

To: [Personal Email/Ex. 6] Gunasekara, Mandy[Gunasekara.Mandy@epa.gov]; Dunham, Sarah[Dunham.Sarah@epa.gov]; Harvey, Reid[Harvey.Reid@epa.gov]
Cc: 'Steve Sexton'[stevesexton@vocgen.com]; 'Mark Vermeer'[markvermeer@vocgen.com]; kevin_holmquist@keybank.com[kevin_holmquist@keybank.com]; tom@dadeyinsurance.com[tom@dadeyinsurance.com]; Bianco, Karen[Bianco.Karen@epa.gov]; Hupp, Sydney[hupp.sydney@epa.gov]; Atkinson, Emily[Atkinson.Emily@epa.gov]
From: Mark Ranalli, Allegiance Energy Systems, LLC.
Sent: Thur 4/27/2017 8:26:13 PM
Subject: Draft Meeting Minutes - EPSI-VOCGEN Discussion Meeting Wednesday 4/26 at 12:30pm EST
[Vocgen National Plan Message.pdf](#)
[10-laitner-sexton-2005-final-copyright-2010.pdf](#)
[External Meeting Request Form 3-31-2017 EPSI-VOCGEN SteveSexton.pdf](#)
[EPA,Jarvis,Ranalli,MeetingNotes 4-26-2017,Re EPSI-VOCGEN.pdf](#)

Hello All,

Thank you again for permitting Doug and I your time to quickly discuss the External Meeting Request Form we submitted.

Below & attached are, as promised, the Draft Minutes from yesterday's call. To perhaps prompt our first next follow-on dialog.

I refer to these notes as "Draft" minutes for two reasons: I didn't take notes - It's from memory, and I added some content for clarification or emphasis;

Plus I'm we probably shouldn't classify this as minutes without your all approval.

Thank you again for your time. It was a pleasure to have met you all, and thank you very much Karen, Sydney and Emily for making this happen !

Talk to you soon.

Best Regards

Doug and Mark

Draft Meeting Notes (with some added editorial – for emphasis or clarity purposes)

Date: Wednesday 4-26-2017

Time: 12:30 pm to 1:00 pm

Venue: Conference Call

Attendees:

- Doug R. Jarvis - President Green Visions Solar and Co-Founder EPSI-VOCGEN New York
- Mark A. Ranalli – Principal Allegiance Energy Systems, and Co-Founder EPSI-VOCGEN New York
- Mandy Gunasekara – Senior Policy Advisor
- Sarah Dunham – Acting Assistant Administrator of EPA’s Office of Air and Radiation
- Reid Harvey – Director, Clean Air Markets Division

Purpose: To review and discuss *US EPA External Meeting Request Form* completed/submitted April 1 2017, on behalf of Environment & Power Systems International (EPSI), by Doug Jarvis and Mark Ranalli, to request a short meeting for EPSI President to present and discuss with Administrator Pruitt the EPSI VOCGEN National Implementation Plan and the EPSI proposed VOCGEN Operating Permit Program. A program that, once in place; can enable the speedy retrofit and construction of new manufacturing facilities with no net increase in Ozone precursors, toxics, or global warming gases. And a national plan, that with the national permitting program, offers the opportunity to leverage the increase of American manufacturing operations without limitation, or opposition by environmentalists, and in full compliance with the presently stayed CPP.

Agenda:

1. Doug and Mark’s (D&M) few questions toward guiding our 30 minute conference call:

a. D&M Question: Have you had a chance to review the completed “EPA External Meeting Request Form” we sent back to Sydney Hupp, along with two documents attached to it? . . .

and, . . .

b. D&M Question: have you any immediate or specific questions for us to address regarding our input on the External Meeting Request Form (EMRF) or the attachments ?

M/S/R Answer: to Qa and Qb – yes we did review the material, and yes we would like to know, summarily from D&M, an overview from those documents, along with a statement about what D&M would like our team to consider.

D&M Response: Agreed, we plan to address your questions and cover basically:

- Who we are,
- What is VOCCGEN, and
- the Purpose of this conference call meeting, such that at the end of the call, you and your team would be sufficiently satisfied and comfortable submitting to Administrator Pruitt:
 - the External Meeting Request Form (EMRF) with attached two documents, plus
 - the two documents we emailed to Emily just before this call; and,
 - with your recommendation that Administrator Pruitt and President Trump will be delighted to:

A. know that the VOCCGEN technology, is:

- a proven, vetted and patented combined Air Pollution Control (APC) / Combined Heat and Power (CHP) technology, that is the quintessential optimal and only effective *market-based solution*, the world, that will cost-effectively transform and help revitalize industrial manufacturing in America,

while

- also being the revolutionary disruptive APC technology that becomes the means to achieve

and exceed the requirements of the presently stayed Clean Power Plan (CPP);

thereby, precluding the Trump Administration's need to modify or denounce the stayed CPP, and in fact leverage their keeping of the Democratic Party's CPP (without destroying the American economy), i.e, toward:

- eliminating the age-old "cost-to-economy" vs. "Environment / Climate Change / regulatory compliance" paradigm, and thus neutralizing the commonplace environmentalist's anti-climate criticism/rhetoric.
 - building increased and additional American Manufacturing – product, revenue, jobs and careers - in America;
 - repatriation of American manufacturing operations;
 - monetizing emissions to America's advantage; and
 - being a means to
- levelize the taxation of Imports, and
 - affecting a new NAFTA program

while,

- increase American Exports and concerns;
- reversing the American Trade Deficit; and,
- decreasing per-capita taxes, yet increasing tax revenue.

and,

B. briefly meet, as requested in the EMRF, via Conference call with EPSI President Steven E. Sexton, to discuss the development of Sexton's proposed Federal Operating Permit Program, toward the creation of a streamlined, standardized yet comprehensive (i.e. optimal) permitting program that can be helpful to and adopted by the States.

c. D&M Question: have you had any recent communication with either Tom Dadey or Senator Thad Cochran?

M/S/R Answer: None, in regard to VOGEN or EPSI; and, we are not familiar with the name Tom Dadey

D&M Response: if or as time permits we'll explain the reason for this question.

2. What is Vocgen:

In one sentence: *VOCGEN is a revolutionary, disruptive technology and market-based solution that represents the future of clean, efficient and competitive American manufacturing and a vibrant American economy based on wealth creation.* –Steven E. Sexton

Briefly – and from attached or referenced documents:

a. VOCGEN is an Air Pollution Control (APC) technology/system that outperforms and is unlike any other APC technology in the world – because it can abate emissions 100% while also cost-effectively perform Combined Heat and Power.

The VOCGEN system's performance exceeds the requirements of the Clean Air Act (CAA) Title I, the National Ambient Air Quality Standards (NAAQS), and the CAA Title V air operating permit requirements for major sources.

b. Moreover, VOCGEN is also a dispatchable, clean energy, Combined Heat and Power (CHP) technology/system – for manufacturing - that outperforms and is unlike any other CHP technology in the world – because it can cost-effectively perform Combined Heat and Power - for the Industrial Sector affording an unheard-of 2 year return on capital investment**, while also most effectively performing Air Pollution Control – Notably, a single VOCGEN power generator (with an output of 560kWe/hr and 6.4MMBtu/hr high quality waste heat) offsets ≈20,000 metric tons CO₂e and toxics annually from regional coal-fired generation; representing high value emissions for trade.

