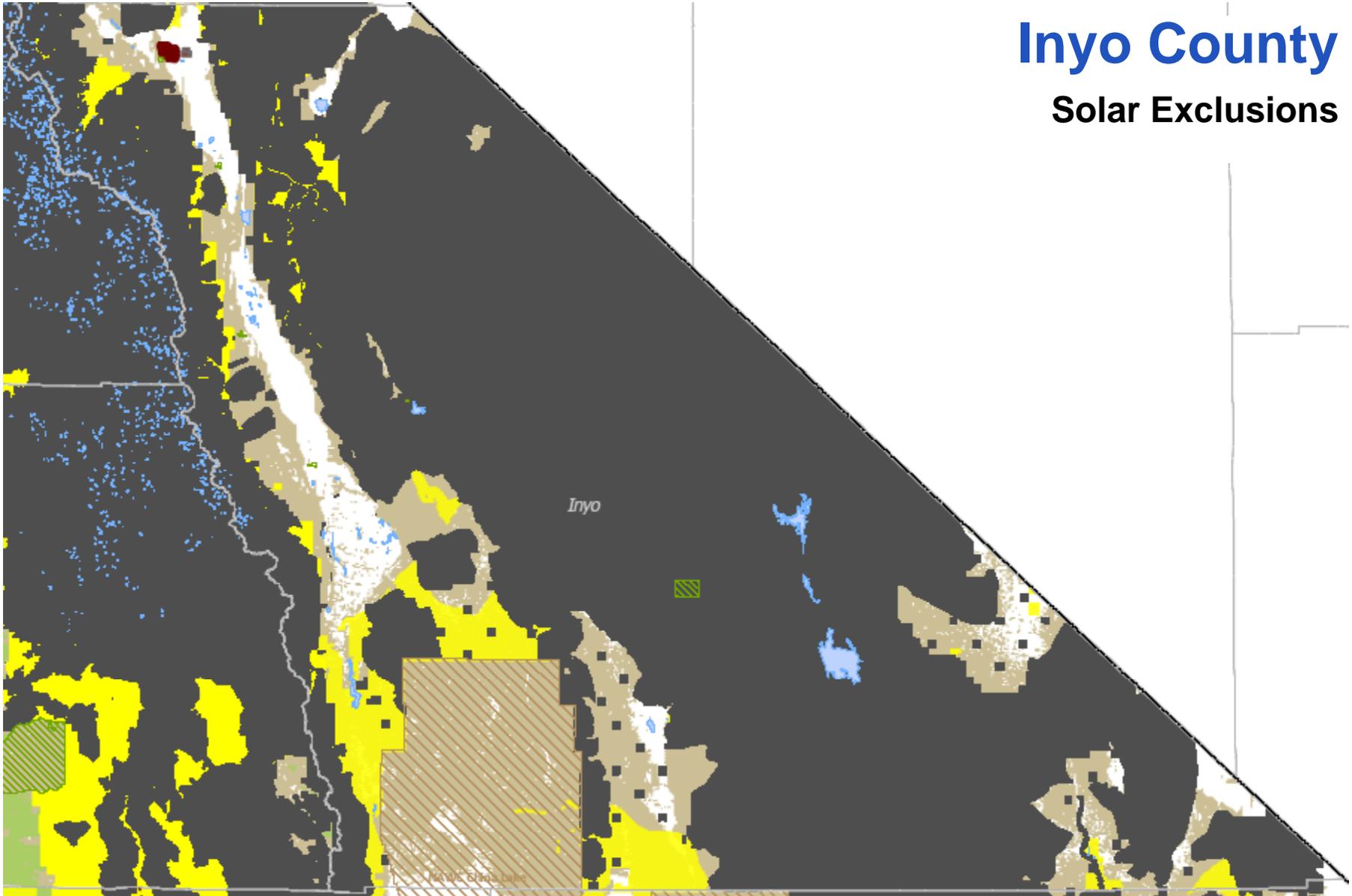
Inyo County

Wind Exclusions



