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# **Small-Scale Bioenergy: Resource Potential, Costs, and FIT Implementation Assessment**

**Adam Schultz**

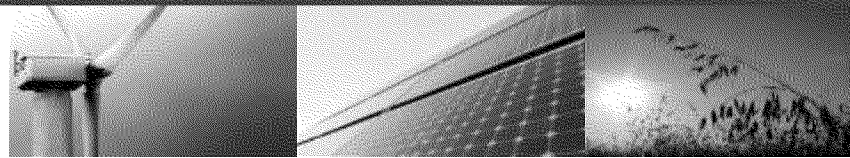
*Lead Analyst, Wholesale Renewable DG Programs*

California Public Utilities Commission

May 2, 2013

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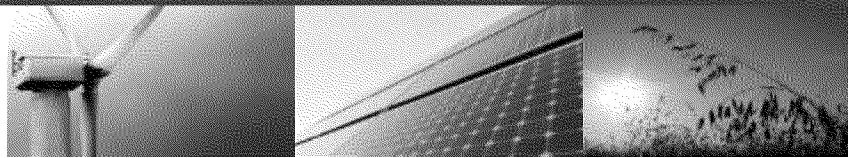
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# Workshop Overview

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- Housekeeping and Introductions
- In-Scope / Out-of-Scope at Today's Workshop
- Workshop agenda
- Overview of SB 1122
- Overview of the PUC's Implementation Process



# In-Scope vs. Out-of-Scope

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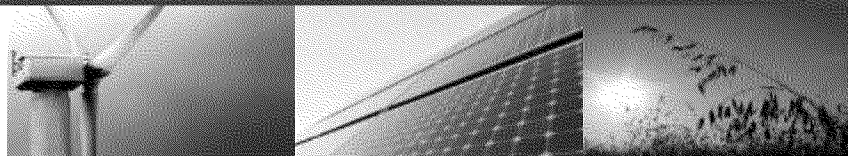
## In-Scope at the Workshop:

- Provide constructive feedback based on real-world experience to improve the methodologies and assumptions presented by B&V
- Identification of public data sources to improve upon the resource potential identified in this draft study
- Identification of public data sources to improve upon the technology cost estimates in this draft study
- Identify market, regulatory, or operational barriers to the implementation of SB 1122

## Out-of-Scope at the Workshop:

- Program rules or administration of RAM
- Proposed Decision on ReMAT PPA scheduled for next week's CPUC Agenda
- Rule 21 / Interconnection reform
- Project-specific disputes or complaints
- Societal benefits (i.e., qualities of a project that, while beneficial, do not reflect a utility's avoided costs)
- Guidance or recommendations on where individual projects should or should not locate

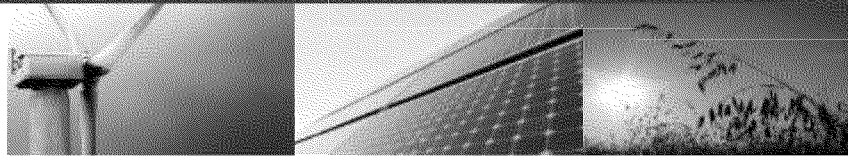
**One rule:** If you're recommending a change, be prepared to demonstrate that (1) it would have a material impact on the analysis, and (2) that it can be sourced to publicly available data/information.



# Workshop Agenda

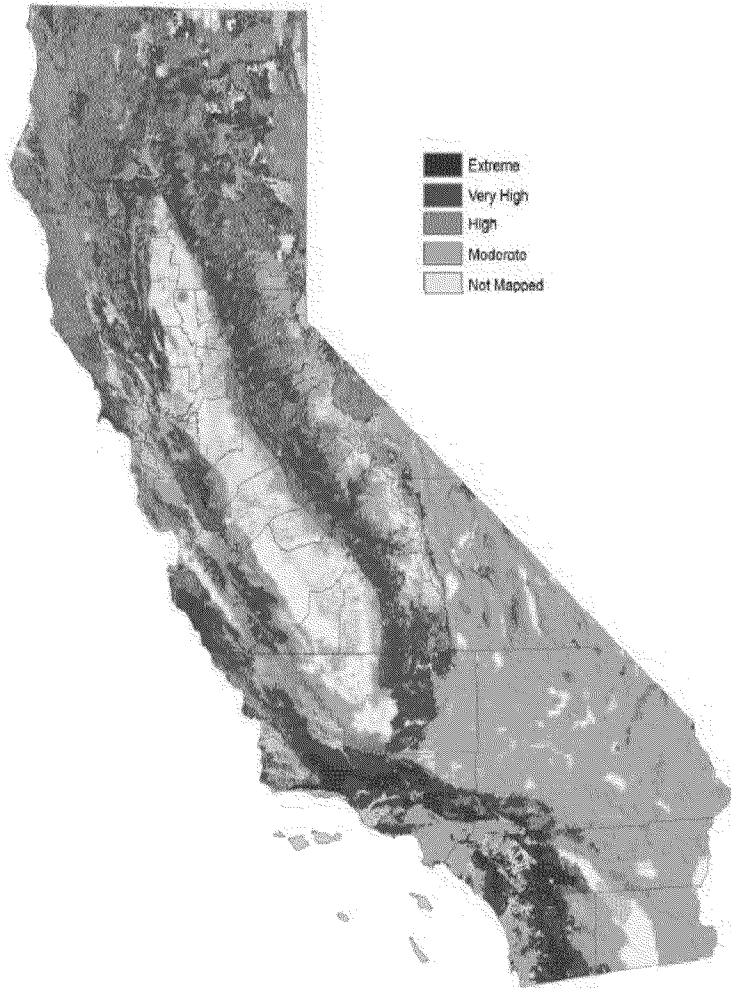
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- 9:30-9:45**      **Introduction and Overview**
- 9:45-10:45**    **Bioenergy Resource Potential**
- *Feedstock definitions and Assumptions*
  - *Overview of potential by category*
  - *Q&A: Resource potential*
- 11:00-12:15**    **Small-Scale Bioenergy Cost Estimate**
- *Assumptions and high-level overview*
  - *Overview of cost estimates by category*
  - *Q&A: Cost Analysis*
- 12:15-1:15**     **Lunch Break**
- 1:15-2:30**      **Feed-in Tariff Implementation Assessment**
- *ReMAT criteria*
  - *Statutory interpretation of SB 1122*
  - *Q&A: FIT Implementation*
- 2:45-4:00**      **SB 1122 Technology Allocation Options**
- *Overview of allocation options and statutory requirements*
  - *Q&A: Allocation options*
- 4:00-4:15**      **Next Steps**



# Background on Law and Analysis

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- **SB 1122 (Rubio)**

- Signed into law 27 September 2012
- Implementation of tariff in 2013

- **Feed In Tariff (FIT) specific for small biomass/biogas**

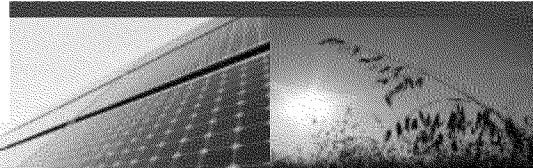
- **Analysis providing insight into:**

- Resource availability
- Costs
- Potential implementation issues



0 50 100 150 Miles  
February 17, 2005

Data Sources:  
FRAP Fire Threat, v02\_4

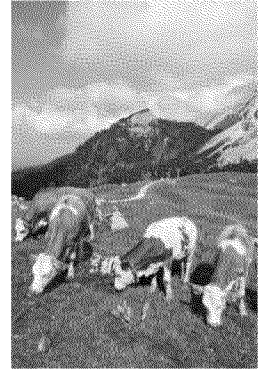


# SB1122 Structure

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- **Eligible Feedstocks**

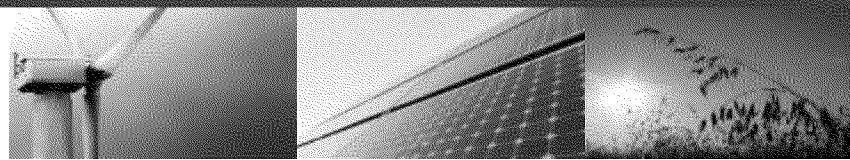
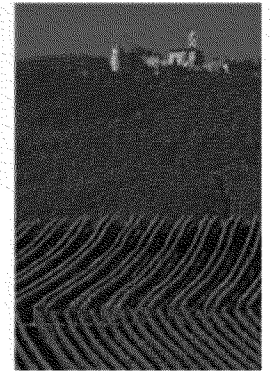
- Wastewater and low solids green wastes
- Dairy and agricultural residues
- Forest, from fire threat treatment areas (FTTAs)



- **Targets**

- 250 MW program, split between the three feedstock types, with potential flexibility for allocation to each IOU
- Utility specific targets based on share of peak load

- **New projects sized up to 3 MW**



# SB1122 Implementation

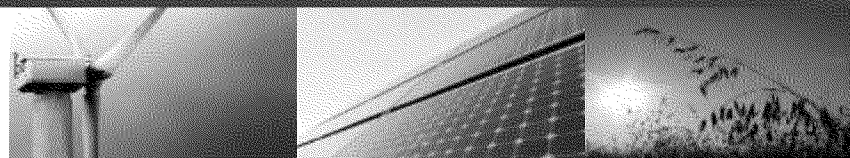
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- **Legislation does NOT cover**

- Landfill gas and use of urban wood wastes
- Woody material not sourced from FTTAs
- Projects sited outside of PG&E, SCE, and SDG&E service territories

- **CPUC's roadmap for SB 1122 implementation:**

- (1) Staff-level analysis developed with Black & Veatch
- (2) ALJ Ruling to seek formal comments on Staff Proposal (to be informed by B&V study) on SB 1122 Implementation
- (3) ALJ to issue a proposed decision on SB 1122 later in 2013



# More Information

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## CPUC RPS Website:

- [www.cpuc.ca.gov/renewables](http://www.cpuc.ca.gov/renewables)

## CPUC's Renewable DG Web pages:

- FIT: [www.cpuc.ca.gov/feedintariff](http://www.cpuc.ca.gov/feedintariff)
- RAM: [www.cpuc.ca.gov/RAM](http://www.cpuc.ca.gov/RAM)
- Solar PV Programs:  
[www.cpuc.ca.gov/PUC/energy/Renewables/hot/Utility+PV+Programs](http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/Utility+PV+Programs).