**Each VOCGEN System will save its Manufacturer in excess of \$1,000,000 annually in operating costs, as a secondary benefit of eliminating its emissions – to comply with regulations.

c. At the heart of the patented VOCGEN technology is the gas turbine oxidizer (GTO), having an off-the-shelf robust industrial gas turbine engine (i.e. combustion turbine or “jet engine”) that has over 45 years of highly reliable operations in marine, desert and Arctic environments; which is coupled with a generator set, to produce 560 kWh/hr electric and 1,876 kWh/hr (or 6.4

MMBtu/hr) heat energy.

d. The VOCGEN is the only cost effective clean energy technology capable of achieving – exceeding - the proposed standards of the CPP Ruling. The VOCGEN is shovel-ready to be made commercially available (i.e. to be mass produced), to fulfill a US industrial sector demand/market of nearly 40,000 facilities. Many of these facilities will install multiple VOCGEN units.

e. The EPSI VOCGEN has been vetted by:

- U.S. DOE - Department of Energy, Berkeley National Labs
- U.S. EPA – Environmental Protection Agency (reference the attached White Paper co-authored by Steve E. Sexton (EPSI) and John A. Skip” Laitner (U.S. EPA))
- U.S. DARPA – Defense Advanced Research Projects Agency,
- GTI - Gas Technology Institute,
- EPRI - Electric Power Research Institute
- ACEEE - American Society for an Energy-Efficient Economy
- CEC – California Energy Commission

3. Our Goal for this Meeting:

That we, Doug and Mark, will have provided you and your team sufficient information and discussion points to:

- ◆ support your due diligence review of the attached and referenced documentation, and following that review and follow-up meeting(s) or clarifications you require from us, to
- ◆ recommend to Administrator Pruitt that a brief meeting (perhaps too with Secretary Rick Perry) be arranged for EPSI President Steve E. Sexton to discuss among other things, the proposed National VOCGEN Operating Permit Program – preferably before President Trump’s policy team votes to determine the fate of the presently stayed CPP.

4. EPA's (M/S/R) questions of or from the aforementioned:

a. M/S/R Question: can you provide us an example from the list of organizations that have vetted the EPSI VOCCGEN technology?

D&M Answer: Yes, reference the attached white paper co-authored by Steve E. Sexton (EPSI) and John A. Skip" Laitner (U.S. EPA)

b. M/S/R Question: describe the state of play of the VOCCGEN – in the US and/or internationally, e.g. are there presently systems deployed in other countries?

D&M Answer: to our knowledge Steve Sexton has resisted or deferred responding to current requests from other countries until he first discusses the VOCCGEN program with the Trump Administration; so, there are no deployed systems, monitored by EPSI, outside the US.

An initial, generation I, VOCCGEN GTO/CHP commercial prototype operated successfully for a 3.5 year period on a mixture of waste pentane air emissions (VOC) and natural gas, in compliance with the requirements of a Class 1 air quality operating permit issued by the San Joaquin Valley Air Pollution Control District.

c. M/S/R Question: are there currently regulatory barriers, in the States or at the Federal level, that are stifling the marketing or precluding deployment of VOCCGEN systems?

D&M Answer: EPSI has Letters of intent to purchase from a number of manufacturing concerns headquartered and/or having operations in U.S.A.

As you may know there are nearly 40,000 facilities of approximately 104 industrial categories, that are subject to Title I of the Clean Air Act (CAA); the National Ambient Air Quality

Standards (NAAQS) for ground level Ozone; the CAA Title V air operating permit requirements for major sources; and the US EPA Clean Power Plan Guidelines.

The Automobile industry is one of those groups, and many manufacturing concerns, like the Automobile industry, have operations in multiple states.

These firms have advised EPSI that not only do they need and want multiple units for their multiple facilities, they expressed that they need too assurance from EPSI that:

A. EPSI can have the infrastructure in place to affect and respond to high production requirements that would come from the demand for the VOCGEN technology/systems –from their multiple plants and from that of their competitors; and

B. That the various State permitting processes won't slow or stifle project implementation; i.e. the Manufacturing concerns need uniformity (or standardization) w/r/t the permitting process.

In regard to the deployment of VOCGEN with respect to interconnection of the VOCGEN systems for grid-tied Distributed Generation (DG or DG/CHP) applications, as you may know each States' Utility Commission has different interconnection requirements – some more onerous than others, and are particularly more complex and onerous in deregulated States where the investor-owned utilities are threatened by DG. However, we believe from experience, that EPSI and the aforementioned EPSI-VOCGEN targeted industrial customers will not, in any way, find Utility interconnection requirements to be a hurdle or barrier to VOCGEN project implementation.

d. M/S/R Question: we would like to continue this conversation via a follow-up dialog if that works for D&M and EPSI.

D&M Answer: Agreed, and we hope these minutes as well as any of the information and data from documents we submitted, referenced, or to be submitted for you review, will prompt more questions & answers toward your satisfaction and conclusion that *the EPSI VOCGEN is indeed the most revolutionary, most documented, most vetted, and the only market-based solution offering a wealth generating economic model that will significantly improve manufacturing industry growth, production, revenue and profits; creating jobs and careers, and vastly improve the American economy, while simultaneously improving energy security, protecting human health, and directly benefiting environmental health – thereby providing the*

environmentalist the quintessential solution that until now was not ever expected or known to exist.

-

Moreover we would like to again encourage visiting the following websites, for more information about EPSI, the VOCGEN technology, and Mr. Steve E. Sexton:

◆ Main Web Site: www.vocgen.com and

<http://vocgen.businesscatalyst.com/publications.html>

◆ Market/Sales Site: Environmental XPRT (product information and publications)
<https://www.environmental-expert.com/AllContent/?keyword=VOCGEN>

◆ Partners: <http://www.vocgen.com/partners.html>

◆ Steve E. Sexton's CV/Resume: <https://www.visualcv.com/steven-sexton>

◆ Vocgen National Plan Download: <https://www.environmental-expert.com/companies/environment-power-systems-international-32306/downloads>

◆ LinkedIn Groups Managed by EPSI's SE Sexton:

· The VOCGEN Energy Group - <https://www.linkedin.com/groups/2740286>

· Oro Valley Energy Venture Group - <https://www.linkedin.com/groups/6563219>

◆ LinkedIn Pulse - Posts By SE Sexton:

1. Advancing Environmental Health

<https://www.linkedin.com/pulse/psalm-environmental-health-steven-e-sexton?trk=prof-post>

2. Advancing Industrial Energy Efficiency Programs

<https://www.linkedin.com/pulse/advancing-industrial-energy-efficiency-programs-steven-e-sexton?trk=prof-post>

3. Advancing Clean Power Plan Objectives

<https://www.linkedin.com/pulse/advancing-clean-power-plan-objectives-stein-e-sexton?trk=prof-post>

4. Manufacturing Sector Business Growth Intelligence

<https://www.linkedin.com/pulse/manufacturing-sector-business-growth-intelligence-stein-e-sexton?trk=prof-post>

5. Advancing a Clean Power Economy

<https://www.linkedin.com/pulse/advancing-clean-power-economy-stein-e-sexton?trk=mp-reader-card>

Thank you again Ms. Bianco, Ms. Hupp, Ms. Atkinson, Ms. Gunasekara, Ms. Dunham, and Mr. Harvey for your efforts, time and consideration of this terrific technology and revolutionary solution - for the Trump Administration to make American Manufacturing and America Great Again – Together - with and to the favor to the Democratic Party and Environmentalist.