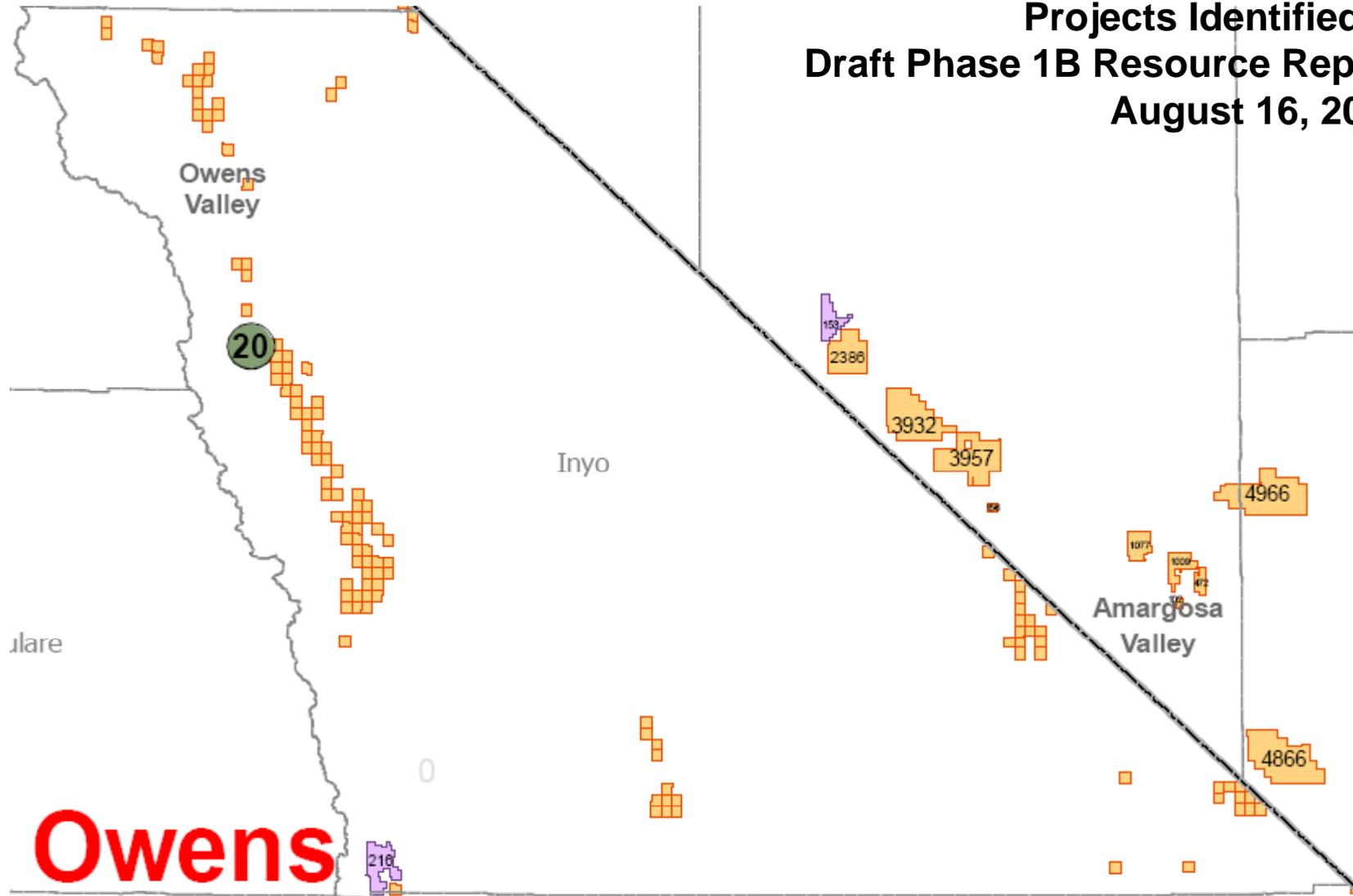
Inyo County

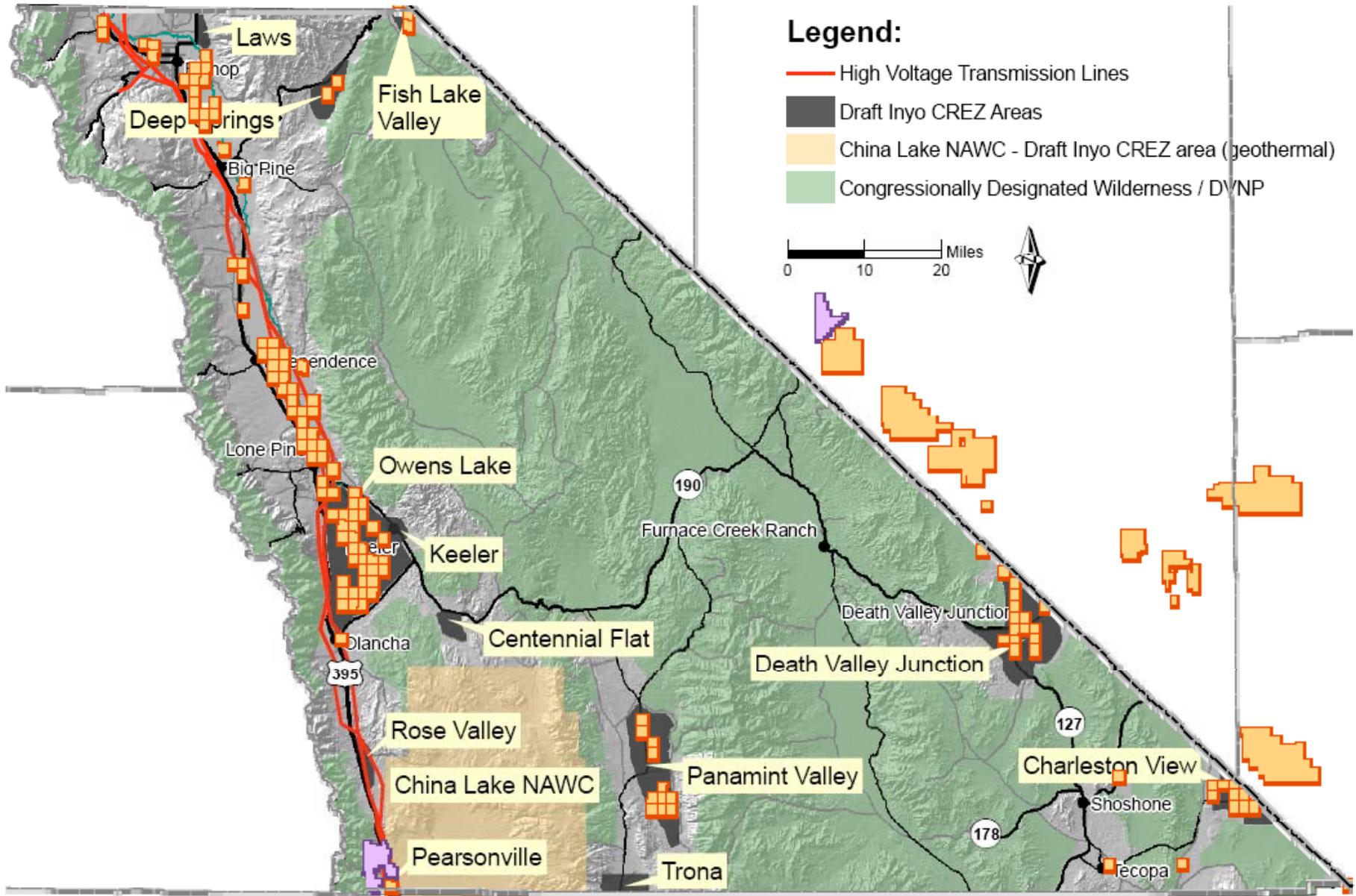
