



How Climate Change is Driving a New Wave of Energy Efficiency Review and Investment

17 November 2011

Topics

- ◆ **Climate Change and Energy Efficiency**
- ◆ **Federal**
 - » **GHG BACT**
 - » **Boiler MACT/GACT**
- ◆ **California**
 - » **Cap and Trade**
 - » **Energy Efficiency and Co-benefits**
- ◆ **Local**
 - » **Boiler Regulation**
 - » **BAAQMD CEQA Guidelines**
- ◆ **Path Forward**



Climate Change & Energy Efficiency

- **CO₂, CH₄, N₂O, PFC, HFC, SF₆**
- **83% of US GHG (CO₂ equivalent) from CO₂ in 2009**
- **95% of US CO₂ from fossil fuel combustion in 2009**
- **Reduce CO₂ by reducing fuel consumption**
- **Reduce fuel consumption through ENERGY EFFICIENCY**
- **Priority focus for current EPA Administration**
- **Motivation for facilities to increasing energy efficiency**
 - ◆ Reduce energy costs - ROI
 - ◆ Regulatory compliance



GHG BACT – New Sources Triggering PSD



- **If Trigger PSD for GHG, need to perform GHG BACT**
- **Potential to emit (PTE) of at least 100,000 short tons per year of CO₂e and total mass emission of GHG is equal or greater than 100/250 tons per year**

OR

Otherwise subject to PSD (due to non-GHG emissions) and has a PTE of at least 75,000 tons per year of CO₂e

GHG BACT – Modified Sources Triggering PSD

- **Modification is otherwise subject to PSD (due to non-GHG) and results in increase of at least 75,000 tons per year of CO₂e.**

OR

Existing source has PTE of at least 100,000 tons per year of CO₂e and at least 100/250 tons per year on a mass basis and the modification results in a net increase of at least 75,000 tons per year of CO₂e;

OR

Existing source was a minor source for PSD but the modification results in total emissions being at least 100,000 tons per year of CO₂e and at least 100/250 tons per year on a mass basis;

- **75,000 short tons ~ 150 MMBtu/hr NG boiler**



GHG BACT – Linking Permitting with Energy Efficiency

- **Consider carbon capture and storage (CCS) but likely not feasible**
- **EPA’s BACT Guidance focuses on options that reduce GHG emissions by improving ENERGY EFFICIENCY.**
 - ◆ BACT for a new source may consider facility-wide emissions reductions resulting from energy efficiency at the source.
 - » May include, for example, non-emitting units such as electric fans, pumps that draw energy from emitting units.
 - ◆ BACT for a modified existing source can consider energy efficiency reductions that are part of the changed emissions unit.
 - » Focuses on achieving the highest possible efficiency at the changed emitting unit(s)
 - ◆ Recommends use of industry-established **benchmarking** tools to comparing efficiency of control options and determining BACT limits (Energy Star has tools)



Setting the Bar for GHG BACT – BAAQMD and GHG BACT

Russel City Energy Center Permit (600 MW, combined-cycle, NG fired) 2/4/09

- ◆ upgrade to more state-of-the-art, higher efficiency turbine technology that achieved 56.4% thermal efficiency (as part of a combined cycle system)
- ◆ Limits for energy efficiency
 - » Emission limits calculated using an “output based” limits (lb/MWh)
 - » Heat rate limit of 7,730 Btu/kWhr
- ◆ <http://www.baaqmd.gov/Divisions/Engineering/Public-Notices-on-Permits/2010/020410-15487/Russell-City-Energy-Center.aspx>
- ◆ Through GHG BACT, ENERGY EFFICIENCY now formally part of the permitting process



MACT/GACT – New and Existing Boilers

- ◆ Control of HAPs under NESHAP Subparts DDDDD (MACT) & JJJJJ (GACT)
- ◆ Subpart DDDDD (major) effective date delayed
- ◆ Annual or biennial tune-ups (0 to 20% increase in efficiency)
- ◆ One time energy assessment by qualified energy assessor
 - » Evaluate operating characteristics of facility & inventory major energy consuming systems
 - » Develop report detailing efficiency measures, costs, benefits, energy savings, and time frame to recoup investments.
 - » Evaluated affected boilers and % of system using boiler output
- ◆ While not required to implement, can take credit if using output based emission limits in MACT
- ◆ EPA stated cost of \$2500 to \$55,000 for assessment
- ◆ Expect to see more of these types of **ENERGY EFFICIENCY** measures in future EPA rule making