It was a pleasure speaking with you all, and we look forward to talking with you again in follow-up dialogs.

Best Regards

Doug and Mark

Attachments

cc:

- ◆ Steven E. Sexton, President, CEO and Managing Director, Environment and Power Systems International
- ◆ Mark E. Vermeer, PE, MBA, Director of Operations Environment and Power Systems International
- ◆ Kevin A. Holmquist, Onondaga County Legislature Member, Manager Key Bank – Manlius

♦ Tom V. Dadey, Onondaga County GOP Chairman, Member Executive Committee of the President Trump Transition Team, President Dadey Insurance Agency

♦ Karen Bianco, Office of General Counsel at US EPA

♦ Sydney Hupp, Office of the Administrator- Scheduling

♦ Emily Atkinson, Management Analyst/Office Manager, Immediate Office of the Acting Assistant Administrator, Office of Air and Radiation, USEPA

From: Atkinson, Emily [mailto:Atkinson.Emily@epa.gov]

Sent: Wednesday, April 26, 2017 11:29 AM

To: Mark Ranalli, Allegiance Energy Systems, LLC. <MARanalli@AllegianceEnergy.com>

Cc: Personal Email/Ex. 6 kevin_holmquist@keybank.com

Subject: RE: VOCGEN Discussion Meeting Confirmed 4/26 at 12:30pm EST

Thank you for sending these over. I will make sure Sarah Dunham gets a copy.

Emily Atkinson
Management Analyst/Office Manager

Immediate Office of the Acting Assistant Administrator
Office of Air and Radiation, USEPA
Room 5412B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850

Email: atkinson.emily@epa.gov

From: Mark Ranalli, Allegiance Energy Systems, LLC.
[mailto:MARanalli@AllegianceEnergy.com]
Sent: Wednesday, April 26, 2017 11:20 AM
To: Atkinson, Emily <Atkinson.Emily@epa.gov>
Cc: Personal Email/Ex. 6; kevin_holmquist@keybank.com
Subject: FW: VOCGEN Discussion Meeting Confirmed 4/26 at 12:30pm EST

Hello Emily,

Looking forward to conference-call meeting with Sarah shortly;

And, I thought It'd be worthwhile to add yet 2 more document tot the two we had attached to your External Meeting Request Form.

While the documents are straight forward, if time permits we may want to go over these with you and/or Sarah.

Thank you again

Mark and Doug

315-373-5055

315-415-5813

From: Mark Ranalli, Allegiance Energy Systems, LLC.
[mailto:MARanalli@AllegianceEnergy.com]
Sent: Tuesday, April 25, 2017 12:05 PM
To: 'Atkinson, Emily' <Atkinson.Emily@epa.gov>
Cc: Personal Email/Ex. 6; 'kevin_holmquist@keybank.com'

<kevin_holmquist@keybank.com>; 'Steve Sexton' <stevesexton@vocgen.com>
Subject: RE: Confirmed 4/26 at 12:30pm EST

Hello Emily,

Thank you.

We look forward to talking with Sarah.

Best regards

Doug and Mark

From: Atkinson, Emily [mailto:Atkinson.Emily@epa.gov]
Sent: Tuesday, April 25, 2017 9:16 AM
To: Mark Ranalli, Allegiance Energy Systems, LLC. <MARanalli@AllegianceEnergy.com>
Cc: Personal Email/Ex. 6 kevin_holmquist@keybank.com; Personal Email/Ex. 6
Subject: Confirmed 4/26 at 12:30pm EST

Hi Doug and Mark,

Wonderful, so you are confirmed for a 30 minute conference call with Sarah Dunham on Wednesday, April 26 at 12:30pm EST. Call in details outlined below.

Ex. 6 - Personal Privacy

Participant Code: Ex. 6 - Personal Privacy

Emily

Emily Atkinson
Management Analyst/Office Manager

Immediate Office of the Acting Assistant Administrator
Office of Air and Radiation, USEPA
Room 5412B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850
Email: atkinson.emily@epa.gov

Steven E. Sexton, Environment & Power Systems International
and
John A. "Skip" Laitner, US Environmental Protection Agency

ABSTRACT

Conventional pollution control technologies do just that; they control pollution to acceptable levels but provide little else in the way of economic benefits. But what if the redesign of such systems makes it possible to produce useful by-products beyond the so-called "end of pipe" controls? In the case of industrial plants required to reduce volatile organic compounds (VOC), the conventional abatement technologies include regenerative thermal oxidizers (RTOs) which have an efficiency removal rate of 98 percent and higher. Environment and Power Systems International, LLC (EPSI) has developed an alternative technology that uses the VOC-containing gases enriched with natural gas to generate both electricity and useful thermal heat as a by-product of pollution control. This paper describes the alternative technology and reviews the potential contribution to the nation's electricity supply. Preliminary data suggests there may be 100,000 industrial facilities that might be able to take advantage of this alternative technology. If 60 percent of these facilities adopt the EPSI system by 2020, the primary energy savings might exceed one quad of energy. This is equivalent to the petroleum production that might be provided by opening the Alaska National Wildlife Refuge.

Introduction

Few question the importance of reducing or eliminating air and water pollutants from our nation's industrial processes. To the extent there is any controversy, it is about the need to balance benefits with costs as we try to manage the reduction of those pollutants. In the case of air pollution generally, and more specifically, the reduction of volatile organic compounds (the primary technology driver in this paper), standard engineering practice generally requires some form of pollution control technology. The good news is that this approach does very well, typically achieving emission reductions of at least 98 percent when the technology is appropriately designed, engineered, and operated. On the other hand, the conventional pollution control technologies do only that; they control pollution to acceptable levels but provide little else in the way of economic benefits.

But, as we ask in this paper, what if the redesign of such systems made it possible to produce useful by-products beyond the so-called "end of pipe" controls? In the case of industrial plants required to reduce volatile organic compounds (VOCs), the dominant abatement technologies include regenerative thermal oxidizers (RTOs) which provide an efficiency removal rate of 98 percent and higher. Environment and Power Systems International (EPSI) has developed an alternative technology that uses the VOC-containing gases enriched with natural gas to generate both electricity and useful thermal heat as a by-product of pollution control. This paper describes the alternative technology and reviews the potential contribution to the nation's electricity supply. Preliminary data suggests there may be 100,000 industrial facilities that might be able to take advantage of this alternative technology (EPSI 2004). If 60 percent of these facilities adopt the EPSI system by 2020, the primary energy savings might exceed one quad of energy. This is equivalent to the petroleum production that might be provided by opening the Alaska National Wildlife Refuge.¹

¹ This estimate is derived from calculations by Laitner (2004) and compared to ANWR production potential found in Koomey et al. (2003).

Background and Technology Characterization

Ground-level or tropospheric ozone is a widespread air pollutant, a gas that forms in the atmosphere when three atoms of oxygen are combined together. It is not emitted directly into the air, but is produced by chemical reactions between oxides of nitrogen (NO_x), and volatile organic compounds (VOC) near ground level and in the presence of sunlight.² Hence, NO_x and VOC are identified as precursors to the formation of ozone. Nitrogen oxides are formed when fossil fuel is burned at high temperatures. Many of the nitrogen oxides are colorless and odorless, although nitrogen dioxide can often be seen as a reddish-brown gas. NO_x results from sources that burn fuel, including motor vehicles, electric generating plants, boilers, and other industrial and residential sources. These NO_x emissions can drift hundreds of miles away from their point of origin, allowing one geographic location to affect an entire region.