Solar Exclusions



Inyo County

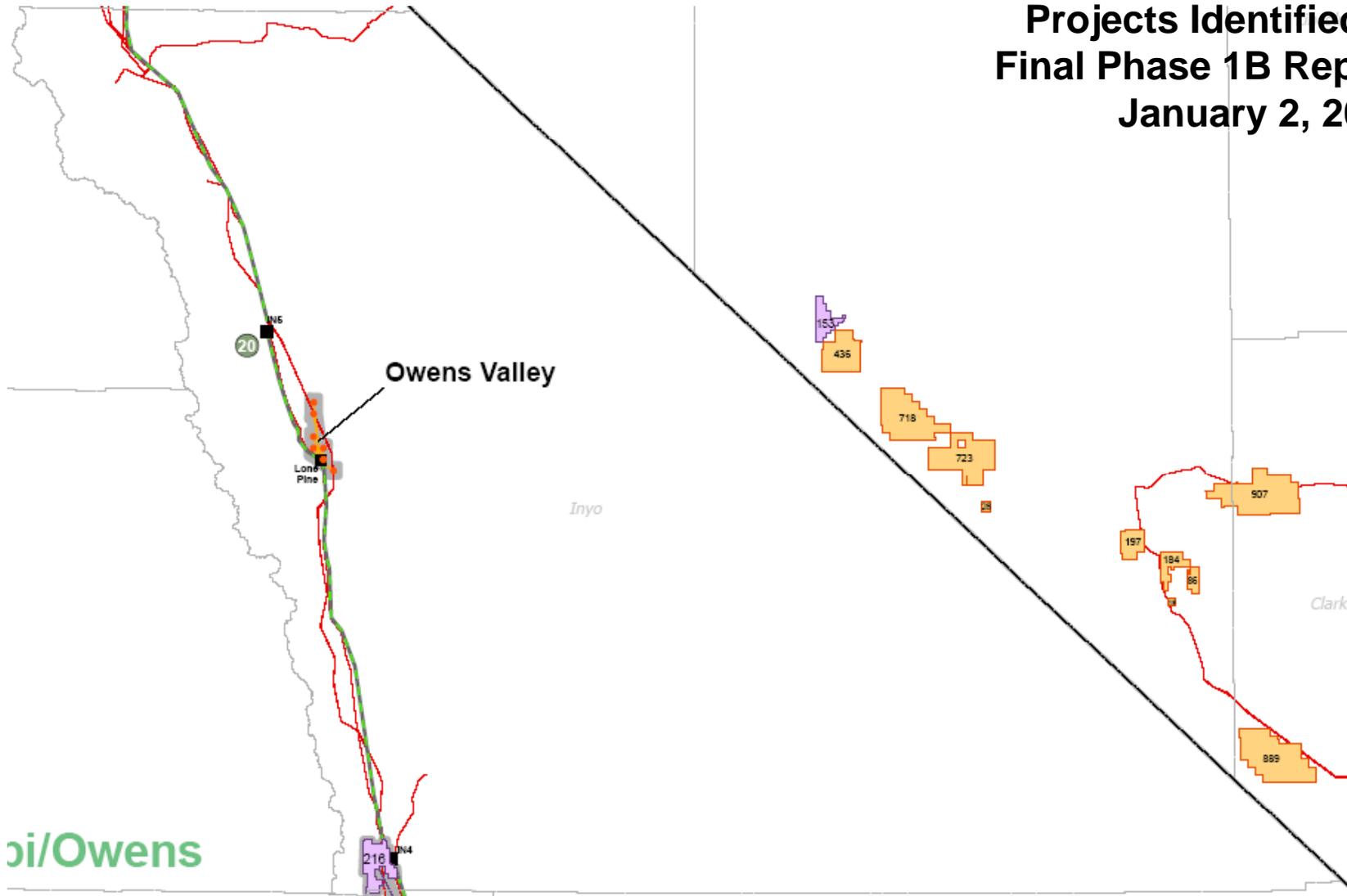
Projects Identified in
Draft Phase 1B Resource Report
August 16, 2008