Energy Efficiency Measures – Industrial Boilers

Energy Efficiency Improvements (% improvement)

1. New Burners / Upgrades (up to 5%)
2. Boiler Insulation (up to 6%)
3. Minimization of Air leakages (up to 3%)
4. Boiler Blowdown Heat Exchanger (up to 7%)
5. Recover waste heat through air preheater or economizer (varies)
5. Refractory Material Selection (variable)



California Cap and Trade

- **AB32 Goal – Achieve 1990 GHG levels by 2020**
 - ◆ cutting approx 30% from business-as-usual emissions levels projected for 2020, or about 15% from today's levels
- **GHG Emissions come under Cap & Trade as of Jan 1, 2012**
 - ◆ OAL has until December 13, 2011 to approve rule.
 - ◆ Compliance Obligation = Emissions from facility
 - ◆ Meet by surrendering obligation in form of allowance or offset
 - ◆ Reduce obligation by improving **ENERGY EFFICIENCY**
 - ◆ Focus on reducing fuel consumption (direct emissions)
 - ◆ Price of electricity forecasted to make electricity efficiency projects attractive (not part of compliance obligation)



Office of the
Governor



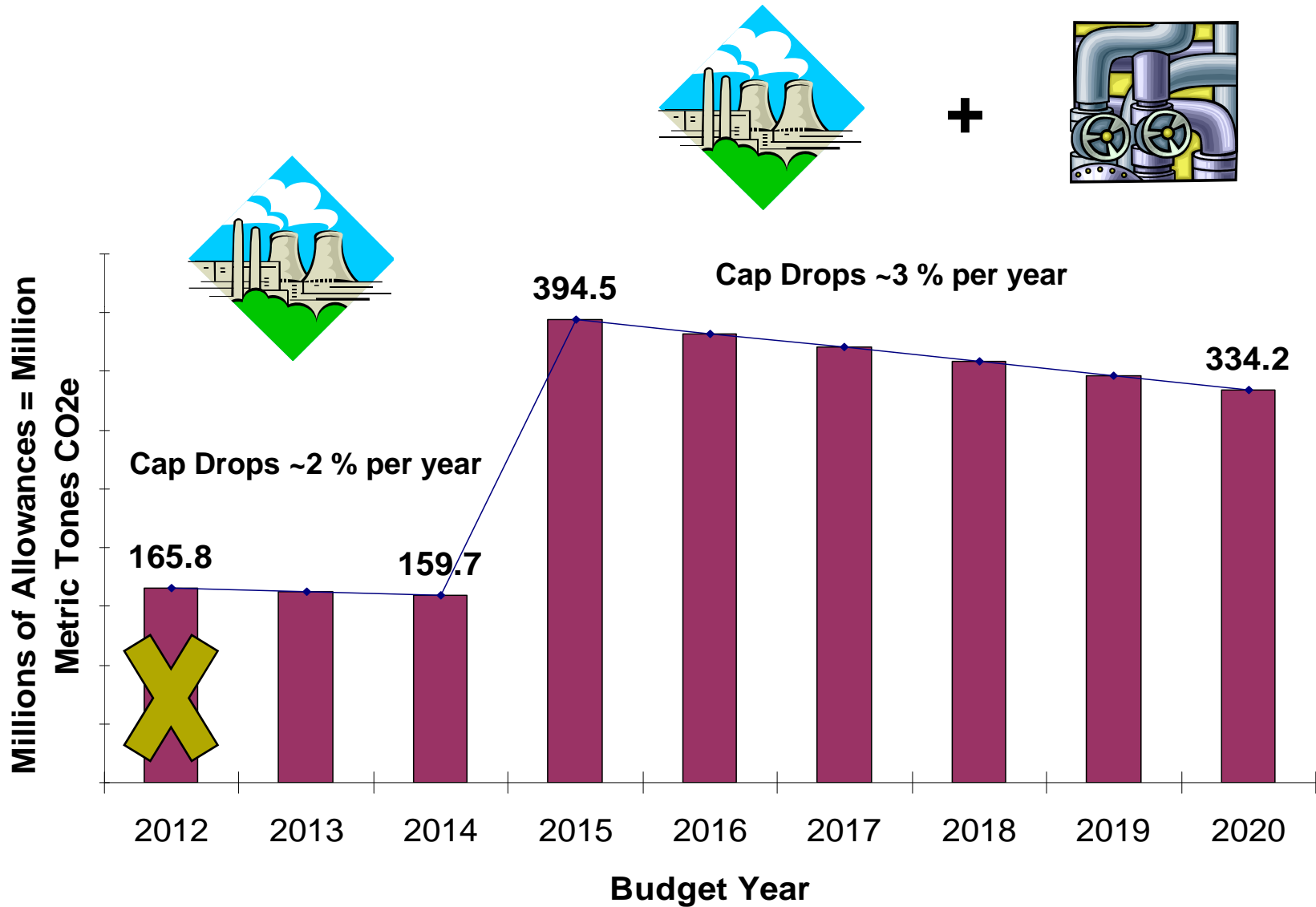
California Energy
Commission



California Public
Utilities Commission



Program Wide GHG Cap



AB32 Energy Efficiency and Co-benefits

- **Large GHG Emitters** (based on CY 2009 >0.5MMTCO₂e in general, cement plants & refineries >0.25 MMTCO₂e)
 - ◆ Conduct energy audit to identify potential projects
 - ◆ Evaluate impact of projects (cost, energy savings, emissions, environmental, permitting)
 - ◆ Can incorporate already implemented projects and planned projects
 - ◆ Assessment report due December 15, 2011
 - ◆ CARB looking at ways to make cost-effective **ENERGY EFFICIENCY** projects mandatory