VOCs, the specific focus of this new technology, are compounds that contain carbon which can volatilize to form an organic vapor in the air and participate in atmospheric photochemical reactions.³ The major man-made sources of VOCs are industrial processes (46 percent) and automobiles (30 percent) (Noll 1999). VOCs are widely used as solvents in a large number of industrial processes because they evaporate into air leaving no residue.

The Clean Air Act will continue to be the pre-eminent driver of the VOC recovery and destruction market. The EPA and several states finalized many relevant and demanding regulations during the last few years increasing the rate of growth in the pollution control markets to their highest levels (Frost and Sullivan 2003). Due to the nature of most industrial processes, one option to meet these air quality regulations is the installation of pollution control equipment. As we previously noted, the equipment is required to achieve at least a 95 to 98 percent VOC reduction rate from what would be released without pollution control equipment.

The largest end-users of VOC destruction and recovery equipment continue to be chemical, oil, gas, lumber and wood industries (EPSI 2004). Specific industries that focus on VOC technologies include aerospace, semiconductor, printing, automotive and generally all coating operations including can, wire, appliances, and furniture. In total, there are 104 industries subject to Clean Air regulatory requirements for VOCs including the subset list of 189 Hazardous Air Pollutants (HAPs).

There are a number of ways VOC emissions can be reduced to meet EPA limitations. New VOC abatement technologies including absorption, ultra violet oxidation and refrigeration/condensation equipment captured 17 percent of the total market in the year 2000 (EPSI 2004). Older, more mature technology segments growing more slowly include carbon adsorption, distillation and air stripping equipment. Thermal oxidation captured 55+ percent of the total market in that year (EPSI 2004). Each method has its own benefits and limitations that may make them more desirable for certain applications. The applicability of a given technique is dependent on the physical and chemical properties of the pollutant and the characteristics of the exhaust stream.

VOC equipment companies are combining multiple technological processes to create unique solutions. Integrated pollution control systems have a strong potential for future growth. Pre-wired, pre-piped, pre-tested and certified systems reduce project costs, trading slightly higher integrated and

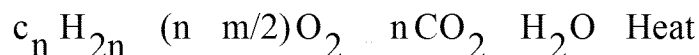
² Ozone occurs in two layers of the atmosphere. The atmospheric layer near the earth's surface is the troposphere. Ground level or "bad" ozone is an air pollutant that damages human health, vegetation, and many common materials. It is a key ingredient of urban smog. Strong sunlight and hot weather cause ground level ozone to form in harmful concentrations in the air. The troposphere extends from ground level to about ten miles up, where it meets the second layer, the stratosphere. In the stratosphere, there is a "good" ozone layer that extends upward from about 10 to 30 miles, and this ozone protects life on earth from the sun's harmful ultraviolet rays.

³ The following compounds are excluded from this list of volatile organic compounds: carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate.

functionally tested equipment costs for decreased field installation and start-up costs, and reduced site installation and maintenance problems.

Thermal Oxidation

Thermal oxidation, by definition, converts a hydrocarbon, in the presence of oxygen and heat, to carbon dioxide and water vapor. As we already indicated, this technology provides the greater part of the VOC control market and becomes the basis for estimating national benefits of the alternative control market based on the Gas Turbine Oxidation approach. A general equation showing this relationship is shown below (Rafson 1998):



The particular n and m subscripts of the equation are used to define the number of carbon atoms and hydrogen atoms. The amount of oxygen atoms present are converted to n molecules of carbon dioxide and m molecules of water vapor and heat which is given off in the exothermic reactor. This last aspect, the exothermic nature of thermal oxidation is a key to generating multiple benefits beyond mere pollution control.

There are three critical requirements to ensure combustion and destruction of the VOCs: time, temperature, and turbulence. Time refers to the retention time or residence time, which is the length of time that an organic is at the appropriate temperature to ensure proper VOC destruction. Typically, a residence time of 0.5 second is adequate to ensure at least a 95% destruction rate at the proper temperature. Temperature must be maintained in conjunction with time. As time is decreased, temperature will need to be increased and vice versa. A minimum temperature for VOC destruction is approximately 1400°F. Turbulence implies an adequate level of mixing. By changing the configuration of the air stream, the inlet air to the destruction chamber is properly mixed to ensure complete combustion takes place. There are three different thermal oxidation processes. These include:

(1) *Direct Flame Incineration*: A direct flame incinerator consists of only a combustion chamber with no heat recovery from the incinerator. Direct flame incinerators are the simplest type of thermal oxidizers. Direct flame incinerators have the advantages of minimum complexity and low cost, but, since they are typically used in applications with dangerous pollutants (explosive, corrosive or poisonous); the overall system including the required safety equipment is typically very complex.

(2) *Recuperative Thermal Oxidation*: The technique of recuperative thermal oxidation involves the recovery of energy produced by burning a support fuel to achieve VOC destruction using a primary or secondary heat exchanger to heat the incoming process air utilizing hot waste gases from the oxidizer. The exhaust gases from the oxidizer pass through a shell and tube or plate-type heat exchanger to recover the heat of combustion and increase the fuel efficiency of the VOC destruction process. Recuperative oxidizers are ideal for high VOC emission rates. A recuperative thermal oxidizer is generally able to recover 70 percent of the heat available from the oxidizer. Some units are designed with a secondary heat recovery unit to preheat air or water or heat transfer fluids for other plant processes such as drying ovens.

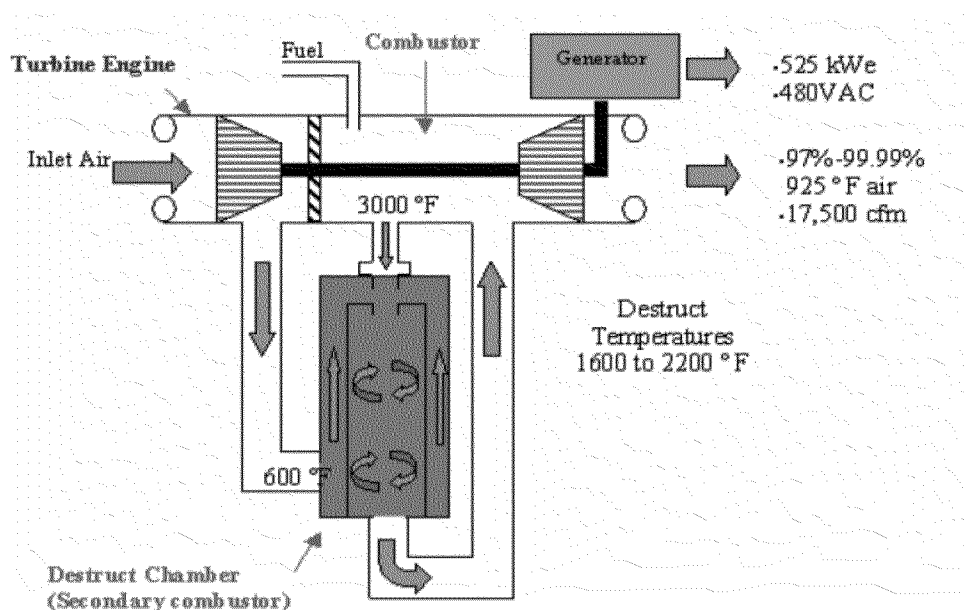
(3) *Regenerative Thermal Oxidation*: Another type of thermal oxidizer is the regenerative thermal oxidizer which appears to be the system of choice among industrial users. These systems are used when the contaminated air stream has a low concentration of VOC (< 1000 ppm) and/or large air flows. They also are used in industrial processes that require a high oxidation temperature. Regenerative oxidizers allow for better heat recovery than a recuperative oxidizer and diluted vapor streams can be incinerated at lower costs. Regenerative systems use beds of ceramic material as a heat sink. Once the ceramics are heated, the flow shifts and the post-combustion gas stream is used to heat up the second bed of ceramic material while pre-combustion air flows through the first hot bed gaining heat as it travels to the burner. Flow is shifted between the beds as they heat up and cool down. Heat transfer efficiencies of 95% can be

achieved with regenerative units. The alternating sequence decreases the removal efficiency of the VOC. The overall removal efficiency can be as high as 99%, but typically is 98% (GTI 2003).