Inyo County

Projects Identified in
Final Phase 1B Report
January 2, 2009



Technology Costs

- RETI Phase 1 (vetted by RETI stakeholders)
 - WREZ (vetted by WREZ stakeholders)
 - RETI Phase 2?

Cost Basis

- 2010 Dollars – “for contracts signed today”
- “All-in costs”
 - Capital costs include: EPC costs plus all owners costs: project advisors, development costs, interest during construction, insurance, financing fees, development fee, insurance, owner's engineer, independent engineer, construction management, land (if applicable), spare parts, sales taxes, start-up, etc.
 - Operations and maintenance costs include: all normal O&M costs, on-going capital expenditures, property tax, and insurance
- Commercial technologies
- No assumed performance or cost improvement
- No escalation of costs

Biomass Assumptions

No change from last week

- Combustion-based technology (stoker / fluidized bed)
- Projects > 15 MW

Performance	RETI Ph. 1	WREZ	RETI Ph. 2
Net Plant Heat Rate (HHV, Btu/kWh)	14,000 to 15,800	14,000 to 16,000	14,000 to 16,000
Capacity Factor (percent)	80	85	85
Economics (2010\$)			
Total Project Cost (\$/kW)	4,350 to 5,500	3,500 to 4,500	4,000 to 5,000
Consolidated O&M (\$/MWh)	23 to 31	25 to 35	25 to 35

WREZ stakeholders felt capital costs were too high and reflected California-centric costs.

RETI Phase 2 adopts WREZ, except capital cost (between WREZ and RETI Phase 1)

Geothermal Assumptions

No change from last week

- Conventional binary or flash technology, depending on resource

Performance	RETI Ph. 1	WREZ	RETI Ph. 2
Capacity Factor (percent)	80-90	80-90	80-90
Economics (2010\$)			
Total Project Cost (\$/kW)	4,000-6,750 (avg. 5,800)	4,000-8,000 (avg. 6,300)	4,000-8,000 (avg. 6,300)
Consolidated O&M (\$/MWh)	31 to 41	27 to 42	27 to 42

WREZ considered additional sites that RETI did not. Capital costs were also increased to account for observed escalation in costs.

RETI Phase 2 adopts WREZ

Wind Assumptions

Reduced Capital Cost to Ph. 1

- Conventional, horizontal-axis, 3-blade machine, 80m hub-height

Performance	RETI Ph. 1	WREZ	RETI Ph. 2
Capacity Factor (percent)	25 to 40	32 to 42	CA: 25 to 40 OOS: 32 to 42
Economics (2010\$)			
Total Project Cost (\$/kW)	2,250 to 2,700	2,350 to 2,700	2,250 to 2,700
Consolidated O&M (\$/MWh)	18 to 25	23	18 to 25

In-state capacity factors would be unchanged and based on original (detailed) RETI Phase 1 analysis. Out-of-state resources would be replaced by WREZ capacity factor by class estimates (shown on next slide)

RETI Phase 2 reverts to RETI Phase 1

Solar Technologies

No change from last week

- Decided Previously:
 - RETI Phase 2: Assume dry-cooling for solar thermal plants, wet-cooling will be used if plant is already permitted to use water.
 - RETI Phase 2: Assume no storage for solar thermal trough plants, unless pre-identified for a specific site
 - RETI Phase 2: Commercial technologies include: parabolic trough, tracking crystalline PV, and thin film PV

