CEFCO
GLOBAL CLEAN ENERGY, LLC

Presentation at: Utility MACT Webinar 2010

Robert Tang

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About CEFCO

The CEFCO Process:

• integrates established and patented technologies
• accomplishes *virtually complete capture of flue gas emission pollutants, including CO₂*

The CEFCO Process will enable MACT compliance by fossil-fueled emissions sources:

• new and retrofitting existing coal-fired power plants
• petroleum refineries
• petro-chemical plants
• cement and lime plants
• industrial and municipal incineration facilities
• pulp and paper and other industrial applications
Key Issues to be Addressed

1. If the CEFCO Technology is so good, then why haven’t we heard about it before now?

2. Why does the CEFCO Technology consume so little “energy penalty” or “parasitic load”?

3. How does the Technology work? What are its major advantages?

4. Where can I obtain a user license for the CEFCO Process?
“Supersonic Emissions Control”

January 2009 issue
“Patent Rights Will Soon be Available for Novel Emission Control Process”

11 August 2009
Tom Ewan had served as a Technology Advisor to the Company until his passing, at age 91, in June 2009. Ewan, a Physicist, retired as Chief of Operations and Administration of the National Ordnance Aerophysics Laboratory of the DOD (Combined USAF, USN, USA, NASA: Aerodynamic Designs for Missiles, Air Frames, NASA Shuttles, etc.), and headed the Executive Committee of the Guided Missile Program of the National Research Laboratory, DOD. Ewan received a B.S. in Physics from the College of William & Mary. He co-authored and published “The Glossary of Guided Missile Terms” that was used by the Department of Defense. Ewan held several issued and deployed patents, including that for the “Free Jet” collision scrubbers, which have been in continuous use at Nuclear Regulatory Commission facilities for the handling and treatment of radioactive incineration off-gases, and toxic and acidic gases emissions. His technology has been recognized by the EPA as a standard component of the Hazardous Waste Combustors (“HWC”) Maximum Achievable Control Technology (“MACT”) for air emissions elimination.

“"We use physics first…then chemistry!"
Hal Cooper serves as the Chief Chemical Science Officer of the Company and is a co-inventor. Cooper was a Professor of Civil Engineering and Environmental Engineering for eight years at the University of Texas at Austin and for two years at Texas A&M University. He taught courses on gaseous and particulate emission control, air quality chemistry and meteorology as well as on energy technologies and systems. He was active in various programs related to air pollution and air emissions control for the power industry and in the study of alternative energy technologies. Cooper received his Ph. D. in Civil Engineering in Environmental Engineering from the University of Washington in 1972, his M.S. in Civil Engineering in Environmental Engineering in 1966 from the University of Washington, and his B.S. in Chemical Engineering in 1963 from the University of California at Berkeley. He is a registered professional engineer. Cooper also worked as Sr. Consulting Engineer at Brown & Caldwell, ICF-Kaiser and Stone & Webster prior to co-founding the Company in 2006. He is an inventor with several issued patents. His motto is: “A pollutant is nothing but a misplaced, very valuable and recoverable resource”.

"A pollutant is only a misplaced but very recoverable and valuable resource."

Hal B.H. Cooper
Chemical Engineering Advisor
and Co-Inventor
Don Degling serves as Chairman and is a co-inventor. Degling has collaborated with Tom Ewan for over forty years in the development of the Ewan aerodynamic processes and his nozzle technology and had filed and prosecuted numerous patents for Tom Ewan. Degling is a retired Intellectual Property Attorney and Senior Partner in the law firm of Fish & Neave (now Ropes & Gray). He received a B.S. in Mechanical Engineering from Cornell University in 1949 and a LL.B/J.D. also from Cornell University in 1952. Degling is an expert in the area of patent, trademark and copyright application, prosecution and litigation throughout the steel, mineral processing, chemical, oil and gas industry, equipment and aircraft engines industries. Degling is the trustee of the Ewan I.P. Estate.
Robert Tang is currently the Chief Executive Officer of CEFCO Global Clean Energy, LLC and is a co-inventor. He also serves on the Board of Directors of two major specialty engineering and construction companies, one of which has great emphasis and experience in the utility power industry and air pollution control (AQCS) industry, and the other is in the petro-chemical and refining industry. Tang received his B.A. from Columbia University in 1971 and two additional graduate degrees from Oxford University in England in 1973 and 1979. In late-2006, Tang invited the Ewan group of inventors to team with Hal Cooper to create the subject patent-pending CEFCO Technology, and led all the co-inventors altogether to co-found the Company by uniting the patented Ewan technology with the patented Cooper Process into an integrated system under new patenting procedure.
CEFCO uses a comprehensive re-circulating and re-generating system that optimizes the conservation of water, energy and all required inputs.
Comparison of Parasitic Load and Energy Penalty

Supersonic “Free Jet Collision”
Shockwave Effect
(Intense Pressure and Energy)

Subsonic “Free Jet” Effect
Ewan’s Subatmospheric Reaction Zone
(Adiabatic Conditions)

Aerodynamic Recovery of
ΔP and ΔT

Reaction Zone for Target Capture/Conversion by Reagent

$P = \text{Pressure}$
$T = \text{Temperature} \, ^\circ F$

$t = \text{time in seconds}$
$t_m = \text{time in minutes}$
The key distinguishing value of The CEFCO Process is the integration of two proven, patented technologies, the Ewan and Cooper Processes, to produce a sequenced, selective and virtually complete removal of pollutants, including metals, SO\textsubscript{2}, NO\textsubscript{x}, and CO\textsubscript{2}.