Gas Turbine Oxidizer

Another type of thermal oxidizer is a gas turbine oxidizer (GTO). As described in this paper, this technology provides the basis for generating both electricity and thermal energy as a by-product of pollution control. The GTO consists of a turbine and a secondary combustion chamber for thermal destruction of production process or waste volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions including renewable hydrocarbon fuels and other organic materials within an air stream.

Figure 1. Schematic Drawing of Gas Turbine Oxidizer



As shown in Figure 1, above, the VOC-laden air, combined with ambient atmospheric concentrations of oxygen (20.9%) is compressed within the gas turbine engine's compressor section to approximately 132 psig or 9 atmospheres. This raises the VOC-laden air temperature to 600 °F. This air enters a patented VOC destruction chamber where it is mixed with the 3000 °F combustion products from the turbine combustor. The resultant air (now ~ 1850 °F, but in the range of 1600 – 2200 °F) travels in a cyclonic fashion inside the destruction chamber. This cyclonic action allows for good mixing and a residence time of approximately 0.44 seconds in which the VOCs oxidize into carbon dioxide and water. This "clean" air stream enters the turbine combustor where it is mixed with fuel and ignited creating temperatures ~ 3,000 °F. This high-energy air is routed through the turbine section of the engine where the air is quickly cooled to 925 °F creating a significant airflow that rotates the turbine shaft. This shaft is connected to a generator that produces electricity (approximately 525 kWe) (GTI 2003).

Gas turbines have several advantages to their design. Due to their high operating temperatures, large amounts of heat are available for recovery. This heat can be used for other plant processes and/or pretreatment of air into a VOC concentrator, which will allow for more VOC destruction within the turbine. The unit is also able to generate electricity, which can be used to power other plant equipment.

The footprint of the system is smaller than other VOC destruction technologies. The turbine itself is durable and should last much longer than other technologies.

System Performance

Although the GTO system requires a higher cost outlay, the lower annual operating costs, together with the credits associated with heat recovery and electricity generation indicate a highly cost-effective system. As summarized in Table 1 below, the generic cost characterizations suggest a simple payback of little as 1.6 years.

Table 1. Cost and Performance Characterization (EPSI 2004)

	RTO System	EPSI GTO System
Total Capital and Project Costs	\$1,800,000	\$3,200,000
Total Annual Costs	\$618,000	\$262,000
Fuel and electricity	\$227,000	\$122,000
Maintenance	\$35,000	\$10,000
Administration	\$94,000	\$90,000
Refurbishment Fund	\$261,000	\$40,000
Total Annual Credits	\$0	\$475,000
Electricity Generation	\$0	\$125,000
Heat Recovery	\$0	\$350,000
Simple Payback Period	None	1.6 Years
Return on Investment		60%

The higher capital costs associated with the GTO system include system costs associated with the generation of electricity and thermal energy. At the same time, the system design reduces annual operating costs (especially depreciation and normal wear and tear, or what we call “refurbishment costs”). The design also anticipates slightly increased natural gas purchases but substantially reduced electricity costs. Most important are the revenues or credits earned through the generation of electricity and process heat or steam.

Assuming a 525 kW unit operating at 63% percent capacity factor (or 5520 hours per year), and subtracting parasitic or ancillary loads needed to safely operate the system, the GTO unit will provide 2.9 million kilowatt-hours (kWh) of electricity. Priced at 4.5 cents per kWh implies an electricity credit of \$125,000 annually. At the same time, the potential for waste heat recovery approaches 1.656 trillion Btu per year. If purchased from local utilities at \$7.0 per million Btu, this implies an even bigger annual credit of \$350,000. The higher capital costs, then, are clearly offset by reduced annual operating costs and a sizeable credit for both electricity and heat. So what is now possible through a technology redesign is to convert a pollution control technology into a new system that provides a new source of combined heat and power operations that pays for itself in less than two years.

Size of Opportunity

The GTO-VOC technology will compete with other abatement equipment and with CHP systems on the basis of quality, price, and service. However, there are no industry players that supply VOC

destruct chambers for gas turbines. North American penetration of this market segment is zero percent and recent technological and design advances in environmental/cogeneration by EPSI have set the stage for making significant inroads against the incumbent VOC destruct only suppliers. With over \$2 billion in North American annual sales, this market segment is expected to provide significant growth for EPSI over the next ten years. But to evaluate the potential for market penetration, we provide a closer look at the economics of the GTO-VOC system.

EPSI will compete in a \$200 billion North American market (Frost and Sullivan) for air pollution control solutions. It is estimated that there are over 100,000 VOC destruct devices with annual turnover of \$13 billion. Growth in this market is being driven by the need for 104 discrete industries subject to EPA regulated control of environmental pollution and is estimated at 7% annually. EPSI's approach is to target these existing thermal oxidizers with our GTO products. EPSI's value proposition to replace these existing thermal oxidizers is its high VOC destruct efficiency, utilization of the useful byproducts of the destruction process (electricity and heat) and its low maintenance costs. This value proposition provides the customer with an attractive ROI on the EPSI system as shown below. With the EPSI system, a pollution control device can have a return on investment. As shown in the example below, an additional investment of \$1.4 million in the EPSI technology will generate annual cash flow of \$831,000, an ROI of 60% and a payback of 1.6 years. We are not aware of any other pollution control device that can make this statement.

Perhaps just as exciting as the attractive return on investment, the GTO system can deliver a sizeable reduction in the nation's total primary energy supply. If we assume that just 60 percent of the existing 100,000 VOC destruct devices are converted to the GTO-VOC technology over the next 15 years, the primary energy savings for both electricity and heat might exceed 1.25 quads. This is about the same as the anticipated annual average production from the Alaska National Wildlife Refuge⁴ and about two percent of current electricity generation. Hence, we have a cost-effective technology redesign that moves pollution control into a significant energy supply opportunity.

Conclusion

The EPSI system's ability to generate electricity, provide recoverable heat for use beyond the VOC destruction process, and its ability to operate within a large temperature band to destroy VOC more efficiently and completely, differentiates it from other pollution control technologies currently available in the market. The development of the 480 VAC synchronous generator component is critical to the success of the EPSI product, as it will provide a sufficient load to the turbine independent of the local electric utility's grid status, assuring combustion temperature for VOC destruction. It will also enable the EPSI system to function as an emergency generator (utilizing the EPSI system's electric output) to power the exhaust fans which move the VOC laden air stream; avoiding the potential of VOC build-up (a potential explosion hazard) that could occur with loss of the local utility grid and the use of an RTO.

