


CPUC, CEC, ARB Electricity & Natural Gas GHG Modeling

AB32 Economic Analysis Technical Stakeholder Working Group


January 28, 2008

 Energy and Environmental Economics, Inc.

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Energy and Environmental Economics, Inc. (E3)

- San Francisco-based firm established in 1993
- Electric and natural gas utility sectors
- Practice areas
 - Energy efficiency and building standards
 - Distributed generation, demand response and CHP
 - Integrated resource planning
 - Transmission planning and pricing
 - Retail rate design

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CPUC, CEC, ARB Project Team

- Energy and Environmental Economics, Inc.
 - Prime, Development of the non-proprietary tool, Integration, GHG Policy
- PLEXOS Solutions LLC
 - State-of-the-art production simulation model
- Schiller Associates, Steven Schiller Lead
 - Advisor on California GHG policy and energy efficiency
- Dr. Ben Hobbs, Johns Hopkins University
 - Academic advisor, World-renowned electricity simulation expert
- Dr. Yihsu Chen, UC Merced
 - Academic advisor, Emerging capability at UC Merced

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Project Overview

- Joint CPUC, CEC, ARB effort to evaluate AB32 compliance options in California's electricity and natural gas sectors
- Model estimates the cost and rate impact of a variety of compliance strategies relative to two reference cases
- Project timeline designed to fit into 2008 Scoping Plan process for AB32
- Deliverables
 - Non-proprietary, transparent, spreadsheet-based model using publicly available data
 - Report on results and sensitivities / scenarios
 - Stakeholder process leading to CPUC/CEC proposed decision
 - Model output to be used as an input to the ARB economic models

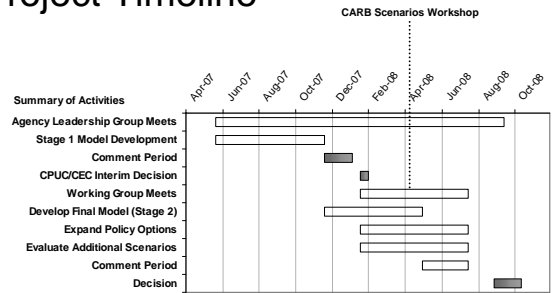
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Two Stages

- Stage 1 (through 2/08): Impacts on Statewide Electricity and Natural Gas Sector
 - Develop data, methodology and test analysis tool
 - Informs CPUC/CEC February 2008 interim decision on electricity and natural gas GHG sector targets for 2020
 - Stakeholder comments / reply comments January 2008
 - Revisions to Stage 1 results following stakeholder comments
- Stage 2 (12/07 – 8/08): Impacts on LSEs
 - Allocation of GHG permits or auction revenues among LSEs
 - LSE-specific rate and cost impacts of different policy approaches
 - Cross-sector trading issues
 - Informs CARB June 2008 decision for 'burden sharing' of GHG reductions among all CA sectors and future decisions on allocation of GHG permits within the electricity sector

5

Project Timeline



6

Stage 1 Key Qs

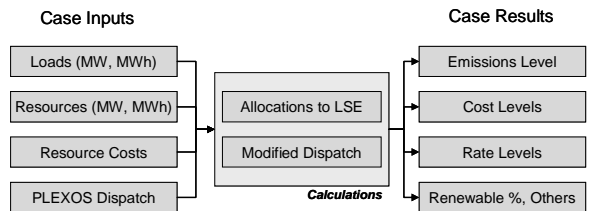
- How much will various policy options reduce CO2 emissions?
- How will these policy options affect electricity rates?
- *Underlying question: At what electricity sector target level do incremental improvements get expensive?*

Stage 2 Key Qs

- What is the cost to California of complying with AB32 under different policy options for the electricity sector?
- What is the cost to different LSEs and their customers of these options?
- *Underlying question: What option has the best combination of cost, fairness and enforceability?*

7

E3 GHG Calculator Approach



8

Modeling Progress

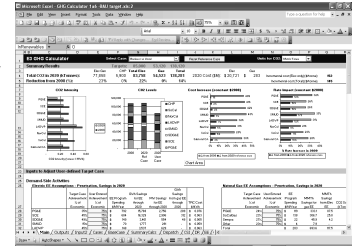
- Preliminary Stage 1 Results Delivered
 - Public Kick-off Meeting at CPUC, Sept. 21st
 - Stage 1 Methodology Presented at CPUC Workshop, Nov. 14th
- PLEXOS Model Runs Complete
- Stage 1 GHG Calculator Delivered
- Stakeholder Comments
 - Opening Comments Submitted Jan. 4th
 - Reply Comments Submitted Jan. 18th
- Stage 2 Beginning

9



GHG Calculator

- Based in Excel
- Uses only publicly available data
- Calculates scenarios rapidly
- Non-proprietary



10



Next Steps

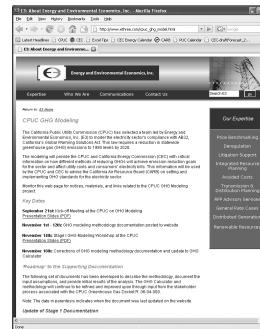
- Model improvements incorporating stakeholder comments
- Model allocation or auction of GHG permits in electricity and natural gas sectors
- Model impacts of offsets/cross-sector trading on compliance in electricity and natural gas sectors
- Sensitivity Analyses
 - Load growth forecast, costs of renewable energy and EE, etc.
- Coordination with ARB modeling