Solar Thermal Assumptions

No change from last week

- Dry-cooled Parabolic Trough, with no storage**

Performance	RETI Ph. 1	WREZ	RETI Ph. 2
Capacity Factor (percent)	22 to 32*	20 to 28	20 to 28
Economics (2010\$)			
Total Project Cost (\$/kW)	4,700 to 5,300*	5,350 to 5,550	5,350 to 5,550
Consolidated O&M (\$/MWh)	30	30	30

*Ranges include wet cooled projects, which typical have higher CF and lower capital cost

- Dry-cooled Parabolic Trough, with 6 hrs storage***

Performance	RETI Ph. 1	WREZ	RETI Ph. 2
Capacity Factor (percent)	NA	29 to 39	29 to 39
Economics (2010\$)			
Total Project Cost (\$/kW)	NA	7,650 to 7,850	7,650 to 7,850
Consolidated O&M (\$/MWh)	NA	22	22

*Storage based on oversized field with 200 MW steam turbine output

RETI Phase 2 adopts WREZ

Solar Photovoltaic Assumptions

(Large Systems: 20 MW +)

Updated O&M: \$55/kW-yr tracking, \$40/kW-yr fixed
 Lowered fixed capital cost range slightly
 Tightened performance ranges

● Single-Axis Tracking Crystalline

Performance	RETI Ph. 1	WREZ	RETI Ph. 2
Capacity Factor (percent)	23 to 28	26 to 31	23 to 30
Degradation			0.75%/year
Economics (2010\$)			
Total Project Cost (\$/kWe)	7,040 to 7,150	5,750 to 5,950	4,000 to 5,000
Consolidated O&M (\$/MWh)	19 to 23	26	20 to 27

● Fixed-tilt Thin Film

Performance	RETI Ph. 1 <i>(sensitivity only)</i>	WREZ	RETI Ph. 2
Capacity Factor (percent)	18 to 27	22 to 27	20 to 27
Degradation			1%/year
Economics (2010\$)			
Total Project Cost (\$/kWe)	3,700 to 4,000	4,550 to 4,750	3,600 to 4,000
Consolidated O&M (\$/MWh)	13	24	17 to 25

Advanced Solar Technologies

- Advanced solar technologies are emerging, for example:
 - Solar Power Tower
 - Solar Stirling Dish
- Recommend treating as a sensitivity study with independently vetted cost and performance, similar to thin film in RETI Phase 1
- Cost data to come from Sargent and Lundy study underway
- Performance to be modeled by the Solar Advisor Model (NREL)

Summary of Cost Changes

What does it mean?