Aerodynamic reactor technology enables CEFCO to utilize advanced chemical engineering to reclaim captured pollutants as final products.

Expected removal efficiencies of > 90% for CO\textsubscript{2} and > 99% for all other flue gas pollutants.

Coal or Other Hydrocarbon Fuels → Boiler → ESP Electro-static Precipitator → CEFCO Module 1: Metals → CEFCO Module 2: SO\textsubscript{2} → CEFCO Module 3: NO\textsubscript{x} → CEFCO Module 4: CO\textsubscript{2} → Recovered Metals → Additional Processing → Carbon Capture + Fertilizers + Feedstock for Petrochemicals
Recovery and End-Products

Sequenced modules selectively capture pure products from pollutants.

<table>
<thead>
<tr>
<th>Final Products</th>
<th>Potential Revenue Streams</th>
</tr>
</thead>
</table>
| CEFCO Module 1: Metals | • Metals Market  
• Alloy-Steel Users  
• Industrial Market  
• Trace Metals for Hi-Tech Electronics Users  
• Catalysts and Additives for Refining & Petrochemical Markets |
| CEFCO Module 2: $SO_2$ | • Fertilizers & Agricultural Applications  
• Industrial Market  
• Feedstock for Petrochemical Market |
| CEFCO Module 3: $NO_x$ | • Fertilizers & Agricultural Applications  
• Industrial Market  
• Feedstock for Petrochemical Market |
| CEFCO Module 4: $CO_2$ | • Enhanced Oil Recovery  
• Sequestration Market  
• Carbon Credit  
• Methanol, Ethanol & Diesel Fuels |

- Metal Compounds (Mercury + Trace Metals)  
- Fine Particulates (< 2.0 Microns)  
- Potassium Sulfate (Fertilizer)  
- Potassium Nitrate (Fertilizer)  
- Pure $CO_2$
The CEFCO Advantage: Faster and Cheaper

CEFCO technology is more compact, more efficient, and results in significantly lower costs:

<table>
<thead>
<tr>
<th>COST CONSIDERATIONS FOR A TYPICAL 1,000 MW PLANT FOR ALL POLLUTANTS AND CO₂ CAPTURE MODULES</th>
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</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td><strong>Current AQCS Technology</strong>*</td>
</tr>
<tr>
<td>• Multiple pollutant-specific technologies required</td>
</tr>
<tr>
<td>• Est. CAPEX ~$1.5 to $2.0B;</td>
</tr>
<tr>
<td>• Equipment size equivalent to 5+ basketball stadiums</td>
</tr>
<tr>
<td>*Current AQCS Technology refers to all technologies in the marketplace from many sources</td>
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<tr>
<td><strong>CEFCO</strong></td>
</tr>
<tr>
<td>• Single integrated technology to treat all pollutants and CO₂</td>
</tr>
<tr>
<td>• 50% less CAPEX</td>
</tr>
<tr>
<td>• 75% less space (~150ft in length), stackable / modular configurations</td>
</tr>
<tr>
<td><strong>Capital Cost</strong></td>
</tr>
<tr>
<td>• Significant energy required for pollutant capture &amp; recovery</td>
</tr>
<tr>
<td>• Total system shutdown required for periodic maintenance and repair</td>
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<tr>
<td><strong>Operating Cost</strong></td>
</tr>
<tr>
<td>• 30%-60%</td>
</tr>
<tr>
<td>• Efficiency degrades over operational use and time</td>
</tr>
<tr>
<td><strong>Parasitic Load</strong></td>
</tr>
<tr>
<td>• &lt; 10%</td>
</tr>
<tr>
<td>• Maintains high efficiency throughout</td>
</tr>
<tr>
<td><strong>Parasitic Load</strong></td>
</tr>
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The CEFCO Advantage: Safer

CEFCO removes CO₂ and all toxins from flue gas to create a cleaner and healthier environment, as well as products that are safe and free from contamination:

<table>
<thead>
<tr>
<th>BYPRODUCTS FROM AIR POLLUTANTS</th>
<th>Current AQCS Technology*</th>
<th>CEFCO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals &amp; Mercury</td>
<td>Contaminated Sludge</td>
<td>Stable metals for mineral refining and metal processing</td>
</tr>
<tr>
<td>Fine Particulates (&lt; 2.0 microns)</td>
<td>Cannot capture</td>
<td>Captures</td>
</tr>
<tr>
<td>SO₂ &amp; NOₓ</td>
<td>Low-valued Gypsum, hazardous Ammonium Fertilizers</td>
<td>Valuable and desirable Potassium-based Fertilizers</td>
</tr>
<tr>
<td>CO₂</td>
<td>CO₂ in hazardous Ammonium Solution</td>
<td>Pure CO₂ gas (sellable), Fuel &amp; Petrochemical Feedstock, Algae production, Sequestration, EOR</td>
</tr>
</tbody>
</table>

*Current AQCS Technology refers to all technologies in the marketplace from many sources
Upcoming Market Segments

CEFCO is looking for experienced and qualified engineering product or service providers to become authorized distributors in the following market segments (or distribution channels) for Clients who are subject to:

- Utility MACT Compliance
- Boiler MACT Compliance
- Cement MACT Compliance
- HWC MACT Compliance

CECO has already appointed licensed distributorship for the Cement and Lime Industries in USA, Canada, and Mexico.

Please visit our Website at: [www.cefcoglobal.com](http://www.cefcoglobal.com)

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