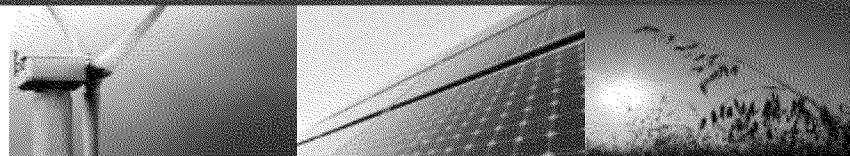
## Questions:

### **Adam Schultz**

*Lead Analyst, Wholesale Renewable DG Programs*

Renewable Procurement and Market Development  
California Public Utilities Commission

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# BUILDING A WORLD OF DIFFERENCE

## SMALL SCALE BIOENERGY: RESOURCE POTENTIAL, COST, AND IMPLEMENTATION ASSESSMENT

SCOTT OLSON

PROJECT MANAGER  
RENEWABLES AND ENERGY EFFICIENCY



**BLACK & VEATCH**  
Building a world of difference.®

2 May 2013

# BACKGROUND



# BACKGROUND ON B&V'S INVOLVEMENT

- **B&V is the prime contractor supporting the CPUC Renewable Distributed Generation Technical Analysis (#11PS5003)**
- **Specific bioenergy tasks:**
  - Technology assessment
  - Resource potential
  - Cost/benefit analysis, including externality quantification (later)
- **Partners:**
  - Energy + Environmental Economics (E3)
  - Katin Engineering Consulting
  - IN Communications

**SB1122 analysis is one portion of this work**



# RESOURCE POTENTIAL



# INTENT OF ANALYSIS

- **What it does:**

- Provides a high level estimate of *total available* resource potential for SB 1122-eligible projects
- Provides insight for the *general distribution* of bioenergy resources across the IOU service territories
- Provides insight on the areas of *potential constraint*

- **What it does not:**

- Quantify all potential resource opportunities
- Provide guidance on where individual projects should or should not be located

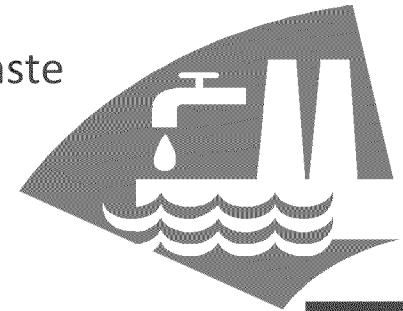


# SB1122 WORDING AND CLASSIFICATION

## Category 1

- **“biogas from wastewater treatment, municipal organic waste diversion, food processing, and codigestion”**
  - Wastewater Treatment Plant (WWTP) biogas
  - Low Solids Green Waste (food processing waste, food waste present in MSW, leaves/grass in MSW, fats, oils, and greases [FOG])
  - Does NOT include high solids food processing waste (not biogas)
- Analysis took into account WWTPs and all sources classified by B&V as “green waste”
- Codigestion potential covered through low solids green waste

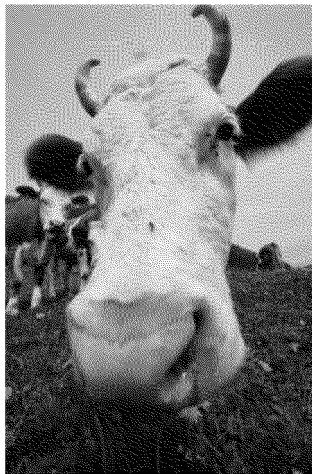
*Reclassify: WWTPFWLGFOG?*



# SB1122 WORDING AND CLASSIFICATION

## Category 2

- **“dairy and other agricultural bioenergy”**
  - Dairy manure digestion
  - Agricultural residues (orchard/vineyard, field/seed, vegetable, etc.)
  - High solids food waste (nut shells, rice hulls, etc.)



# SB1122 WORDING AND CLASSIFICATION

## Category 3

- **“..bioenergy using byproducts of sustainable forest management. Allocations under this category shall be determined based on the proportion of bioenergy that sustainable forest management providers derive from sustainable forest management in fire threat treatment areas [FTTAs], as designated by the Department of Forestry and Fire Protection”**
  - Any material from FTTAs technically eligible
  - Quantification made of non-merchantable forest slash and thinnings
  - Merchantable material and shrub excluded from the analysis





# RESOURCE ASSUMPTIONS

- **Used public, previously peer reviewed data**
- **Technical potential reported**
  - Takes into account collection and use factors
  - Higher than what may be economic
- **Only new, unutilized resources are eligible**
  - §399.20(f)(2), “commence operation on or after 6/1/13”
  - Food waste, ag. waste, and dairy manure being used for power generation removed from estimates
- **Known issues**
  - Datasets used are not comprehensive
  - FOG and FTTA material already being used not removed
  - “Technical” potential can be debated

***Intent was to capture relative availability and constraints, not all possible options***



# TECHNOLOGY ASSUMPTIONS

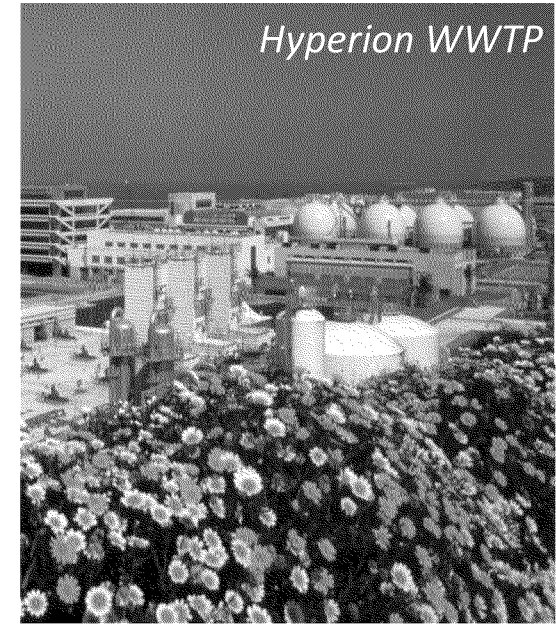
- **Used to create MW and cost of generation estimates**
- **Conversion technology**
  - Digestion and reciprocating engine for biogas ( $\eta = 35\%$ )
  - Gasification and reciprocating engine for biomass ( $\eta = 21\%$ )
- **Digestion**
  - Complete mix, glass lined steel tanks
  - Biogas cleaning to remove moisture,  $H_2S$ , and siloxanes
  - Engines have  $NO_x$  and CO removal equipment
- **Gasification**
  - Limited commercial options at this scale
  - Syngas cleaning prior to feeding to engines



# CATEGORY 1 METHODOLOGY DETAIL

- **WWTPs**

- Evaluated potential at:
  - facilities without AD (>10 MGD)
  - facilities with AD not utilizing any biogas
- Biogasdata.org used for screening; multi-stakeholder database
- MW potential estimated using assumptions for solids content and gas production
- Potential codigestion resources taken into account as stand alone units
  - Food waste, FOG, etc.
  - Could be used at WWTPs if space available



# CATEGORY 1 METHODOLOGY DETAIL

WWTP	CITY	COUNTY	HAVE OPERATING DIGESTERS?	AVERAGE FLOW, MGD	ELECTRICITY POTENTIAL, MW
Coachella VWD - WRP	Indio	Riverside	No	10	0.3
Vallejo Sanitation and Flood Control District	Vallejo	Solano	No	13	0.4
Palo Alto RWQCP	Palo Alto	Santa Clara	No	22	0.7
Central Contra Costa Sanitary District	Martinez	Contra Costa	No	54	1.6
Beale Air Force Base	Beale AFB	Yuba	Yes	0.4	0.01
Crescent City WWTP	Crescent	Del Norte	Yes	1.9	0.06
Pinole/Hercules WPCP	Pinole	Contra Costa	Yes	2	0.06
Banning WWTP	Banning	Riverside	Yes	2.2	0.07
El Centro WWTP	El Centro	Imperial	Yes	4	0.1
Yuba City WTF	Yuba	Sutter	Yes	6	0.2
Manteca WQCF	Manteca	San Joaquin	Yes	6.2	0.2
Simi Valley WQCP	Simi Valley	Ventura	Yes	9.1	0.3

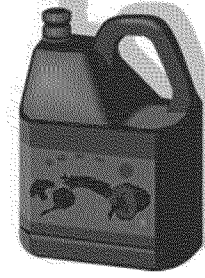
**Could be higher with codigestion**



# CATEGORY 1 METHODOLOGY DETAIL

- **Low Solids Green Waste**

- Food processing waste
  - 2011 CEC/CBC analysis
  - Excludes data from soft drink manufacturers, sugar refineries, and snack producers, due to limited response
- Food waste, leaves/grass
  - 2007 CEC/CBC analysis
  - 2017 technical potential
  - Material diverted from MSW stream (50% recovery)
- FOG
  - NREL estimates for FOG/person, 50% recovery
  - CEC 2017 population estimates