BAAQMD Boiler Regulation

- ◆ BAAQMD Regulation 9, Rule 7
 - ◆ Rule to control NO_x and CO
 - ◆ Annual tune ups (BAAQMD assumed 10% improvement efficiency)
 - ◆ Insulation requirements (BAAQMD assumed 5% improvement efficiency)
 - ◆ Stack gas temperature limits
 - ◆ If increase efficiency of all effected boilers in SF Bay Area by 5%, reduce CO₂ by about 2500 MT per day (~1 million MT/yr)



BAAQMD CEQA Guidelines

- Under CEQA, Projects seeking discretionary permit with needs to consideration GHG
- Project has Significant GHG if
 - ❑ Stationary Sources > 10,000 MT/yr CO₂e Considered Significant
 - ❑ Land Use Projects
 - ❑ > 1,100 MT/yr CO₂e
 - ❑ > 4.6 MT CO₂e/Service Population/yr (residents+employees)
- Not significant if consistent with adopted qualified GHG Reduction Strategy/Climate Action Plan
- If significant, implement mitigation measures to reduce to less than significant. Guidelines contains measures to improve **ENERGY EFFICIENCY**

Path Forward – What Are Facilities Doing?

- Conduct company-wide or facility energy efficiency audits
- Review Energy Efficiency opportunities considering new economic and potential regulatory drivers
- Consider Energy Efficiency requirements in Permitting
 - ◆ Examine existing and short-term future permit applications to ensure they address CO₂e
 - ◆ Plan for GHG BACT implications to project designs
 - ◆ Allow even more time in project permitting schedules
- Capture sufficient records to document and quantify credits due to any recently implemented energy efficiency projects
- Look for new energy efficiency regulations driven by climate change/air quality



