Fuel Cells and Power Generation
August 31, 2011

Ryan Cornett, MPA, Virginia Clean Cities
www.vacleancities.org

Co-hosted by Clean Energy States Alliance
www.cleanenergystates.org

Funding Support from US DOE
Housekeeping

Participants will be connected to audio portion of this webinar using their computer’s microphone and speakers (VoIP) or through a headset. All participants are automatically placed on mute and will remain muted throughout the broadcast. Dial-in by phone information is contained on your registration confirmation email.

We invite you to submit questions by typing them in via the Question Pane on the webinar console. We will relay your questions, as time permits, to the panelists during the Q&A session after all the presentations have been made. You can queue up a question anytime by typing it in.

Presentations will be posted at www.vacleancities.org after the webinar.
FUEL CELLS AND POWER GENERATION
• GENERATED UP TO 300,000 LBS OF ONION WASTE PER DAY (TOP, TAIL AND PEEL)
• WASTE BECAME UNMANAGEABLE AND COST-PROHIBITIVE
• CREATED ODOR PROBLEMS, POTENTIAL GROUND WATER CONTAMINATION
SOLUTION
ONION WASTE TO ENERGY
ADVANCED ENERGY RECOVERY SYSTEM (AERS)

• CONVERTS ONION WASTE TO RENEWABLE ENERGY, ULTRA-CLEAN BIOGAS AND CATTLE FEED

• MEETS OUR GOALS FOR AIR QUALITY, ZERO WASTE AND RENEWABLE ENERGY

• WASTE NOW BECOMES A RESOURCE VS. LIABILITY
SIMPLIFIED PROCESS SCHEMATIC

- Juice Extraction
- Juice Preparation
- UASB
- Biogas Preparation
- Fuel Cells
• HIGH SULFUR CONTENT - REMOVE IMPURITIES AND MOISTURE FROM BIOGAS

• PERMITTING OF NEW TECHNOLOGY – NO STANDARDS EXISTED FOR REFERENCE

• FIRE & SAFETY - EXTRA ALARMS, LIABILITY WAIVER

• FINANCING – HAD TO DEVELOP A GOOD ECONOMIC MODEL
FUEL CELLS BECOME THE MOST INNOVATIVE PRACTICAL SOLUTION TO FULFILL OUR NEEDS

• MEETS OUR GOALS FOR AIR QUALITY, ZERO WASTE, AND RENEWABLE ENERGY

• HIGH FUEL-TO-ELECTRICITY CONVERSION RATE: 47-50% EFFICIENCY

• ELIMINATION OF 40,000 GALLONS DIESEL FUEL TO HAUL ONION WASTE TO FIELDS

• REDUCES GHG AND KEEPS US AHEAD OF AB 32 REGULATIONS
OVERALL PROJECT COSTS

• AERS TOTAL COST INSTALLED: $10.8 M
• SEMpra ENERGY SELF GENERATION INCENTIVE $2.7 M
• ARRA (AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009) $3.2 M
• CEC (TO WORK WITH GTI FOR THE STUDY OF THE GAS CLEAN UP) (GRANT) $499,000
$10.8 million projection anticipated payback between 5-6 years

Immediate savings in hauling and energy costs of $1.1 million annually

Gills' generates up to 300,000 lbs/day of onion waste – converted to biogas

2 fuel cell energy fuel cells – 600 kw

Provides 100% of base-loaded electricity requirement
NEXT STEP

INSTALLATION OF A
CLEAN ENERGY STORAGE SYSTEM
BY FALL 2011

VANADIUM REDOX BATTERY VRB-ESS™
WHAT IS A FLOW BATTERY?
• LIKE A RECHARGEABLE FUEL CELL - BUT FOR INDUSTRIAL USE.

• YOU STORE AND PRODUCE CLEAN, EMISSION FREE ELECTRICITY FROM IT.

• BUT YOU CAN ALSO FORCE ELECTRIC CURRENT THE OTHER WAY, BACK INTO THE SYSTEM, WHERE THE ENERGY IS STORED IN BENIGN, ELECTRO-CHEMICAL LIQUIDS.
STATUS OF THE PROJECT

ANALYSIS, DESIGN AND CONSTRUCTION PHASE

• ON-SITE ASSESSMENT OF OUR STORAGE NEEDS
• DESIGNED THE SYSTEM BASED ON OUR STORAGE NEEDS USING THE LATEST TECHNOLOGIES AND MATERIALS
• HIRED LOCAL CONTRACTOR TO MANAGE THE ENTIRE CONSTRUCTION PROCESS INCLUDING PERMITTING, LOGISTICS AND THE UTILITY INTERCONNECT PROCESS
WHAT DOES THIS MEANS FOR GILLS ONIONS?

• THIS PROJECT, AS AN EXPANSION OF THE AERS IS ANTICIPATED TO REDUCE ELECTRICITY COSTS BY AS MUCH AS 30%.
• THIS WILL EXPAND OUR COMMITMENT TO SUSTAINABILITY - THIS SYSTEM IS VIRTUALLY EMISSIONS FREE, THERE IS NO COMBUSTION OR BURNING OF FUEL WITH THE NEW TECHNOLOGY.
• THIS WILL NOT ONLY PROVIDE US WITH ELECTRICITY DURING THE HIGHEST DEMAND AND EXPENSIVE PERIODS OF EACH DAY BUT WE WILL HAVE EMERGENCY BACKUP POWER WHENEVER WE NEED IT.
Brewing with Fuel Cells

Cheri Chastain
Sierra Nevada Brewing Co.
Sustainability Coordinator
Sierra Nevada was founded in 1980 using recycled dairy equipment and an old soda bottling line and was founded with efficiency and conservation at the forefront.
We are now the 7th largest brewer in the United States but have maintained the early philosophies of conservation and efficiency.
With energy prices on the rise and the California grid loosing stability, we started looking into onsite power generation options in 2003.

Looking for consistent source of power (largely eliminates solar and wind).

Looked into sterling engines, but the technology was not yet cost effective.
Purchased four Fuel Cell Energy DFC 300 units for a total of 1.2 MW potential in 2004.

Each system was coupled with a heat recovery system to add 15% efficiency.

Original installation was designed to run on natural gas with potential for biogas feed.

Installation was commissioned in May 2005.
Our system was intended to run on biogas generated at our waste water treatment facility.
Some of the economics...

- Roughly 70% of the installation cost was covered through:
  - 30% Federal Investment Tax Credit
  - Rebate from local utility through the Self Generation Incentive Program
  - Joint grant from DOE/DOD

- Expected a 6 year payback and it
Things to consider...

• Did not need to be permitted through our Air Resources Board
• We did have to adjust our EPA hazardous waste generator status
• They are a significant source of our CO₂ emissions
• Are really good in situations where constant electricity is needed and there is a beneficial use for the heat
Since the Fuel Cells...

**Solar Panels**
- 503 kW Elevated, Tracking
- 1500 kW Roof Top System
- 14 kW at Rail Spur
- 5 kW at Day Care
Sierra Nevada On-Site kWh Generation
Cheers,

Cheri Chastain
(530) 893-3520
Cheri@SierraNevada.com