# CATEGORY 1 METHODOLOGY DETAIL

- **Low Solids Green Waste**

- Gas yields based on industry averages; can vary greatly

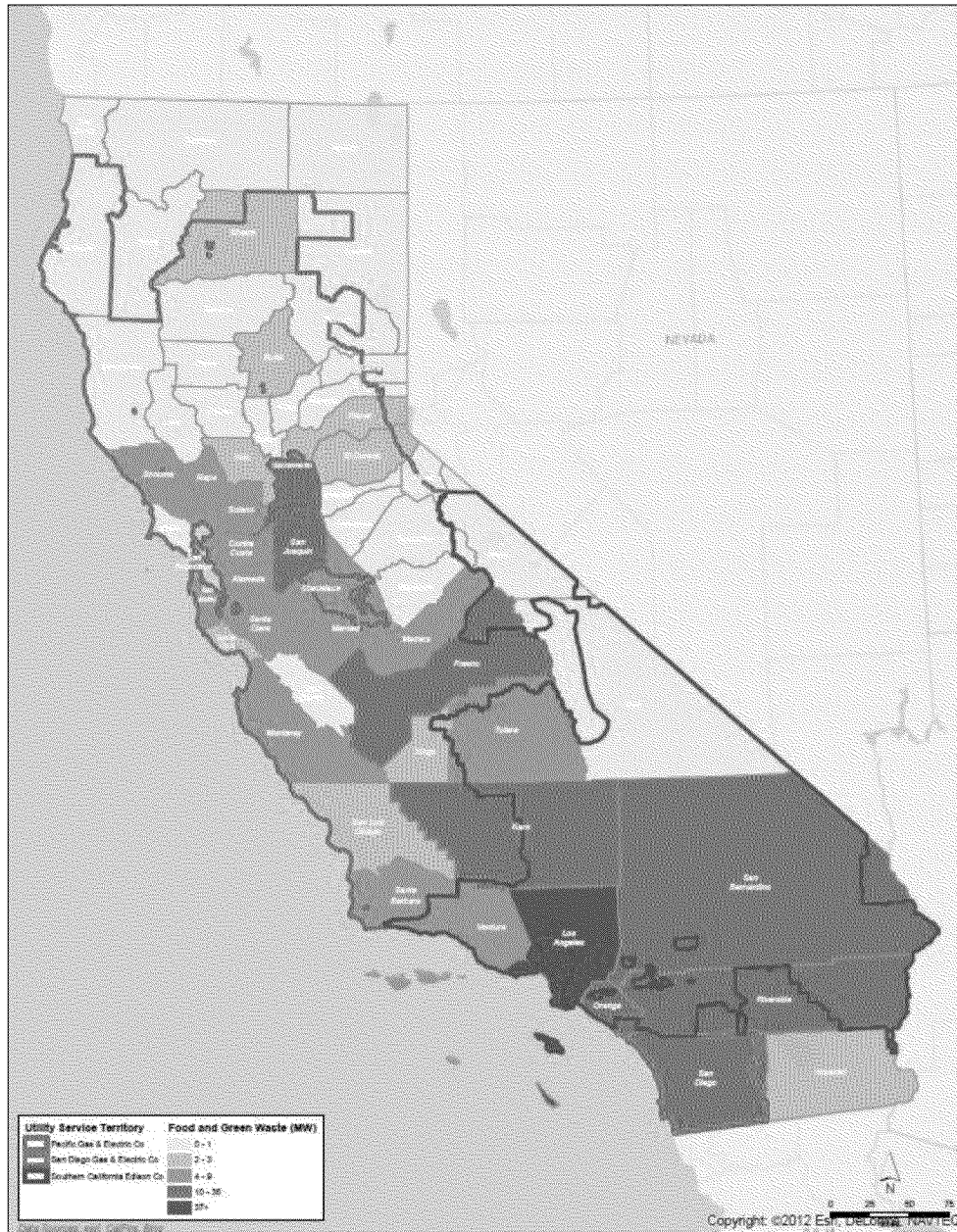
Material	Gas Yield (ft <sup>3</sup> methane/dry ton)
Food waste	13,300
Leaves/grass	6,650
FOG	39,900

- Estimated capacity

Material	State Capacity Estimate (MW)
Food waste in MSW	159
Food processing waste	41
Leaves/grass	30
FOG	65



# CATEGORY 1 GEOGRAPHIC DISTRIBUTION



CPUC Food & Green Waste Bioenergy Potential



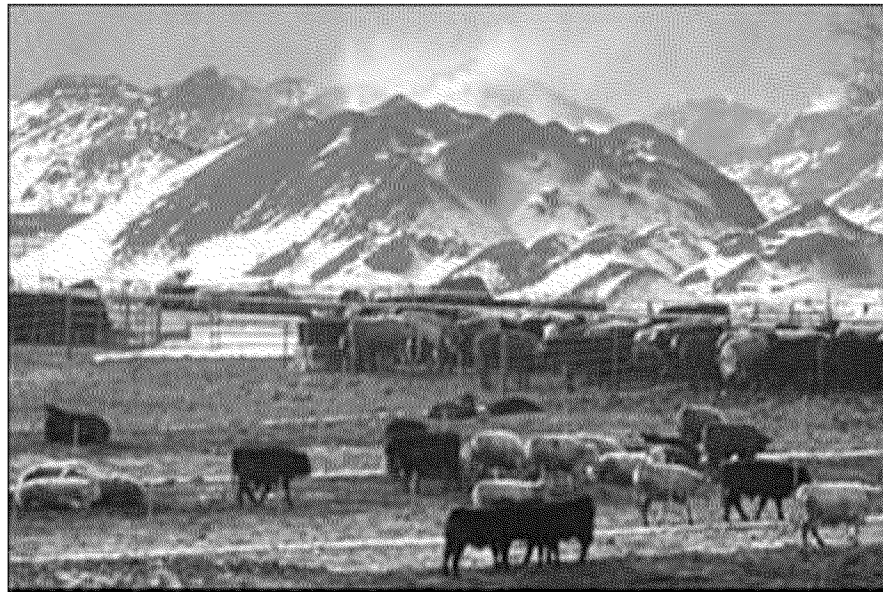
UTILITY	CATEGORY 1: (MW)
PG&E	101
SCE	115
SDG&E	26
<b>Total Potential</b>	<b>241</b>
<b>SB 1122 Target</b>	<b>110</b>



# CATEGORY 2 METHODOLOGY DETAIL

- **Dairy Manure**

- Dairy head count per county used to estimate potential, using USDA and CDFA 2011 published data
- USDA assumptions for methane production at a flushed freestall dairy using plug flow digesters (31 ft<sup>3</sup>/day/cow)





# CATEGORY 2 METHODOLOGY DETAIL

- **Agricultural Residues**

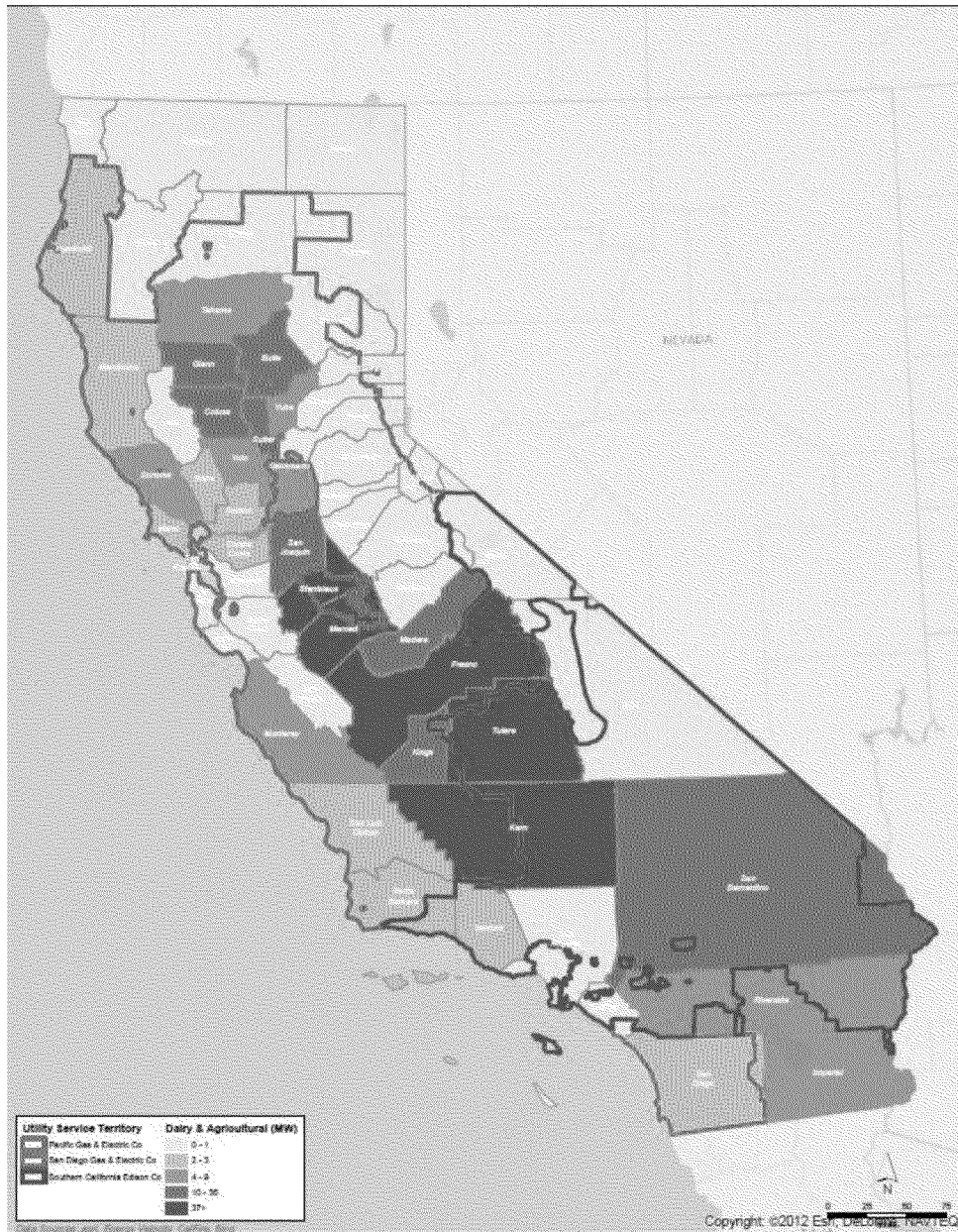
- Started with 2007 CEC/CBC analysis, 2017 technical potential
- Estimated existing use removed
- Remaining material further discounted by two-thirds to take into account competing uses (consistent with Renewable Energy Transmission Initiative)