The ability to quickly achieve VOC destruction temperatures from a cold start position is another advantage over RTO technology. Based on the information supplied by an RTO manufacturer and an end-user's data, the RTO requires one to eight hours to achieve proper temperatures from a cold start position. The GTO achieves destruction temperatures within minutes.

Based on the information gathered by an end-user, the major overhaul frequency of an RTO (50 to 60 SCFM) is between seven and ten years, at a cost of approximately \$250,000. This amount is almost three times higher than EPSI's estimates for the GTO. One unknown with the GTO is the impact particulate or foreign matter will have on the turbine if inlet air scrubbing and filtration is not used

⁴ For a review of the "fully-risked" market production potential of ANWR, see (Koomey et al. 2003).

appropriately. When particulate begins to collect on an RTO, its performance will begin to degrade. On the other hand, depending on the type and the amount of particulate, the (GTO) turbine may become damaged, possibly inoperable if corrosives or particulates are not addressed for gas turbine protection

After reviewing all the information, the following advantages and disadvantages are noted:

Advantages of the EPSI GTO system over standard (tower type) RTO include:

- Shorter initial cold start-up time (5 minutes versus 1 to 8 hours)
- Recoverable heat for use by end-user (RTOs use their heat in the VOC abatement process)
- Electrical power generation
- Higher combustion temperature (which in combination with high residence time assures more complete destruction of VOC) (VOC as renewable resource fuel)
- Smaller equipment footprint
- Lower major overhaul cost
- Short-term return on investment

The disadvantages of EPSI system when compared to standard (tower type) RTO include the following:

- Air flows greater than 6,200 scfm which need to be treated, require a VOC concentrator
- Although based on proven ASE 8 gas turbine installations (there are over 500 units installed in the field), this is a new product (the secondary combustor is the new component), whereas hundreds of RTOs have been installed and are in use.
- Greater consumption of natural gas for low air-flow systems

Based on the points listed above, our conclusion is that the EPSI system can provide a more thorough destruction of VOC due to its higher temperature variable thermal oxidation process (compared to an RTO) and having the ability to generate electricity, makes it a better choice of the two pollution control devices. Using the electricity the GTO can produce, it may also be possible to use the energy to purge the VOC stream ductwork (in the event of loss of the local electric grid) to minimize or eliminate the potential of VOC buildup – which would increase plant safety. The EPSI system reviewed is based on a 525 kW system. The implementation of the concept, using a larger turbine (2 to 5 MW range), would improve system economics through the elimination of the need for a VOC concentrator, obtaining greater usable electrical power and a greater amount of recoverable heat.

References

- [EPSI 2004] Environmental Power Systems, Inc. 2004. *Market Prospectus*, Environmental Power Systems, Inc., Tucson, AZ.
- Frost & Sullivan. 1995. "U.S. Equipment Markets: VOC Recovery and Destruction Research, Frost and Sullivan, New York, NY, March 17, 1995
- [GTI 2003] Distributed Energy Resources Group. 2003. *Technical Assessment of EPSI's Proposed VOC-Destroying/525 kWe Generator System*, Gas Technology Institute, Des Plaines, IL, June 2003.
- Koomey, Jonathan G., Chris Calwell, Skip Laitner, Jane Thornton, Richard E. Brown, Joseph H. Eto, Carrie Webber, and Cathy Cullicott. 2002. "SORRY, WRONG NUMBER: The Use and Misuse of Numerical Facts in Analysis and Media Reporting of Energy Issues," Annual Review of Energy and Environment. Volume 27, pages 119–58.
- Laitner, John A. "Skip" Laitner. 2004. Unpublished calculations. U.S. Environmental Protection Agency, Washington, DC
- Noll, Kenneth. 1999. *Fundamentals of Air Quality Systems*. American Academy of Environmental Engineers.
- Rafson, Harold. 1998. *Odor and VOC Control Handbook*. McGraw-Hill, New York, New York.

r =ot - ss w u ' " s O G G G G7 G G P

r o s h Gb TYdTYWKe
wshXYhaWG G GXhWWG

s' s h q Gq

O s'rss h

r G=UGx T" Gu G G G Ttq Gs" w "qus' G' G
- GoUG= G7 Go Gs G SG Ttq Gs" w "qus'
' G
- Gu G7 G" Go
Gr G7 Go Go G Gs"oG G" G Go G G=

" ~" s h G G G m m m m
V Go GXGYWKeSG G G Gs GMG" G Gw
Os" wPSG Gr Gx G G G= SG G G G G Gs" wG" G
G G G Go G" G Gs" wG "qus' G' Gw G"
G Gs" wG G "qus' G" G" UGCoG G SG G G i
G G G G G G G G G G G G G G G
G G" G SG SG G G G UGCo G S G
G G G S G G G G G G Go
G G G G SG G G G SG G G

ous'ro h

XU r " uGo'r - o=y GOrM P ts · s w" G " o=rGu w rw uG" ≈ aW-w s
q" ts=s' qsGqozz h

U rM-G h v G G G G G G G G GGC s"oGs
- G= Gt GD G G G G Gv SG
G G G G nGUGU

U rM-G h G G G G G G G G G G G G
Os-≈tP G G Gm

-V V≈Go h · G · G7 G G G G S
G G G S rM SG G G G
G G G G G G U

rM-G= h o SG G G G h
G G S

G G "qus' S
 G" G G G G G G SG G G
 G G G G SG G G G G G G G
 G G G G G G G G G G G
 o Gs G G G G G G G G G G G
 G S G G G G G G G G G
 o G G G G G G G G G G G
 i S G G G G G G G G G
 o G G G G G G G G G G G
 " G G G G G G G G G G G
 oU G G "qus' G SG h G G
 o S G G G G G G G G G G
 q G'q PV q Gv G G' G G' P
 SG G SG G SG G
 T - m SG G SG G
 G Go S G G G
 o G G G G G G G G G G
 G G G G G G G G G G
 Oq""Pi S G G G G G G G G G
 G G G G r " G q"" O
 G Go G PSG U S h
 T CC s G G G G G G G G G
 G G G G G G G G G G
 T V U G G G G G G
 - G G SG SG G
 T T Go i G G G G G
 T G o G G G G G G
 T i G G G G G G G G
 T G G G G G G G G G
 □ G G G G G G G G
 □ G 'ot _ oG
 S G G G G G G G G G
 T Go Gs G G G G G G
 T G Go G G G G G G
 T G T G SG G G G G
 U
 S
 pU G SG G G G G Gs ~t SG Gq G
 s" wG" G Gs UG SG G

" SG G G G t G" G"
 G G G O U UG S P
 G G G G G G G U
 U r M-G h G G G G G G G G Gr
 -V V=Go h ' S G G G "qus' G Gs" iW S G G G
 r M-G h G G G G G G G G G G G G G

