



# Reducing Greenhouse Gas Emissions from California Refineries

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**Air Resources Board**  
California Environmental Protection Agency

Questions via E-Mail

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## Topics

- Discuss recommended measures in Draft Scoping Plan
- Discuss potential measures in April that were not included in Draft Scoping Plan
- Discuss next steps

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## The Global Warming Solutions Act of 2006 (AB 32)

- The Act requires GHG emission reductions
  - ✓ Maximum technologically feasible
  - ✓ Cost-effective
  - ✓ Real, permanent, quantifiable, verifiable, and enforceable
- ARB is working with stakeholders, including EJ groups, industry, local air districts, CEC, and other agencies
- Adopt Scoping Plan by the end of 2008

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## Potential Measures for Refining Sector

- Establish criteria to increase efficiency of existing process heaters, boilers, FCCs, and hydrogen plants
- Develop and expand requirements for refinery flaring operations as well as increasing gas recovery capacity of flares
- Reduce refinery fugitive emissions by removing methane exemption from existing regulations
- Total annual estimated GHG reductions:  
2 – 5 MMTCO<sub>2</sub>E

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## Boilers & Process Heaters

Potential Measure	Potential GHG Reduction (MMT CO <sub>2</sub> eq.)		Comment
	April	August	
Replace and/or retrofit low efficiency units	3 (0.6)	1	April's assumption: Replacement of 20% of all units. (Includes math error) Now: Increase efficiency of 50% of units.

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## Fluid Cat. Cracker

Potential Measure	Potential GHG Reduction (MMT CO2 eq.)		Comment
	April	August	
Install FCC power recovery turbine	N/A	0.5	Not considered in April
Valero refinery in Houston – 22MW electricity generation			

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## Coke Combustion

Potential Measure	Potential GHG Reduction (MMT CO2 eq.)		Comment
	April	August	
Improve the Catalyst Type (reducing the carbon formation on FCC catalyst)	0.6	0.8	Previous assumption: 10% reduction of total FCC emissions. Now: based on 4 units.

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## Hydrogen Production

Potential Measure	Potential GHG Reduction (MMT CO2 eq.)		Comment
	April	August	
Retrofit Steam Methane Reformer for CO2 Capture *	N/A	1	Not Considered in April Now: ~20% GHG reduction based on 2004 emission of all H2 plants.
* Based on more efficient technology using pressure swing adsorption.			

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## Flare Emissions

Potential Measure	Potential GHG Reduction (MMT CO2 eq.)		Comment
	April	August	
Increase Gas Recovery Capacity of Flares	0.2	0.3	Revised flare emissions since April.

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## Fugitive Emissions

Potential Measure	Potential GHG Reduction (MMT CO2 eq.)		Comment
	April	August	
Removing Methane Exemption	0.03	0.01 to 0.02	

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## CHP Sector

- Preliminary Recommendation sets a target of an additional 4,000 MW of installed CHP capacity by 2020
- First workshop was on August 22, 2008
- Presentations and additional information is available via following webpage:  
<http://www.arb.ca.gov/energy/chps/meetings/meetings.htm>

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## Potential Measures That Were Not Considered in August

Proposed in April	
Potential Measure	Comment
Replace low efficiency units with electrical heaters *	Electrical heaters (from Combined cycle) are less efficient than direct-fired heaters (~60% vs. >80%) except for old/inefficient heaters. * This measure is mutually exclusive of the other measure for boilers & heaters.
Replace distillation with membrane filtration	Effective for temperature <190F; Maintenance intensive (1/2% of solids in the crude will plug the membrane); Doesn't fractionate; not applicable to crude distillation.
Optimize carbon on regenerated catalyst (CRC) ratio with CO boiler or incinerator	Mutually exclusive
Heavy Oil Slurry-Catalyst Technology (eliminates coke byproduct but requires hydrogen)	Need additional hydrogen
Replace turbine with simple cycle turbine or combined cycle cogen	Not cost effective

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## Potential Measures That May Be Considered

- Carbon sequestration from hydrogen plants
- Reduce electricity use
- Reduce imported steam needs
- Other?

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## **Refinery Sector Technical Working Group**

- **Propose assembling a technical working group**
  - **composed of industry, EJ groups, local air districts, CEC, and ARB**
  - **12 -16 members**
- **Examine refinery processes to determine potential GHG emission reductions**
- **Meet at least monthly**
- **Conduct periodic workshops to discuss accomplishments**

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## **Energy Efficiency Audits**

- **Large industrial sources (> 0.5 MMT CO<sub>2</sub>E)**
- **Includes 13 refineries and two hydrogen plants**
- **Proposed adoption: 2010**
- **Proposed implementation: 2012**

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## Energy Efficiency Surveys

- **Cement and Oil & Gas Production Sectors are conducting surveys**
- **Refinery survey would precede energy efficiency audits**
- **May initially concentrate on boilers and process heaters**

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- **Webpage (for now):**

<http://www.arb.ca.gov/cc/scopingplan/oil-gas-sp/oil-gas-sp.htm>



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