- **High Solids Food Processing Waste**

- Largely 2011 CEC/CBC analysis
- Rice hulls and cotton gin waste added (2007 CEC/CBC)
- Discounted as above



# CATEGORY 2 GEOGRAPHIC DISTRIBUTION



Utility Service Territory	Dairy & Agricultural (MW)
North Gas & Electric Co.	0-1
San Diego Gas & Electric Co.	2-3
Southern California Edison Co.	4-5
	6+

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CPUC Dairy & Agricultural Bioenergy Potential



UTILITY	CATEGORY 2: (MW)
PG&E	340
SCE	118
SDG&E	1
<b>Total Potential</b>	<b>460</b>
<b>SB 1122 Target</b>	<b>90</b>

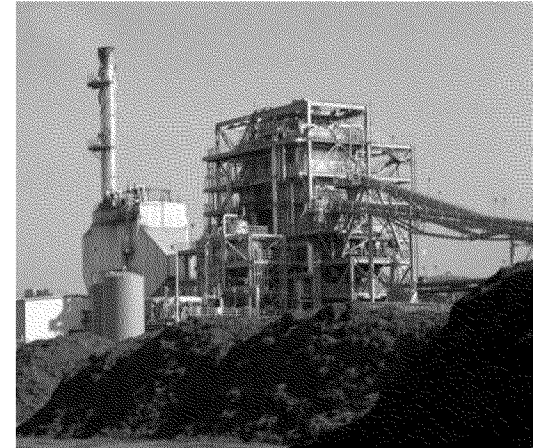
TYPE	STATE SPLIT (%)	PG&E SPLIT (%)	SCE SPLIT (%)
Ag.	55	68	36
Dairy	45	32	64

26

# CATEGORY 3 METHODOLOGY DETAIL

- **Sustainable Forest Management Byproducts**

- Data from 2005 CEC/CAL FIRE analysis
- Focus on non-merchantable forest slash/thinnings (“byproducts”)
- CAL FIRE data incorporates assumptions for sustainability and availability
- Intersected GIS files with IOU service territories

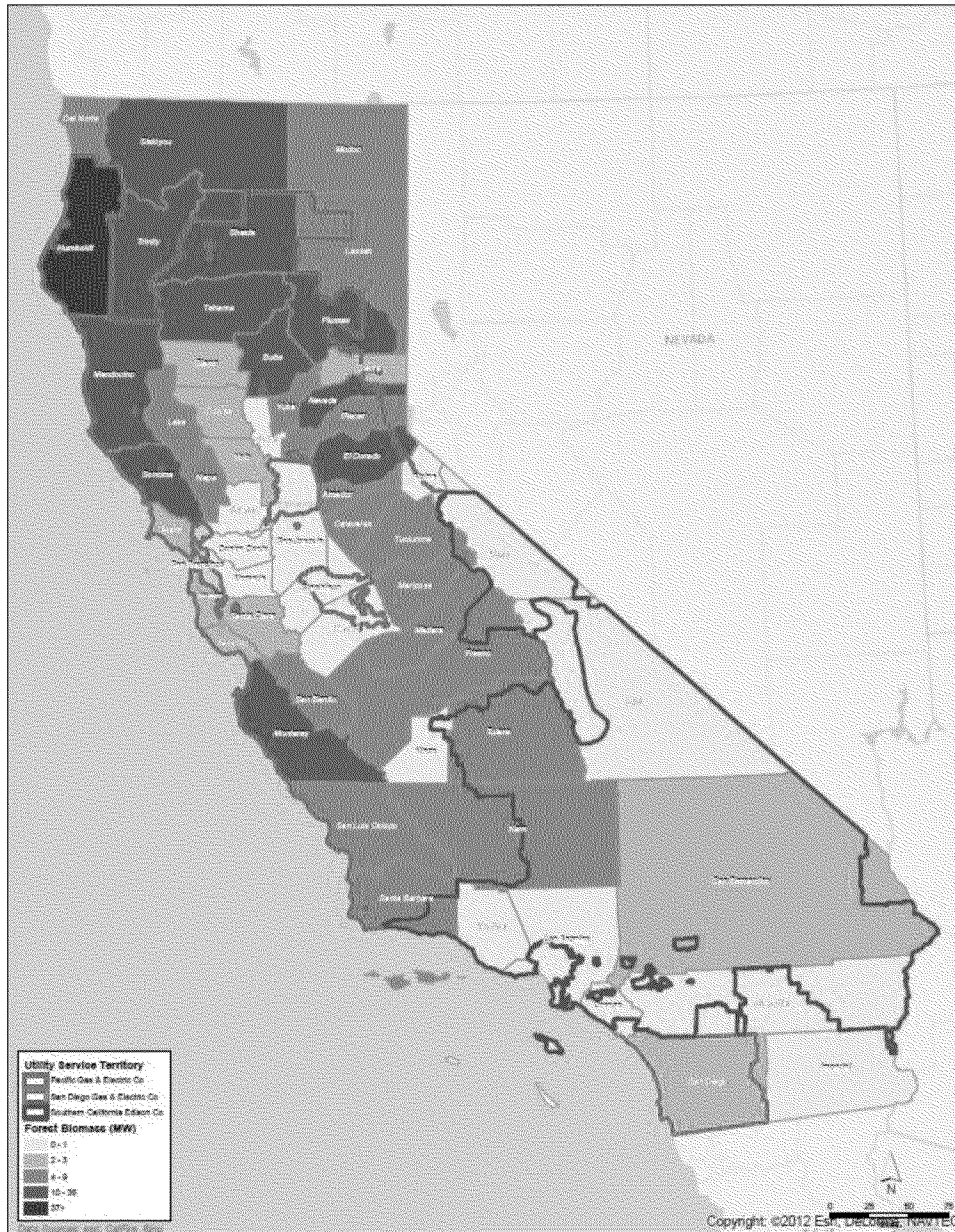


- **Caveats**

- Not discounted for material already being used
- While technically allowed, did not include shrub
  - Collection challenges, environmental issues, and quality of resource
  - Of interest to developers?



# CATEGORY 3 GEOGRAPHIC DISTRIBUTION



CPUC Forest Resource Potential



UTILITY	CATEGORY 3: (MW)
PG&E	277
SCE	15
SDG&E	2
<b>Total Potential</b>	<b>295</b>
<b>SB 1122 Target</b>	<b>50</b>



# RESOURCE SUMMARY

UTILITY	WWTP AND GREEN WASTE BIOGAS	DAIRY AND AG. BIOENERGY	FOREST	TOTAL POTENTIAL	SB 1122 TARGET
PG&E	101	340	277	718	109
SCE	115	118	15	249	118
SDG&E	26	1	2	29	23
<b>Total</b>	<b>241</b>	<b>460</b>	<b>295</b>	<b>996</b>	<b>250</b>
SB 1122 Target	110	90	50	250	

**Plentiful, but disproportionately spread**



# QUESTIONS

- **Is the resource quantification approach reasonable? What other data is needed to show the approach?**
- **Does the relative availability of resource types seem reasonable, focusing on areas of potential constraint?**
  - Any significant resources missing? Shrub biomass?
  - Should any availability factors be significantly modified?
- **Are the resource limitations at SDG&E and SCE likely? Any other areas or types?**
- **Several parties commented on CAL FIRE's definition of sustainable forest management. Is it appropriate?**
  - If not, can parties suggest an alternative definition that's publicly available and already vetted by a state agency?



# COST ANALYSIS



# INTENT OF ANALYSIS

- **What it does:**

- Estimate the levelized cost of energy (LCOE) from a generic set of SB 1122 compliant projects
- Provide a range of potential compliance costs

- **What it does not:**

- Set the FIT price—this will be performed by the Renewable Market Adjusting Tariff (ReMAT)
- Incorporate possible incentives and coproduct values
- Reflect of the value of bioenergy to the state







# POTENTIAL VALUE OF BIOENERGY

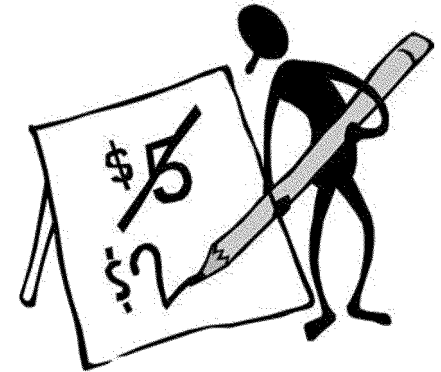
- Improved forest health and reduced fire risk
- Baseload resource in capacity constrained markets
- Local community development
- Renewable energy resource
- GHG benefits relative to alternatives
- Others!