YU vo Gw "qus' h

w G G h m m ym m -
 m m m m m m m ym m m
 m G7 GsUG
 p G7 G G G G G h
 U "qus' G G Go G" Gq GOo"qPG V G G
 G G G G Go"qG G G G G7 G G G
 GXWLG G G T G Gq Gv G G" U
 G "qus' G G G G G G G G Gq Go Go GOqooPG GvS
 G' Go Go G G GO'oo PSG G GqooG G G G
 G G G U
 U - S "qus' G G SG G SGq v G
 " GOqv"PG V G7 G T G G
 G G Cqv"G G G G G7 G G G T
 Gq Gv G G" T G Gw G
 T YG G G G G G G G
 Go G" Gq G7 SG G G "qus' G G
 O G G G GcdW V GdUb -p V G G G P
 I v YV S W W W G G Gq "Y G G G G G T
 i G G G G G G G U
 QG G "qus' G G G G G G G G G G X S V W W S W W W G G
 S G G G G G G G G7 G G U
 U o G G G G G G "qus' G G G G G G
 Ou "PSG G T T G G G G G O U U
 G G G G G G G G G G G G G
 G SG G Go G i G G G
 G S G GcdWG V G G G X S fedG V GO GdUb
 --p V PG U
 U G "qus' G G G G G G G G G G
 G7 T G G G G G Gq""G UGG G "qus'

G T G G G G G GO U UG G PS
G G G G G G V G bVWVWV U -
G G G G G G "qus'G U

U Gs" wG "qus'G G G G h
T U Ur"s Tr G Gs SGp G' Gz
T U UGs"oGz G" Go GO G G G
" G T G G GsUG GOs" wPG Gx GoUG GD GO U UGs"oP
T U UGr"o="o G7 Go G= G' Go S
T u wTu G GW S
T s"=wTs G" G= GW
T oqsss To G G G Gs Ts Gs
T qsq Gq Gs Gq

aU " ~ U"oz t"~ vw - ss wuh

G SGr G - SG G G G G G
G G h
G G G G G G G
SG G G T O PG
G G G S
G Go G" G G O G G
G= G" PG Gs" wG" G GsUG G G
G G SG G G' G "qus'G" G" G" G7
G G G" G G G G G G G
G G Gq'U'

bU s"oG O V V=P . s w" "tG"=Gt"=- G vsGot"=s -s' w"sr h

U - V V=G h G G G G G G G
G Gs" wG "qus'G m
rM-Go h SG G G G G T G
GsUG GOs" wPG Gx GoUG GD Gz GO U UGs"oP
U - V V=G h G G G G G "qus'G7 G G G V
SG U UG G G G G G
G m
rM-Go h G G G G G G
G G G G G G G
o G G G "qus'G G G G S
G Gs" wG G G U
o G SG GwSG "qus'Gu "Vqv"G
G G G aUcG G G G

G G G G G GO "qPG G
 SG G G G G G G G Gq GXG
 G G G G G G G G G
 o G" Gq Gr U
 U - V V≈G h G G G G SG G G G G
 Gt G SG G G G G G
 G G "qus'G m
 rM-Go h s" wG Gz G G G G G G G
 G G U Ub
 o G G G G G G G GbVSWWG G
 GXWbG G S G G G
 GWG G Gq Go Go GOqooPi G G' Go Go
 G G GO'oo PG G G G" iG oCqo
 G G G G G G G G G i
 G G Gs"oCq G" G" Gu U
 Go G G G G G G SG G
 G SG G Go G S
 G G G G U
 G G G G Gs" wG G G G G
 G G G G G G SG
 G G G G G Gs" wG h
 oU s" wG G G G G G G G G
 G G G G G
 G G G G "qus'
 V G7 G G G G G
 G G G iG
 pU G G G G G G G G G
 G G G G iG U UG
 G G GO G PG V V G
 G U
 wG G G G G G "qus'G G G
 G G G "qus'G G G T
 r Gu GO'uG GruVqv"PG SG G
 G G G G Gq G7 G G G G
 SG G G G G G G G
 G G G T G G S
 G GruU v SG G G G
 s" wG G G Gs" w "qus'G
 G G G G S
 "qus' G G U

U - V V≈G h G G G G G G G G G G GT
 G G G G GrM-G Gs" wU

rM-Go h o SG G G G G G G G G G G
 G G G G S
 SG G G G G SG
 G M G G G
 G m m m m m m m
 ym m ym m ym
 m m m m m
 m m m y y m
 m m m ym m m
 m m m m m m m m m
 m m m m m m m m m

- G G G G G G G SG G
 G Gs" Sw "qus' S G- UG GsUG h

- G G h U U
 hW U U V U

- V G hGs G "≈O G G P
 hW U T U Vo q Vm k "qus'

" h hW U U V U
 GsUG Gq V≈ h hW U U V T
 G' G" Gr h hW U T
 U V V T T T TaYaWdV

z w Gu G- G Gs" wG sG h
 I? G "qus' Gs Gu T hW U U V VWebWfd
 I?" G Gs Gu T hW U U V VdcdaYXg

z w G" T" Gp G sG h

XUGGo Gs Gv
 hW U U V V T T T TT m k T

YUGGo Gw Gs Gs G"
 hW U U V V T T T T TT m k T

aUGGo Gq G" G" "
 hW U U V V T T T T T TT m k T

bUGG- G Gp Gu Gw
 hW U U V V T T T T T TT m k T

cUGGo G Gq G" Gs
 hW U U V V T T T T TT m k T T

v G G - UGp S- UGv SG- UGo SG- w S- UGr SG G- U
 G G G SG G G G G G G G

o T G Go G G G G G Gr G G G Go Gu U
 w G G G T G U G G G SG G G G G G G G G G
 p G
 r G G
 o
 h
 - GsUG SG" Sqs" G Gr SGs G G" G G Gw
 y GsUG SG"sSG-poSGr G G" Gs G G" G Gw
 oUv S" Cq Cz G SG Gy Gp G7 G G G"
 Ur SG" Cq Gu""Gq SG- Gs Cq G G G"
 G S" Gr Gw Go G Gs"o
 y Gp SG" G Gu Cq T G Gs"o
 Gv SG" G G Go V" G Sw G" G G Go Go
 s Go S G Go G G V" G Ss"o
 o S" G Go G G Ss"o

o o o
o o o
o o o

og o

Nj hdi ghn

o

Nk Nj c
Nk Nk cN
Nk N N ghn

o

c N e N N c N NhgN NgN
N N e N ' NE eN

o

x o o o o o o y
N N N N NE N

- N Whldkhl dl ohj Y N N Whldj nj dl gl l Y N N
cN N N N N NE N N eN NeN

o o

N eN N N N eN N N N N NE N z '
N N N N z ' N cN N N N N
N N Ne eN N N N N N N c
N N N N N N N N N N N N
N N N N cN Nk N N N N N N
N cN N cN N N rN N N N N N
N N N N N N N cN N cN N

o o o

x N N NN c N N N z N N N N N N N

q

N N N dN N N eN N rN d N N
N N N N N N N N N r
N NN d N NW N N N YN N N N N
N N N NknegggN N N r
N NN YN N N rN N N N N

ShN

f

r

N N N N N N q
e eN ' d- N N cMy N N
e eN xd' N Nk
e eN-x x d- Nk N N Nk cN N N N Ne e
- N N
d N N NW N N Y
' d' N N N
xz'' dx N N N N d N
z'z dz N N

o o o

N N N N N z' N N e

N N NN cN N N'

o o

' N NN cN N N'
li g d k h k p k n i

President Donald J. Trump
The White House
1600 Pennsylvania Avenue
Washington, D.C. 20500

Subject: The Vocgen National Plan for Manufacturing Industries

Dear Mr. President:

I offer a market-based pollution control and clean energy solution that can cost-effectively help revitalize industrial manufacturing.

I would like to send you the Vocgen National Plan describing the Solution, which has been formally peer-reviewed, commercially deployed and now represents shovel-ready projects and jobs.