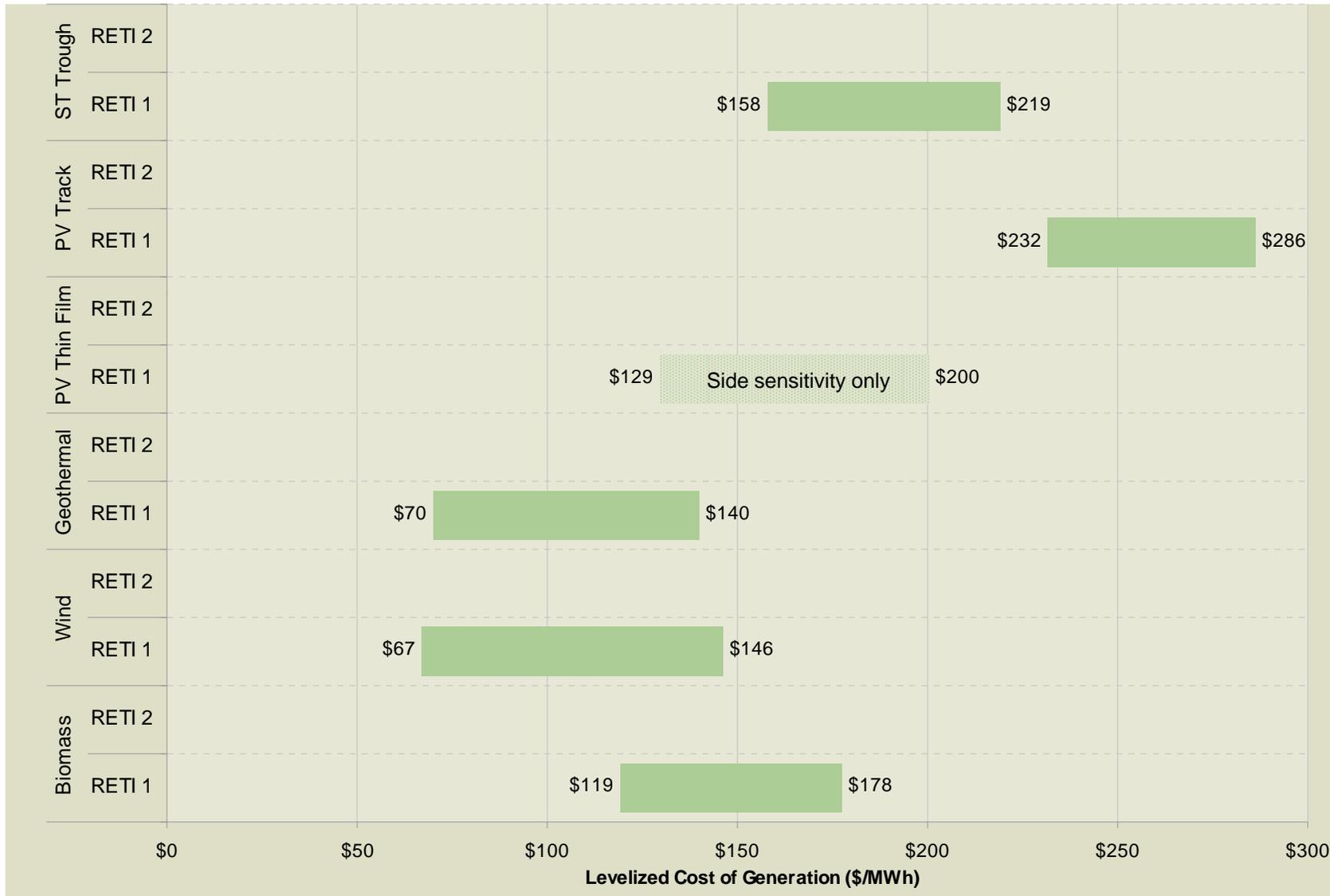
Levelized Cost of Generation

- All-in, bus-bar cost to generate 1 MWh of power, levelized over the life of the plant
- Does not include transmission
- Does not include energy value
- Does not include capacity value