**Not quantified here, but will be in later analysis**

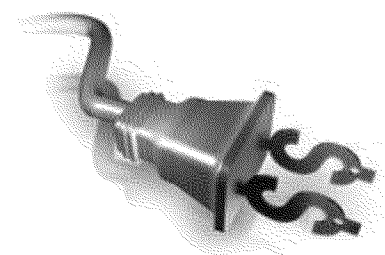


# REMAT PRICING MECHANISM

- Pricing mechanism used for any FITs adopted under §399.20 of the Public Utilities Code
- Project must first pass screens:
  - Bid Fee
  - Interconnection Studies
  - Site Control
  - Development Experience
  - 24 month on-line requirement
- **Tariff starts at \$89.23/MWh, then may adjust**
  - 5 eligible projects must enter the queue
  - Tariff adjusts every 2 months based on market demand



# GENERAL ASSUMPTIONS, LCOE



- Includes all direct and indirect costs
- Reflect ownership by a taxable entity with power being sold under a PPA back to a utility
- Does not include:
  - Federal or state incentives, with exception of accelerated depreciation (MACRS)
  - Value or cost for coproducts, with the exception of heat at WWTPs with digesters
- Estimates made for feedstock cost/tipping fees
- Simple interconnection to circuits with available capacity that do not require transmission upgrades



# FACILITY COST ASSUMPTIONS

- Capital and O&M costs from B&V engineering estimates, vendor quotes, and/or public prices
- Sizes based on lowest cost option or feasibility due to likely resource constraints

Resource	Size (MW)	Basis
WWTP	0.3	Largest likely new option
Low Solids Green Waste	3	SB1122 Maximum
Dairy Manure	1	Largest typical single dairy
Forest/Ag Residues	3	SB1122 Maximum



# FINANCIAL MODEL ASSUMPTIONS

- Debt/Equity: 60/40
- Debt Rate: 7 percent
- Cost of Equity: 10 percent
- Debt Length: 15 years
- Project Life: 20 years
- Depreciation: 7 year MACRS
- Tax Rate: 40 percent
- O&M and Fuel Cost Escalation: 2 percent/year

**Cost of Generation Calculator**  
All inputs are in \$/yr.

Technology Assumptions		Financial/Economic Assumptions		Incentives	
Project Capacity (MW)	2.84	Debt Percentage	60%	PTC (\$/MWh)	0%
Capital Cost (\$/kW)	\$9,700	Debt Rate	7%	PTC Escalation	0%
Fixed O&M (\$/kW)	\$460	Debt Term (years)	15	PTC Term (years)	0%
Fixed O&M Escalation	2%	Economic Life (years)	20	ITC	0%
Variable O&M (\$/MWh)	0	Depreciation Term (years)	7	Other Incentives (\$/year)	0%
Variable O&M Escalation	0	Percent Depreciated	100%	Incentive Escalation	0%
Fuel Cost (\$/MWh)	\$5.00	Cost of Generation Escalation	0%	<b>Outputs</b>	
Fuel Cost Escalation	2%	Tax Rate	40%	NPV for Equity Return	\$0
Heat rate (Btu/kWh)	10000	Cost of Equity	10%	Levelized Cost of Generation	\$139.33
Capacity Factor	90%	Discount Rate	7%	<b>Calculation</b>	

Year	1	2	3	4	5	6	7	8	9	10	11	
Annual Generation (MWh)	22,548	22,548	22,548	22,548	22,548	22,548	22,548	22,548	22,548	22,548	22,548	
Cost of Generation	\$189.18	\$189.18	\$189.18	\$189.18	\$189.18	\$189.18	\$189.18	\$189.18	\$189.18	\$189.18	\$189.18	
Operating Revenues	\$3,138,298	\$3,138,298	\$3,138,298	\$3,138,298	\$3,138,298	\$3,138,298	\$3,138,298	\$3,138,298	\$3,138,298	\$3,138,298	\$3,138,298	
Fixed O&M	\$1,401,400	\$1,429,628	\$1,458,017	\$1,487,177	\$1,516,920	\$1,547,239	\$1,578,104	\$1,609,708	\$1,641,993	\$1,674,805	\$1,708,289	
Variable O&M	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Fuel Cost	-\$1,127,412	-\$1,149,960	-\$1,172,959	-\$1,196,419	-\$1,220,347	-\$1,244,754	-\$1,269,649	-\$1,295,042	-\$1,320,945	-\$1,347,362	-\$1,374,309	
Incentives	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Operating Expenses	\$273,988	\$279,668	\$285,057	\$290,758	\$296,573	\$302,505	\$308,655	\$314,776	\$321,021	\$327,441	\$333,000	
Interest Payment	\$1,185,164	\$1,118,797	\$1,048,184	\$1,016,098	\$959,298	\$898,518	\$833,485	\$763,901	\$689,445	\$609,777	\$524,533	
Principal Payment	\$502,289	\$708,757	\$758,070	\$821,436	\$868,227	\$899,050	\$894,008	\$1,053,033	\$1,128,108	\$1,217,770	\$1,303,020	
Debt Service	\$1,827,553	\$1,827,553	\$1,827,553	\$1,827,553	\$1,827,553	\$1,827,553	\$1,827,553	\$1,827,553	\$1,827,553	\$1,827,553	\$1,827,553	
Tax Depreciation	\$3,964,332	\$6,794,016	\$4,852,076	\$3,464,976	\$2,477,361	\$2,474,586	\$2,477,361	\$1,237,293	\$0	\$0	\$0	
Taxable Income	(\$2,265,196)	(\$5,053,983)	(\$3,068,019)	(\$1,633,534)	(\$594,532)	(\$537,317)	(\$481,533)	\$822,378	\$2,127,882	\$2,301,079	\$2,279,775	
PTC	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
ITC	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
Taxes	(\$906,074)	(\$2,071,593)	(\$1,277,298)	(\$613,434)	(\$217,573)	(\$214,923)	(\$192,443)	\$128,951	\$651,133	\$860,482	\$911,910	
<b>Total</b>	<b>(11,096,800)</b>	<b>1,942,831</b>	<b>3,092,059</b>	<b>2,252,895</b>	<b>1,673,400</b>	<b>1,252,148</b>	<b>1,223,169</b>	<b>1,194,631</b>	<b>667,097</b>	<b>130,591</b>	<b>102,871</b>	<b>64,814</b>

MACRS Depreciation Schedules

Year	1	2	3	4	5	6	7	8	9	10	11
MACRS	0.1429	0.2449	0.1776	0.1254	0.0873	0.0625	0.0462	0.0351	0.0274	0.0219	0.0177



# CATEGORY 1: WWTPS

- Without existing digestion

	LOW ESTIMATE	MED. ESTIMATE	HIGH ESTIMATE
Project Size (MW)	0.3	0.3	0.3
Capital Cost (\$/kW)	17,840	22,300	31,220
Operating Cost (\$/kW-yr)	1,672	2,090	2,926
LCOE (\$/MWh)	448	591	709

- With existing digestion

	LOW ESTIMATE	MED. ESTIMATE	HIGH ESTIMATE
Project Size (MW)	0.3	0.3	0.3
Capital Cost (\$/kW)	7,120	8,900	10,680
Operating Cost	544	680	816
LCOE (\$/MWh)	148	190	233

**Power gen rarely the main driver at WWTPs**



# CATEGORY 1: LOW SOLIDS GREEN WASTE

	LOW ESTIMATE	MED. ESTIMATE	HIGH ESTIMATE
Project Size (MW)	3	3	3
Capital Cost (\$/kW)	7,760	9,700	11,640
Operating Cost (\$/kW-yr)	392	490	588
Tipping Fee (\$/ton)	30	20	10
LCOE (\$/MWh)	80	139	204

- Larger size and tipping fee greatly improves economics over WWTPs
- This economy of scale likely only in largest metro areas
- Value/cost potential for digestate



## CATEGORY 2: DAIRY MANURE

	LOW ESTIMATE	MED. ESTIMATE	HIGH ESTIMATE
Project Size (MW)	1	1	1
Capital Cost (\$/kW)	8,720	10,900	13,080
Operating Cost (\$/kW-yr)	760	950	1,140
LCOE (\$/MWh)	211	278	334

- **No tipping fee, smaller size relative to green waste**
- **May be able to create larger facilities with consolidation of waste from multiple dairies**
- **AB 32 GHG offsets possible, improving economics**
- **Value/cost potential for digestate**