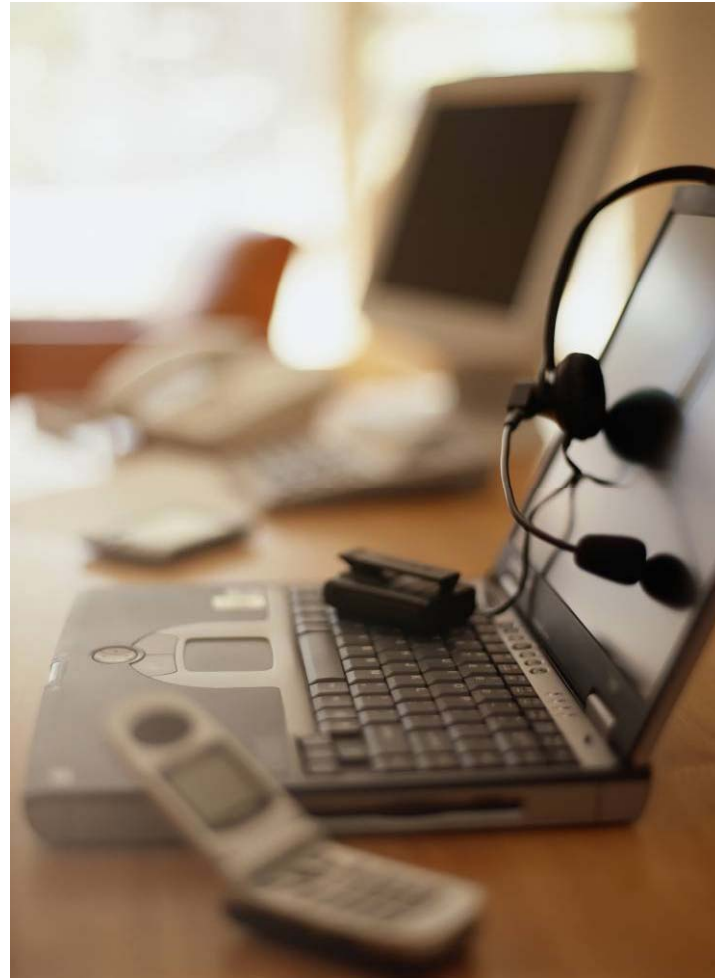
Questions



ERM Contact Information

Lynn McGuire
lynn.mcguire@erm.com
925.482.3255

Rick Shih
rick.shih@erm.com
925.482.3281



The following are EXTRA SLIDES

BACT Example – Natural Gas Boiler

GHG BACT => O₂ trim control, economizer and condensate recovery for the boiler, high transfer efficiency heat exchanger.

- Emission limit expressed in **lbs of CO₂e emissions per pound of steam produced**, averaged over 30 day rolling periods;
- CO₂e emissions are to be determined based on **metered natural gas use** and the application of standard emission factors;
- Steam production determined from a gauge on the outlet of the boiler;
- In addition, there would be a requirement to install the boiler as described in the application and BACT determination;
- There would be a requirement to implement a **preventive maintenance program** for the air to fuel ratio controller of the boiler; and
- A requirement for **periodic maintenance and calibration** of the natural gas meter and the steam flow analyzer.

Setting the Bar for GHG BACT – BAAQMD and GHG BACT

Russel City Energy Center Permit (600 MW, combined-cycle, NG fired) 2/4/09

- ◆ no feasible post-combustion controls (e.g., CCS)
- ◆ **upgrade to more state-of-the-art turbine technology**
- ◆ upgrade O&M, reliability practices and system controls
- ◆ considered solar thermal vs. use of duct burner (ruled out due to space)
- ◆ state-of-the-art SF6 circuit breakers w/leak detection
- ◆ **“output based” limits for emissions + thermal efficiency 56.4% standard**
- ◆ annual heat rate performance testing
- ◆ <http://www.baaqmd.gov/Divisions/Engineering/Public-Notices-on-Permits/2010/020410-15487/Russell-City-Energy-Center.aspx>