Vocgen was designed by AlliedSignal/Honeywell and Environment & Power Systems International, LLC to help build a sustainable and competitive manufacturing sector and an energy efficient economy.

Notably, the solution eliminates the age-old cost vs. air quality compliance paradigm, making cost-effective air pollution controls and clean energy available to all industrial operations big and small. It represents an energy and air pollution control solution designed to serve over 38,800 existing US industrial operations. Our 0.560MW power generators reduce energy consumption resulting in positive cash flows averaging \$1 million USD/year.

The National Plan proposes to replace energy-intensive air pollution controls at industry with combined heat and power (CHP) systems that uniquely uses waste regulated air emissions as supplemental fuel for the cogeneration of electric power and useful high quality heat. The plan can substantially improve industrial energy security, environmental health and the overall economy of the United States of America.

I respectfully request an introduction to Scott Pruitt to discuss and develop a Vocgen operating permit program for States to adopt. Once such a program is in place; it can enable the speedy retrofit and construction of new facilities with no net increase in Ozone precursors, toxics, or global warming gases. This fact offers you the opportunity to leverage the increase of manufacturing operations without limitation, or opposition by environmentalists.

100% project financing, the best equipment manufacturers and contractors are already in place to kick off the transformation of both the air pollution control market including a transition to greater industrial sector security, profitability and competitiveness.

I look forward to hearing from you and making America great again!

Respectfully,

Steven E. Sexton
CEO and Managing Director
Environment & Power Systems International, LLC

The Vocgen Solution for Industry

A national plan to support competitive manufacturing and an energy efficient economy

Steven E. Sexton, CEO and Managing Director of Environment & Power Systems International

An ambitious plan is proposed to replace energy-intensive air pollution controls at industry with a combined heat and power (CHP) technology that uniquely uses regulated air emissions as supplemental fuel for the cogeneration of electric power and useful high quality heat. The plan can substantially improve industrial energy security, environmental health and the overall economy of the United States of America.

At the heart of the patented VOGGEN power generator and the solution overall is the gas turbine oxidizer (GTO). The GTO is the only combined energy generator and air pollution control alternative that has undergone product development through peer group scrutiny via the stage-gate method including product prototyping; testing and evaluation; business case and planning; risk analysis; and a stage six (6) review of the economic feasibility representations essential for commercialization. Vocgen is a market-based energy efficiency and cost savings scheme for manufacturing industries created by recycling VOC energy, thus eliminating the traditional cost necessary to operate air pollution control systems. Notably, a Vocgen power generator with an output of 560kWe and 6.4MMBtu high quality waste heat offsets ~20,000 metric tons CO₂e and toxics annually from regional coal-fired generation; representing high value emissions for trade.

VOGGEN is a combined air pollution control and cogeneration solution for industries subject to Title I of the Clean Air Act (CAA); the National Ambient Air Quality Standards (NAAQS) for ground level Ozone; CAA Title V air operating permit requirements for major sources; and the US EPA Clean Power Plan Guidelines.

Critical to its ability to replace legacy thermal destruction equipment costs at industry is the understanding that this innovation is not a “me too” energy solution. It is a unique alternative that generates positive cash flows for the 20-year+ life of its operation. When the legacy equipment is altogether replaced within a corporate fleet, an improved and competitive cost of operations model is achieved. This profitability is not realized by simply adding up the fuel value of volatile organic air emissions used to help fuel the generation of electric power and heat. It is realized by replacing the lifecycle costs of legacy thermal destruction equipment with the lifecycle savings produced by combined heat and power (CHP) equipment, consisting of specially designed and configured power and heat producing equipment. Such equipment is used to offset the emissions typically generated on the grid to energize, heat and cool industrial production processes and buildings at industry. It therefore offsets coal-fired power and emissions just like renewables.

Given the fact that only a handful of the 104 industrial categories regulated by the U.S. EPA/States have ever deployed on-site combined cooling heating, and power (CCHP), the VOGGEN solution creates an extraordinary emergent market consisting of over 38,880 facilities within the United States alone. The significance of the emergent market is its potential market capitalization and potential to support industrial manufacturing growth. This potential, despite the fact that the air pollution control market is saturated with inefficient legacy “burner” type equipment, can be quickly realized considering the contemporary factors shaping the mandate for the growth of a cost-effective and competitive U.S. industrial manufacturing sector.

Once national commercialization begins, the impact of the VOGGEN plan will be nationwide industrial facility retrofit construction projects and jobs in support of cost-competitive manufacturing; representing a significant reduction in ground level Ozone and CO₂e and a measurable reduction in environmental health cost. Primarily, the Vocgen wealth generating economic model has the potential to significantly improve business growth, create jobs and improve the American economy.

Copyright©2017Environment & Power Systems International, LLC – All Rights Reserved

A long-awaited clean energy solution is superbly positioned to help President Trump execute a manufacturing resurgence in America. It was purposefully designed and commercially demonstrated by AlliedSignal Honeywell and Environment & Power Systems International, LLC to cost-effectively cogenerate high quality power and heat energy onsite for industrial operations subject to Title V air quality permit requirements. The solution offsets coal-fired power generation emissions CO₂e and Toxics pursuant to the clean power plan. It also offsets emissions generated by traditional air pollution controls and other energy-intensive onsite equipment, significantly reducing energy consumption. The solution creates a CFO-approved ~2-year return on capital investment upside making shovel ready projects and jobs possible. It represents the future of clean, efficient and competitive American manufacturing and a vibrant American economy based on wealth creation.

Steven E. Sexton, CEO
Environment & Power Systems International, LLC

A SOLUTION FOR THE 21ST CENTURY

- Voegen eliminates the age-old cost vs. regulatory compliance paradigm; making cost-effective air pollution controls and clean efficient energy available to industrial operations
- Voegen is a market-based solution designed to serve over 38,880 existing U.S. industrial operations
- A single Voegen genset (1 unit) significantly reduces energy consumption; designed to generate positive cash flows averaging \$1 million/year/unit within the U.S.

LANDMARK REALIZATIONS

- 1st - Proves both air quality and an energy efficient economy is possible
- 1st - Proves free market competition can drive uniquely unexpected innovations and new markets
- 1st - Proves Voegen to be a superior clean energy solution rivaling, however enhancing renewables
- 1st – A market-based energy efficiency program for industry
- 1st – Gas turbine oxidizer (GTO power generator/pollution controls) w/buy-back program warranty
- 1st - Substantial positive cash flows for the life of Voegen projects; lowering cost of operations
- 1st – Eliminates governmental energy-production subsidies
- 1st - Economic incentive for grandfathered and synthetic minor permittees to abate air emissions

PERSPECTIVE

1. Promotes competitive electricity and natural gas markets
2. Promotes national security and energy security
3. A free-market approach to climate change
4. A win for both environmentalists and private corporations
5. Advances the modernization of American manufacturing
6. A conservative approach to federal energy and environmental policies
7. Financial partners offer project financing to help clients conserve capital. Energy savings pay for projects
8. Guarantees end-users lowest cost for energy and reduces risk of failed production and plant operations
9. A lean federal operating permit program can help states and end-user clients to promote and justify shovel-ready clean energy projects consistently from state to state where adopted

Copyright©2017Environment & Power Systems International– All Rights Reserved - April 19, 2017

www.voegen.com +1.520.414.9472 Environmental-Expert@Voegen.com