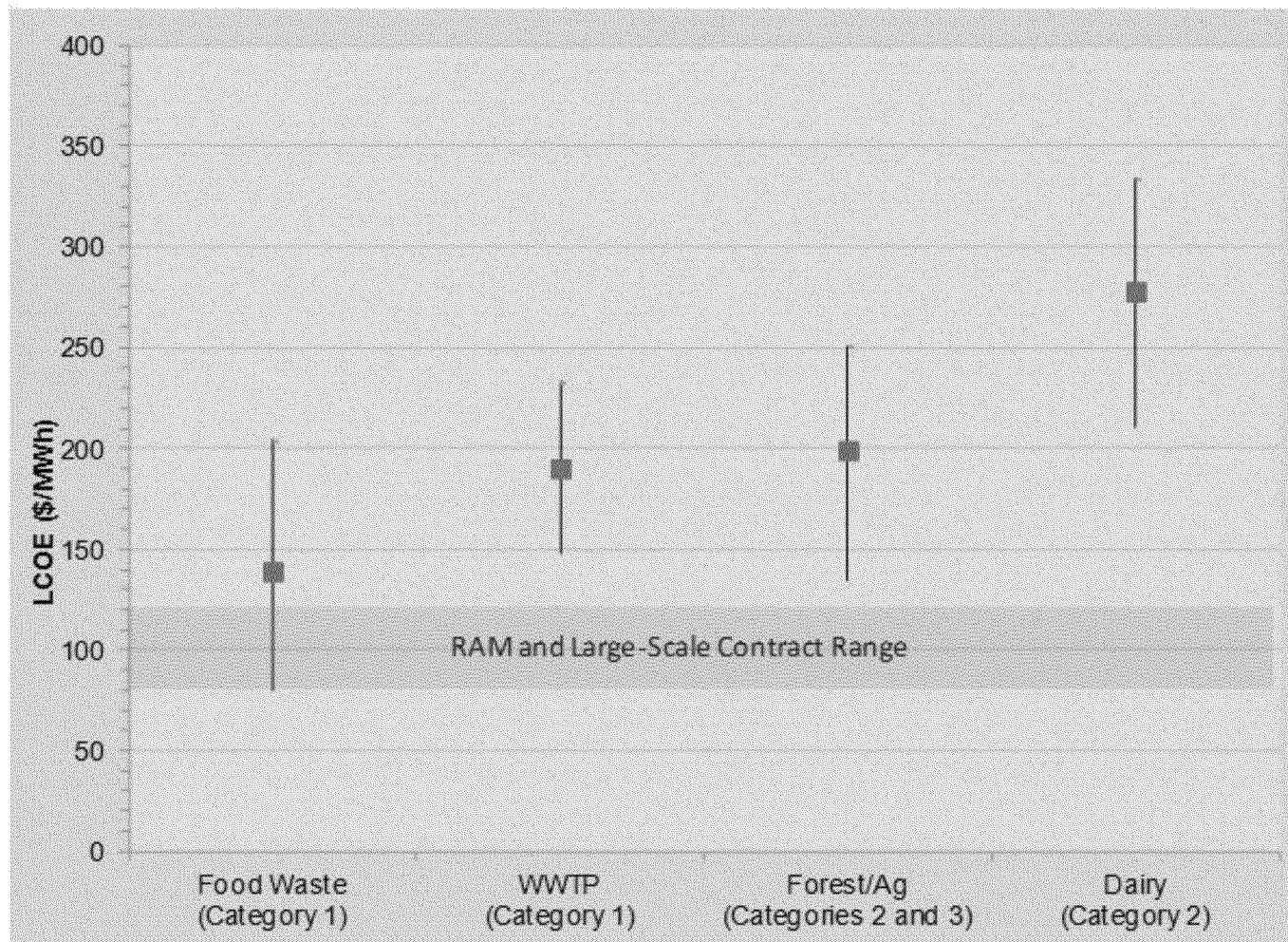
## CATEGORY 2/3: FOREST AND AG. RESIDUALS

	LOW ESTIMATE	MED. ESTIMATE	HIGH ESTIMATE
Capital Cost (\$/kW)	5,000	6,000	7,500
Operating Cost (\$/kW-yr)	347	553	590
Size (MW)	3	3	3
Feedstock Cost (\$/dry ton)	20	30	40
LCOE (\$/MWh)	134	199	251

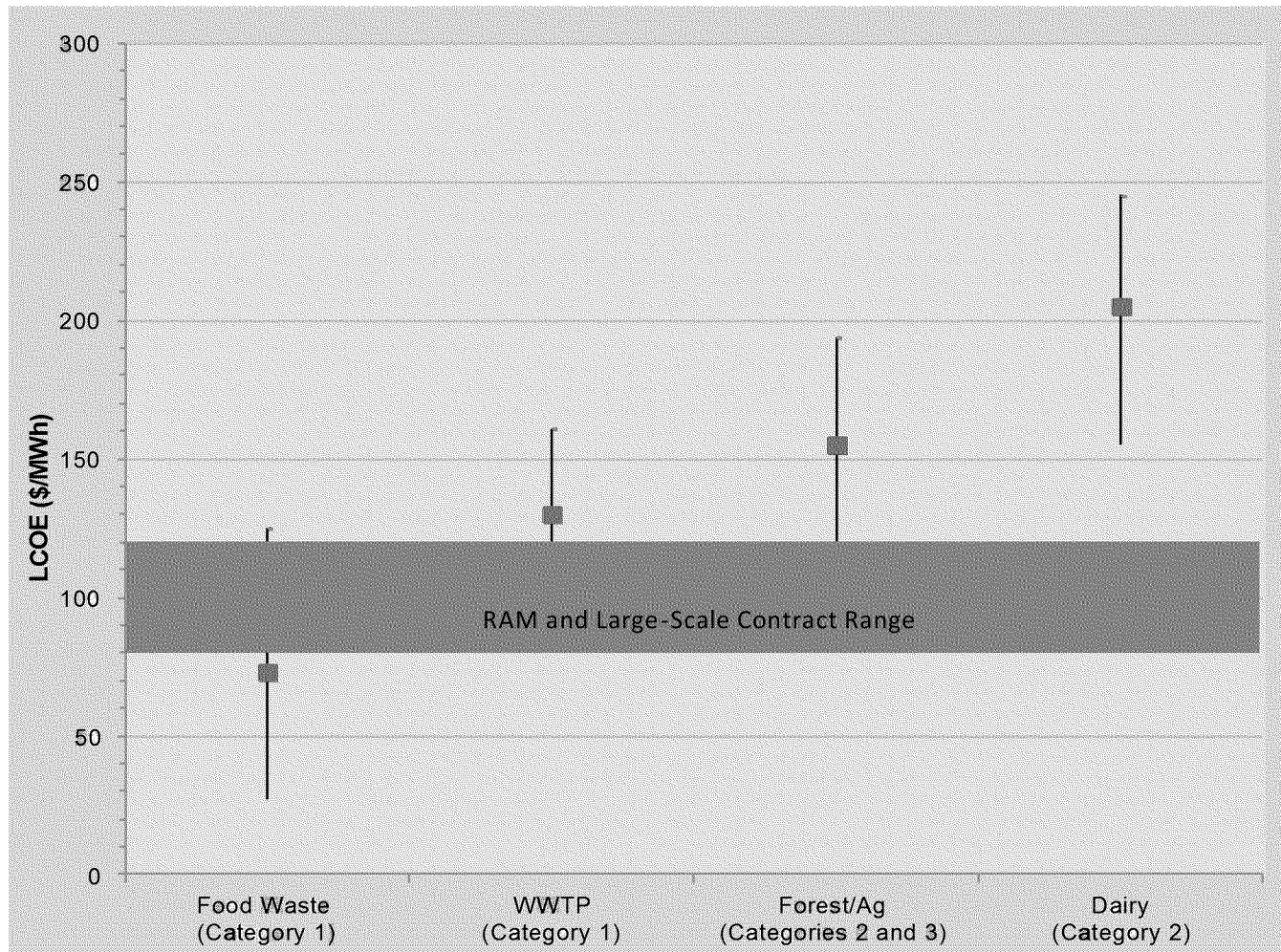
- **Similar technology/cost for both resources, although feedstock handling and resource costs can vary**
- **Feedstock costs included a discount when compared to larger facilities (\$50/BDT)**
- **SB 1122 specific resource competition?**



# LCOE SUMMARY (NO INCENTIVES/COPRODUCT VALUE)



# LCOE SUMMARY (WITH 30% INVESTMENT TAX CREDIT)



**Reflects proxy incentives/coproduct values**



# QUESTIONS

- **Are the range of costs reasonable?**
  - If not, how will this impact the use of ReMAT?
  - Other examples of representative projects?
- **Any major assumptions that should be changed that are not already reflected in the estimate range?**
  - Forest/ag. resource cost basis for small scale
- **Several parties expressed a desire for the study to incorporate coproduct values/cost, incentives, and GHG offset revenues.**
  - Are there values that should be incorporated into all base cases?
  - How would the uncertainty around potential GHG offset revenues be incorporated into a long-term PPA?



## QUESTIONS (CONTINUED)

- **Several parties commented on the potential variability of fuel and feedstock costs (e.g., due to variable transportation fuel costs, due to increased demand for limited resources, due to relocating projects nearer to load, etc.).**
  - What would be suggested to better identify and capture these variable costs for the base cases?



# IMPLEMENTATION ASSESSMENT



# POTENTIAL IMPLEMENTATION ISSUES

- Technical
- ReMAT Application
- Statutory Interpretation
- Allocation Targets



# TECHNICAL ISSUES

- **Limited CA experience:**
  - Dry digestion (up to 40% solids)
  - Biomass gasification
- **Siting and development hurdles**
- **Feedstock quality**
- **Digestate/ash disposal**





# REMAT APPLICATION ISSUES

- **Must be “strategically located”**
  - ReMAT decision defined with \$300k cap on upgrades
  - Few biomass projects in the queue now and even fewer meet this definition
- **Development experience screen**
  - Little experience in the US with some technologies at this scale
- **Seller concentration**
  - No restriction in ReMAT
  - Could be an issue in resource constrained locations