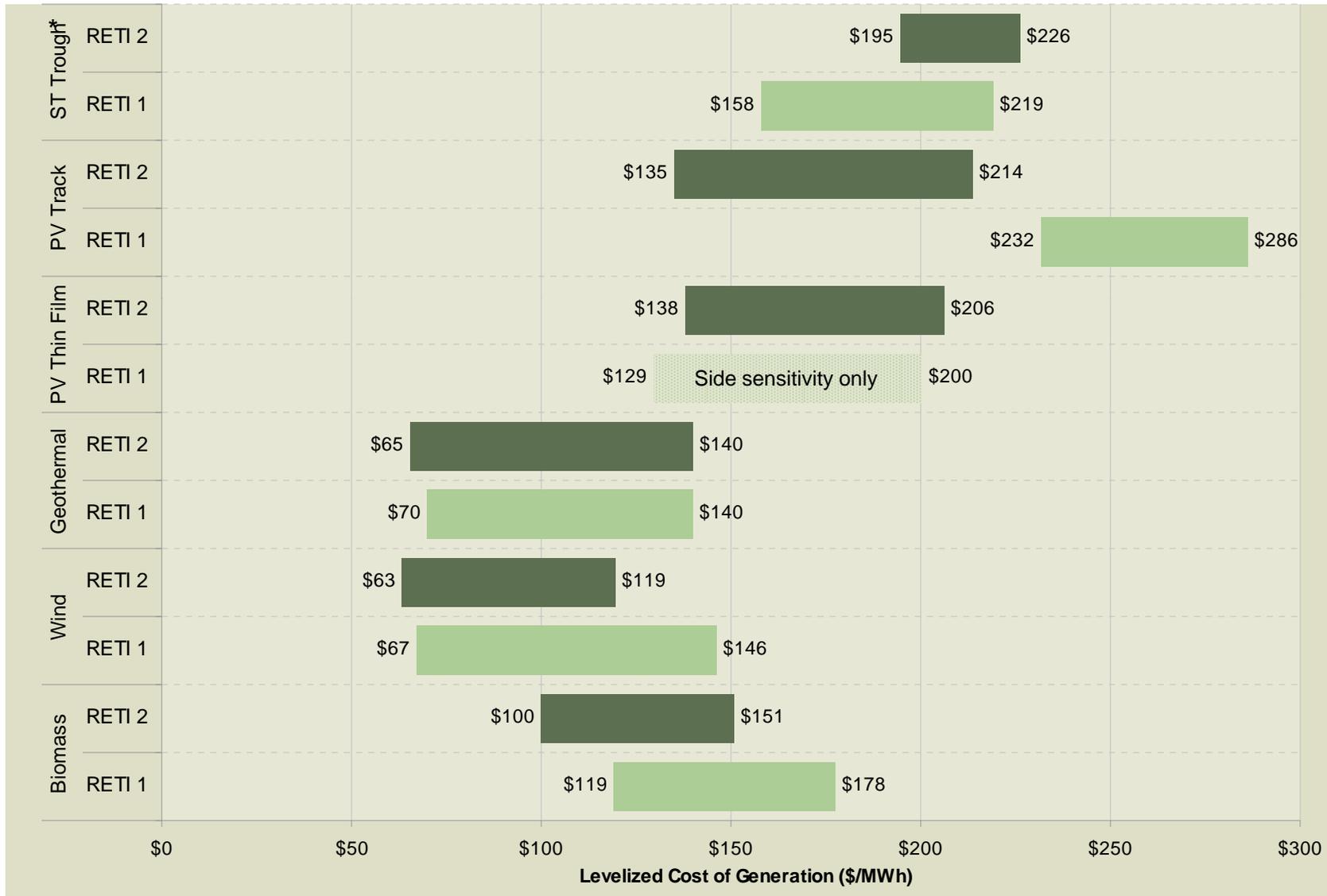
Changes from RETI 1 to RETI 2 that Impact Economics

- Changes in performance and cost assumptions
- New availability of 30% ITC/Grant to wind, geothermal and biomass
- Consideration of additional out of state resources
- Note: no changes in financing assumptions (long-term view through 2020)

RETI Phase 1 View of Renewable Economics (2008)



Current RETI Phase 2 Black & Veatch Proposal



Summary of Significant Drivers of Cost Change

- Biomass
 - + 30% ITC vs \$10/MWh PTC
 - + 85% vs. 80% Capacity factor
 - + ~10% reduction in capital cost
 - ~10% increase in O&M costs
- Wind
 - + 30% ITC vs \$21/MWh PTC
 - + max capacity factor increased by 2% due to consideration of OOS wind
- Geothermal
 - + 30% ITC vs \$21/MWh PTC
 - Upper end of capital cost range increased to accommodate new smaller OOS plants
- Solar PV
 - + Substantial drop in capital cost and consideration of thin film as part of base case
- Solar Thermal
 - Increase in capital cost and decreased capacity factor due to assumption of dry cooling