11



Highlights of Modeling Progress

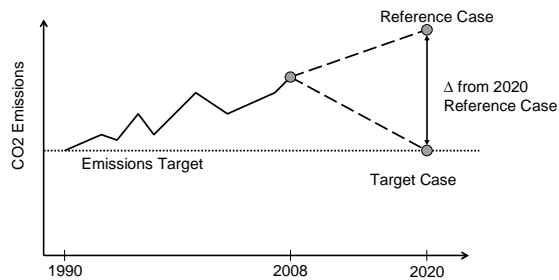
- Project Website
- Workshop updates & past presentations
- Calculator available for download
- Documentation of methodology and inputs
- www.ethree.com



12



Measuring CO2 Change from Reference to Target Cases



13

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2020 Reference Cases

Policies	Business-as-Usual	Aggressive Policy
Renewable Energy	20% RPS (7,404 MW)	33% RPS (16,119 MW)
Energy Efficiency	"BAU" energy efficiency embedded in CEC load forecast (~35% economic potential)	100% of economic energy efficiency potential achieved
California Solar Initiative and Demand Response	1,091 MW of PV installed 5% demand response	3,000 MW of PV installed 5% demand response
GHG Emissions	170 MMTCO _{2e}	138 MMTCO _{2e}

14

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Resource Options Modeled

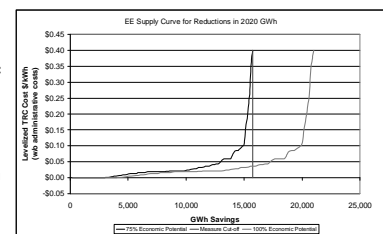
- Energy Efficiency by LSE
- Solar PV, Demand Response, Small CHP by LSE
- Large Scale Renewable Energy
 - Developed by zone
 - Developed by transmission size and configuration
- Large Scale Generation
 - Gas CCCT, Gas CT, Nuclear, Coal IGCC, Coal IGCC w/ CCS, Coal ST, Large CHP

15

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Energy Efficiency Supply Curves

- Created 7 LSE-specific EE supply curves of economic potential: relating energy savings to levelized total resource cost
- Data available from 2006 Itron EE potential studies



- Itron data available for 3 IOUs and SMUD. Relied on AB 2021 filings for POU economic potential and 2016 EE targets to scale EE supply curves to the POU

16

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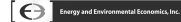
Renewables Modeled by Zone

- User selects transmission capacity to each zone
- Calculator estimates costs of renewables
 - Busbar cost
 - Transmission
 - Integration
 - Firing

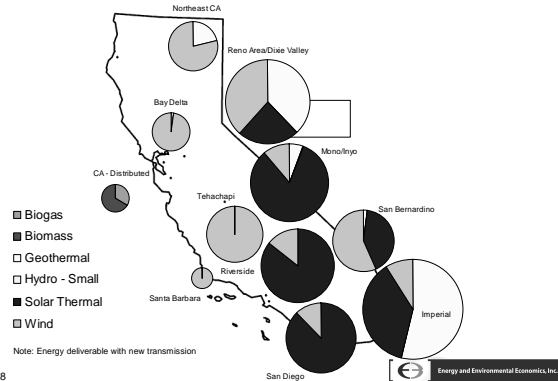
Incremental Generation to California 2008 to 2020
Renewable resources by transmission cluster

	Total Renewable Resources (MW)	Reference Case MW	User Selected MW
1 Alberta	6,000	-	
2 Arizona-Southern Nevada	6,000	-	
3 Bay Delta	2,991	-	
4 British Columbia	4,420	-	
5 CA - Distributed	900	-	
6 CFE	5,020	-	
7 Colorado	6,000	-	
8 Geyser/Lake	719	2,500	
9 Imperial	6,000	-	
10 Mono/Inyo	6,000	-	
11 Montana	6,000	-	
12 NE NV	1,487	-	
13 New Mexico	6,000	-	
14 NorthEast CA	3,194	-	
15 Northwest	6,000	-	
16 Reno Area/Delta Valley	6,000	-	
17 Riverside	6,000	-	
18 San Bernardino	6,000	-	
19 San Diego	6,000	-	
20 Santa Barbara	6,000	-	
21 South Central Nevada	6,000	-	
22 Tehachagi	6,000	4,500	
23 Utah-Southern Idaho	6,000	-	
24 Wyoming	6,000	-	

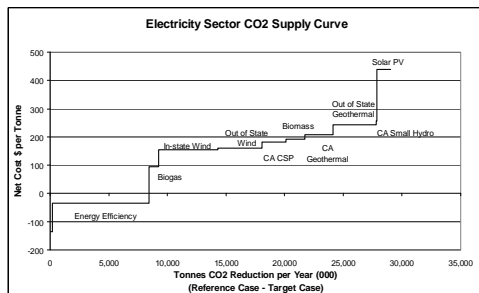
Screen 'capture' from GHG Calculator



CA Renewable Resource Zones



Example CO2 Reduction Portfolio Reductions from BAU Reference Case



Thank You
Any Questions?