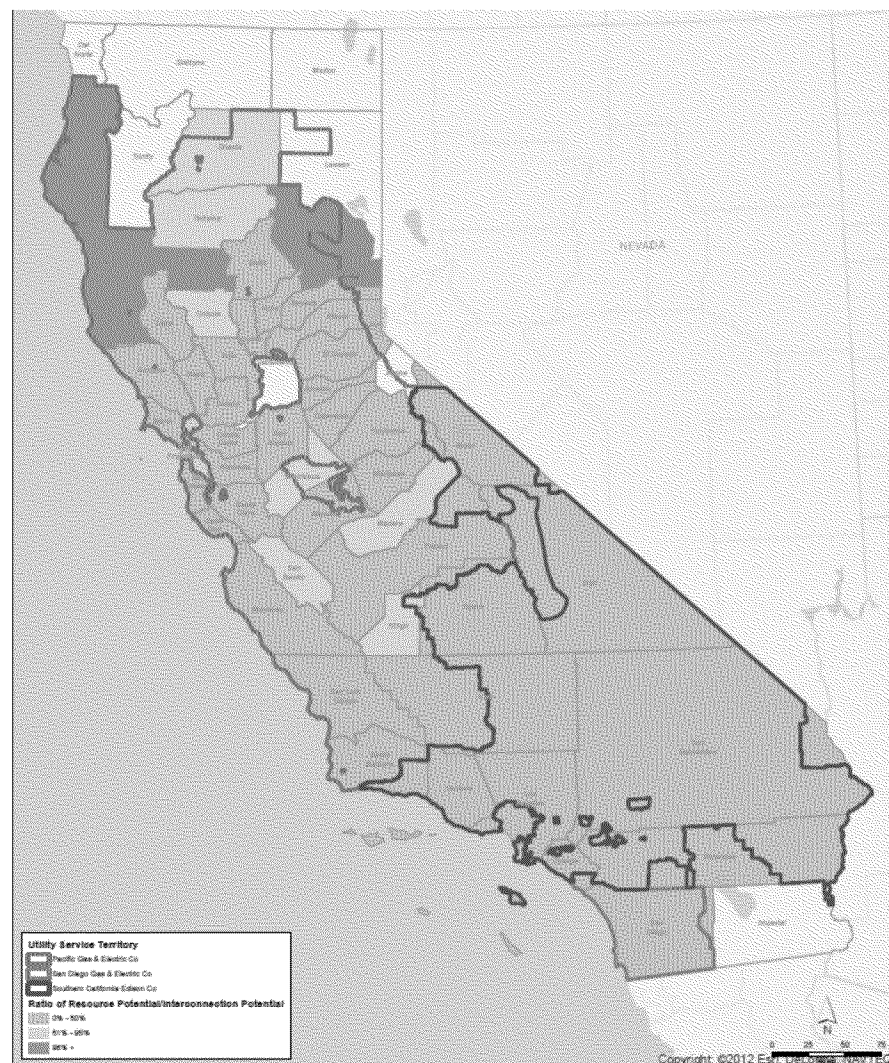
**Many of these issues mentioned in R1105005 filings**



# INTERCONNECTION BARRIERS?

- Substation capacity availability from E3\*
- Calculated resource potential/transmission availability
  - <0.5 = green
  - 0.51 – 0.94 = yellow
  - >0.95 = red
- Provides data on areas that may be constrained, but will be very site specific

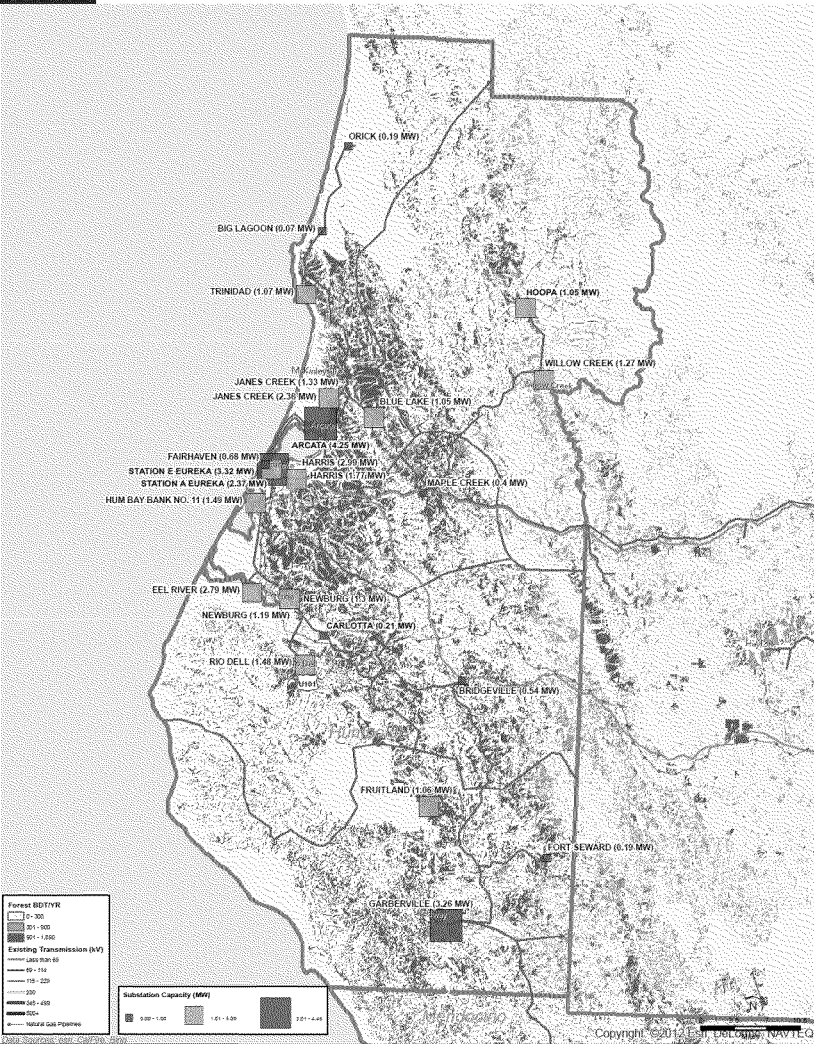
\*Data from “Technical Potential for Local Distributed PV in California” modified for baseload resources



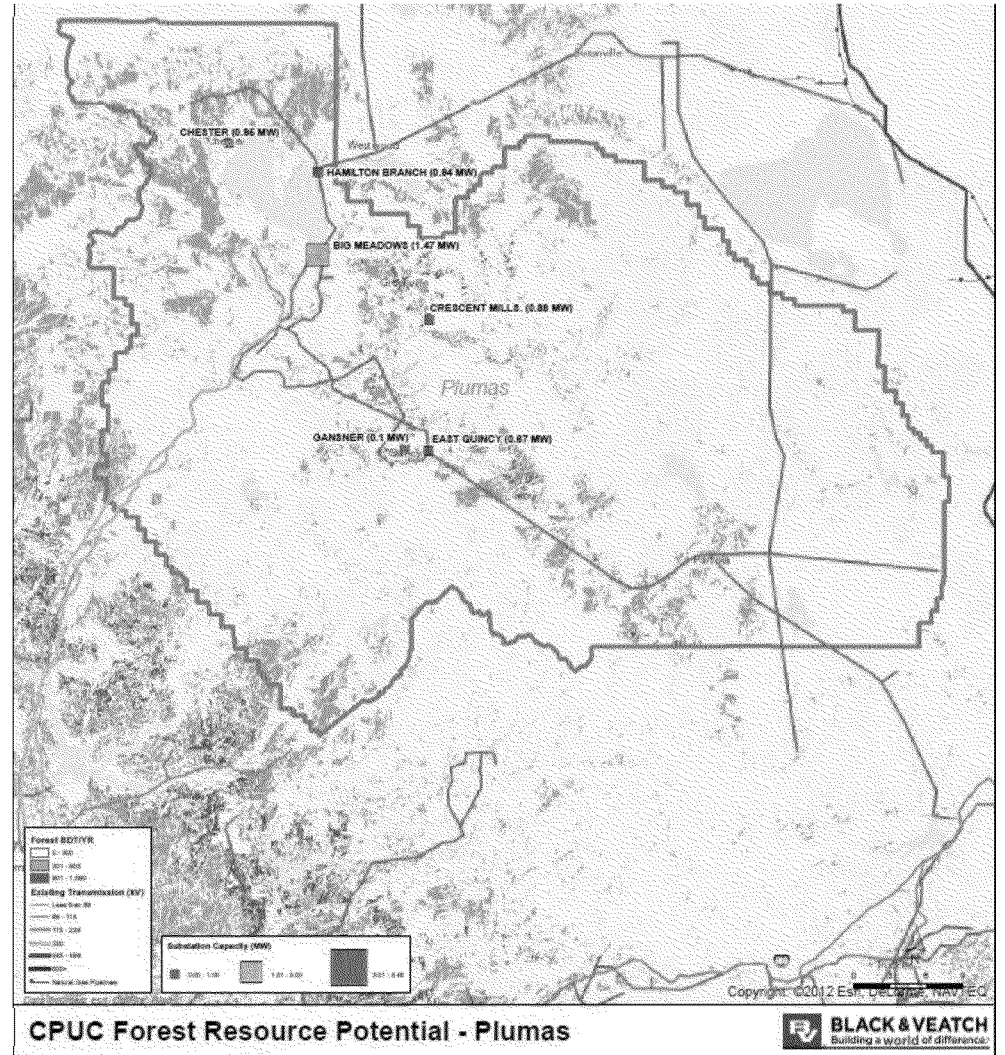
CPUC Interconnection and Resource Availability Comparison



# INTERCONNECTION BARRIERS?



**Humboldt**  
Large resource and transmission potential



**Plumas**  
Limited transmission availability

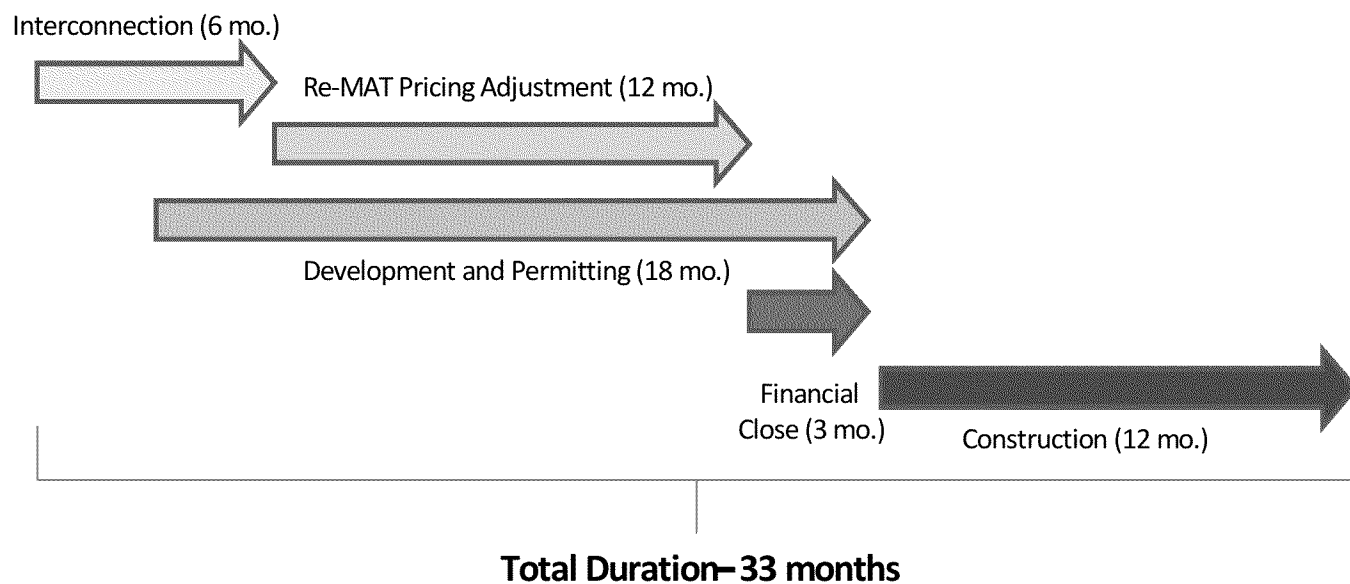
CPUC Forest Resource Potential - Plumas  
BLACK & VEATCH  
Building a world of difference