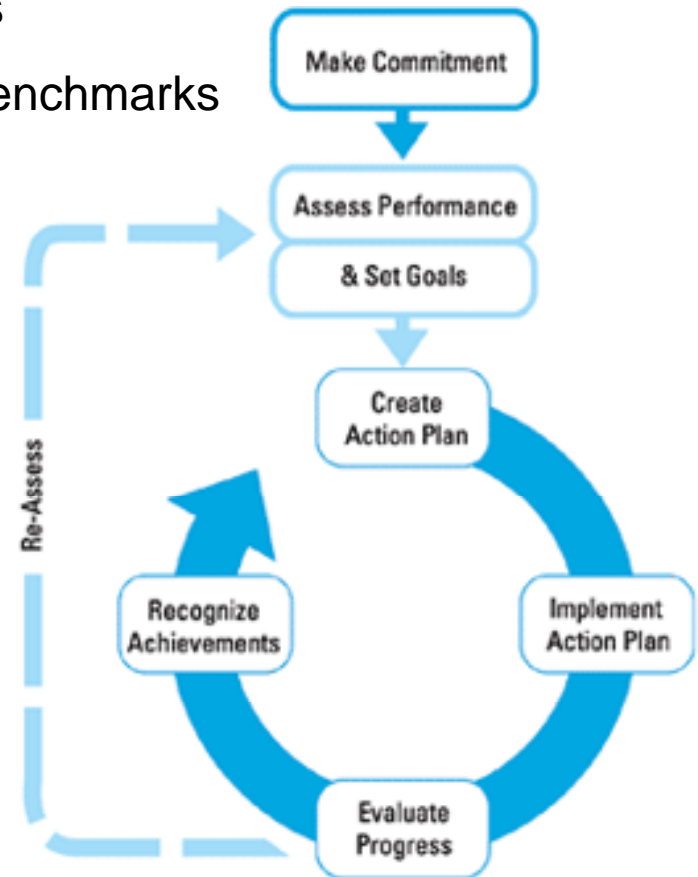
Typical Energy Efficiency Measures – continued

Energy Programs and Management Systems

1. Sector-Specific Plant Energy Performance Benchmarks
2. Industry Energy Efficiency Initiatives

Other Measures to Reduce GHG Emissions

1. Alternative Fuels – Biomass
2. Co-firing
3. Fuel Switching
4. Combined Heat and Power (CHP)
5. Carbon Capture and Storage



Energy Efficiency Benchmarking

- **ENERGY STAR Industrial Sector Energy Guides and Plant Energy Performance Indicators (benchmarks)** <http://www.energystar.gov/epis>
- **ENERGY STAR Guidelines for Energy Management**
<http://www.energystar.gov/guidelines>
- **EPA's GHG Mitigation Measures Database**
<http://www.epa.gov/nsr/ghgpermitting.html>
- **DOE's Industrial Technologies Program (Best Practices)**
<http://www1.eere.energy.gov/industry/bestpractices/>
- **EPA's Voluntary Partnerships for GHG Reductions:**
 - ◆ Landfill Methane Outreach Program (<http://www.epa.gov/lmop/>)
 - ◆ Coalbed Methane Outreach Program (<http://www.epa.gov/cmop/index.html>)
 - ◆ Natural Gas STAR Program (<http://www.epa.gov/gasstar/index.html>)
 - ◆ Voluntary Aluminum Industrial Partnership (<http://www.epa.gov/highgwp/aluminumpfc/index.html>)
 - ◆ CHP Partnership Program (<http://www.epa.gov/chp>)



Save Energy Now
Best Practices Publications



Permitting (CEQA) Guidelines

- **Significance threshold of 10,000 mtpy CO₂e (BAAQMD, SCAQMD)**
- **Facility/source scope is different, e.g., some non-stationary sources**
- **Requires mitigation to below significance threshold**
- **Mitigation can include:**
 - ◆ GHG emissions reductions at the site
 - ◆ Energy efficiency projects
 - ◆ Electrification of operations
 - ◆ Funding of supplemental GHG reduction projects
- **Most contentious part of recent EIRs**

Recommended Energy Efficiency Measures in BAAQMD CEQA Guidelines

- Strategic placement of trees to provide shade (30% reduction)
- Smart meters/programmable thermostats (10% reduction)
- Green Building (3 to 38% reduction)
- Tankless water heaters (35% reduction)
- HVAC duct sealing (30% reduction)

Energy Efficiency Measures – Industrial Boilers

Energy Efficiency Improvements (% improvement)

1. O&M Practices for Improved Combustion (up to 4%)
2. New Burners / Upgrades (up to 5%)
3. Air Preheat and Economizers (variable, 6% per 300F)
4. Boiler Insulation (up to 6%)
5. Minimization of Air Infiltration (up to 3%)
6. Boiler Blowdown Heat Exchanger (up to 7%)
8. Refractory Material Selection (variable)
9. Minimization of Gas-Side Heat Transfer Surface Deposits (up to 3%)
10. Steam Line Maintenance (variable)