# REMAT APPLICATION ISSUES

- **ReMAT Step Rate**

- At least 5 eligible projects must be in the queue
- Step rate will take 12 months to reach \$150/MWh
- May not see projects for years after implementation



# STATUTORY INTERPRETATION

- **Definition of “sustainable forest management”**
  - Currently using CAL FIRE data
- **Classification of projects that use multiple feedstocks**
  - Which category? How to distinguish?
  - What if a project switches during operation?
  - Should CPUC or others verify the feedstock?
- **Definition of “commence operation”**
  - Assuming new projects only; consistent with CEC RPS
  - Repowering would likely require a major investment
- **Feedstock definitions and eligibility of out of state feedstocks**



# TECHNICAL, REMAT, AND INTERPRETATION QUESTIONS

- Which technical barriers, if any, may slow project execution? Are there regulatory solutions?
- Is a market-based pricing mechanism appropriate given the infancy of the small-scale bioenergy market?
  - Any bioenergy or SB 1122 specific modifications necessary?
  - How would these modifications improve the outcome?
  - Given the pre-commercial nature of some SB 1122 eligible technologies and potentially limited cost-effective resources, how should the CPUC contain the costs of the program to protect ratepayers?



# TECHNICAL, REMAT, AND INTERPRETATION QUESTIONS (CONTINUED)

- **Are the current statutory interpretations reasonable?**
  - How should multiple feedstocks be treated? Should switching be allowed?
  - Are more specific definitions of feedstock types required?
- **The feed-in tariff statute requires projects to be “strategically located.” What costs should be taken into account when defining “strategically located” for bioenergy projects?**
  - What mitigation strategies should be acceptable?



# ALLOCATION OPTIONS





# ALLOCATION TARGETS

- **SB 1122 defines capacity goal (250 MW) and split between utilities based on share of peak load**

Utility	Estimated Target (MW)
PG&E	109
SCE	118
SDG&E	23

- **Also defines total resource targets, but gives flexibility for these targets to be changed**

Resource Category	Target (MW)
1 (WWTPFWLGFOG)	110
2 (Ag. and Dairy)	90
3 (FTTA Forest Residues)	50

**Resource target by utility not defined**



# ALLOCATION OPTIONS

- **Option 0: No targets**
  - Administratively easier, but may create confusion amongst utilities and developers
  - Does not respect potential constraints at the outset
- **Option 1: Proportional by Load**
- **Option 2: By Resource Availability**
- **Option 3: By Resource Availability, using Market Competition Factors**



# ALLOCATION OPTION ANALYSIS

- **Estimated splits in the 3 major SB 1122 compliant cases**
- **Estimated the average LCOE range and yearly cost of compliance to the utilities**
  - Low and Medium LCOEs used if sufficient resource
  - Medium and High LCOE used if resource constrained
  - Ag residues used for Cat. 2 compliance for SDG&E and PG&E
  - SCE Cat. 2 compliance:
    - 50/50 split of ag. and dairy (resource)
    - 50 percent of dairies receive AB 32 offset credits
- **Also investigated non-compliant options**



# ALLOCATION OPTION 1: PROPORTIONAL BY LOAD

UTILITY	CATEGORY 1: WWTP AND GREEN WASTE BIOGAS (MW)	CATEGORY 2: DAIRY AND AG. BIOENERGY (MW)	CATEGORY 3: FOREST (MW)	ESTIMATED BLENDED COST RANGE (\$/MWH)	NET EXPENDITURE PER YEAR (\$MM)
PG&E	48 (101)	39 (340)	22 (277)	110-170	95-148
SCE	52 (115)	43 (118)	24 (15)	130-190	124-180
SDG&E	10 (26)	8 (1)	4 (2)	145-200	27-37
Totals	110	90	50	--	245-365

Targets for each utility and resource are shown, along with the estimated service area potential in parenthesis.

- Resource targets split just like overall allocation
- Could create resource constrained scenarios



# ALLOCATION OPTION 2: BY RESOURCE AVAILABILITY

UTILITY	CATEGORY 1: WWTP AND GREEN WASTE BIOGAS (MW)	CATEGORY 2: DAIRY AND AG. BIOENERGY (MW)	CATEGORY 3: FOREST (MW)	ESTIMATED BLENDED COST RANGE (\$/MWH)	NET EXPENDITURE PER YEAR (\$MM)
PG&E	15 (101)	52 (340)	42 (277)	125-190	109-164
SCE	55 (115)	56 (118)	7 (15)	120-185	114-172
SDG&E	20 (26)	1 (1)	2 (2)	145-210	27-38
Totals	90	109	51	--	249-374

Targets for each utility and resource are shown, along with the estimated service area potential in parenthesis.

- Based on availability within the service territory
- Green waste procurement down, dairy/ag up—would require agreement on new targets
- PG&E compliance costs up, SCE down; little net cost impact versus Option 1



# ALLOCATION OPTION 3: BY RESOURCE AVAILABILITY USING COMPETITION FACTORS

- Begin with Option 2 allocation, then redistribute to preserve original SB 1122 resource targets
- **Options for redistribution. One potential pathway:**
  - Maintain SDG&E targets. Green wastes only?
  - Set SCE forest target given resource constraint (sets Cat. 3 targets for all)
  - Redistribute PG&E and SCE Cat. 1/Cat. 2 targets
- **Fastest and reasonably equitable option**
  - SDG&E may still be resource constrained
  - Must be comfortable with resource estimates, especially valuation of shrub



# NON-COMPLIANT ALLOCATION OPTIONS

- **Option 4: Flat 25 percent resource usage target**
  - Would greatly increase the procurement target of PG&E (180 MW)
  - Greatly lowers SDG&E's compliance cost, but little impact on net cost
- **Option 5: By statewide resource potential percentage**
  - Maintains original resource targets
  - Lowest net cost option
  - 160 MW procurement target for PG&E
- **Option 6: Remove siting restriction**
  - Resource targets based on state availability, utility targets based on percentage of peak load
  - Most equitable option, provides greatest flexibility



# ALLOCATION OPTION SUMMARY

Allocation Option	Legal?	Enactment Ease*	Net Cost	Cost Equity	Timing	Siting By
1 (Load)	Yes	Low	Med.	Low	Fast	Load
2 (Resource)	Yes	Med.	Med.	Med.	Slow	Load + Resource
3 (Mod. Resource)	Yes	M/H	Med.	Med.	Fast	Load + Resource
4 (Flat)	No	Med.	Med.	Med.	V. Slow	Resource
5 (State Resource)	No	Med.	Low	Med.	V. Slow	Resource
6 (Open Siting)	No	High	Med.	High	V. Slow	Load + Resource

\*Enactment Ease refers to ease of compliance for the IOUs and regulation for the CPUC *if* this allocation was adopted





# ALLOCATION QUESTIONS

- **Which option is preferred?**
  - What should be the basis for selection?
  - How should resource availability be taken into account?
- **Is the approach for expenditure estimates reasonable?**
- **Other options that should be considered?**
- **How should the utilization of a particular SB 1122 feedstock be certified and verified?**



# THANK YOU!

**SCOTT OLSON**

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RENEWABLES AND ENERGY EFFICIENCY**

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# Next Steps

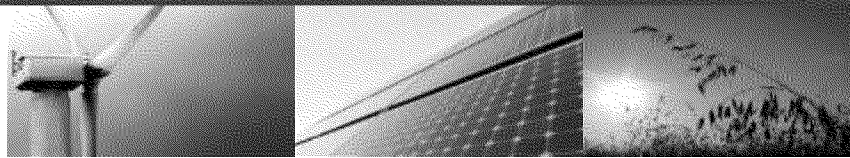
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- **What's next:**

- Informal post-workshop comments
  - Standard of Review: (a) material change + (b) publicly sourced information

- **CPUC's overall roadmap for SB 1122 implementation:**

- (1) Staff-level analysis developed with Black & Veatch
- (2) ALJ Ruling to seek formal comments on Staff Proposal (to be informed by B&V study) on SB 1122 Implementation
- (3) ALJ to issue a proposed decision on SB 1122 later in 2013



# More Information

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## CPUC RPS Website:

- [www.cpuc.ca.gov/renewables](http://www.cpuc.ca.gov/renewables)

## CPUC's Renewable DG Web pages:

- FIT: [www.cpuc.ca.gov/feedintariff](http://www.cpuc.ca.gov/feedintariff)
- RAM: [www.cpuc.ca.gov/RAM](http://www.cpuc.ca.gov/RAM)
- Solar PV Programs:  
[www.cpuc.ca.gov/PUC/energy/Renewables/hot/Utility+PV+Programs](http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/Utility+PV+Programs).

## Questions:

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