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U.S. DEPARTMENT OF ENERGY

The CHP Solution for Growth, Economics, and Business Continuity

Tuesday, May 16

3:45-5:00 pm

U.S. DEPARTMENT OF ENERGY

Panelists

- Kenneth Duvall, Sterling Energy Group
- Sharon Nolen, Eastman Chemical
- Denise Brinley, Pennsylvania Department of Community & Economic Development
- Jim Freihaut, Mid-Atlantic CHP TAP
- Bruce Hedman, Entropy Research (Moderator)

Kenneth Duvall

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Case Study: Florida Public Utilities / Eight Flags Energy CHP at Rayonier Advanced Materials, Amelia Island, FL

How Utility & Industry Collaboration on CHP Captures Enormous Benefits on Both Sides of the Meter

Enhanced Resiliency, Lower Costs, Superior Efficiency, Lower Emissions Plus Economic Development, Expanded Jobs and Community Development

Better Buildings® U.S. DEPARTMENT OF ENERGY

The CHP Solution for Growth, Economics, Business Continuity

Ken Duvall
Sterling Energy Group, LLC
11 Dunwoody Park, Suite 125
Atlanta, GA 30338
Direct: 770.381.1995
kduvall@sterlingenergy.com

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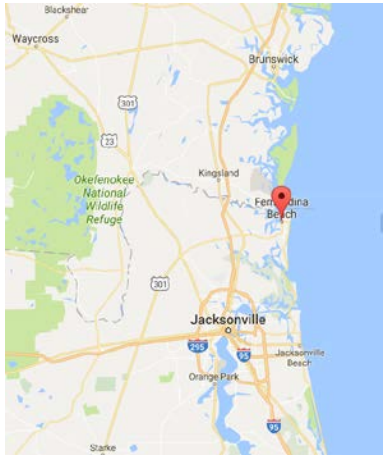
The CHP Solution for Growth, Economics, Business Continuity

When Utilities and Industry Collaborate

Florida Public Utilities /Eight Flags CHP – Case Overview

- FPU, a Small Investor Owned Utility (subsidiary of Chesapeake Utilities) Serving electric/gas customers on Amelia Island, FL– NE Corner of FL
  - 20,000 residential, commercial customers plus two large paper mills on Amelia island, 80 MW summer and winter peak demands
- All power from JEA via ~ 30 mile, 138 kV radial transmission line
  - 30 mile gas pipeline – initially to replace oil in mills boilers



- **Challenge in 2013: FPU CEO – Jeff Householder**
- ***"How can we improve resiliency and lower cost for our electric system customers while also helping our community develop new jobs and add value for the greater Fernandina Beach community?"***

Note: Since 1562, Eight Flags have flown over Amelia Island: : *France*, *Spain*, *Great Britain*, *Spain* (again), the Patriots of Amelia Island, the Green Cross of Florida, *Mexico*, the Confederate States of *America*, and *the United States*, thus inspiration for the name - Eight Flags Energy CHP

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FPU – Supply Options Considered

- Modify /renegotiate existing purchased power agreement for lower costs – build additional transmission connection
- Buy into 3rd party power plants - cycle plant and peakers (off island)
- Build natural gas recip engine or small gas turbine combined cycle on island
- Evaluate/Build Renewable Energy options on island – biomass, PV
- Buy power from one of two large mills on island – as available
- **Partner with one of large mills on island to build new CHP**

  - Both mills self-sufficient on Power – import and exports with FPU as mill operating conditions swing
  - Both mill have very large continuous thermal loads – could support gas turbine CHP ranging from 8-60 MW
- **Zero interest by Mills in any Investment –**

Key Note: Both Mills already have CHP (bottoming cycles)

Existing CHP Systems Does Not Mean the Site will Not be a Good Candidate for Additional

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FPU Power Supply Development Criteria

- **Must accomplish criteria** -
  - Lower electric cost to FPU customers and community
  - Materially improve Resiliency / Reliability of Power supply to island customers
    - Be able to survive CAT 4 storm & supply island
  - Be environmentally clean and beneficial to island / region
  - Enhance community development, jobs and help drive economic growth
- **Good to have criteria**:
  - Add competitive value to local industry – major employer
  - Fast track – have on line in < 2 years

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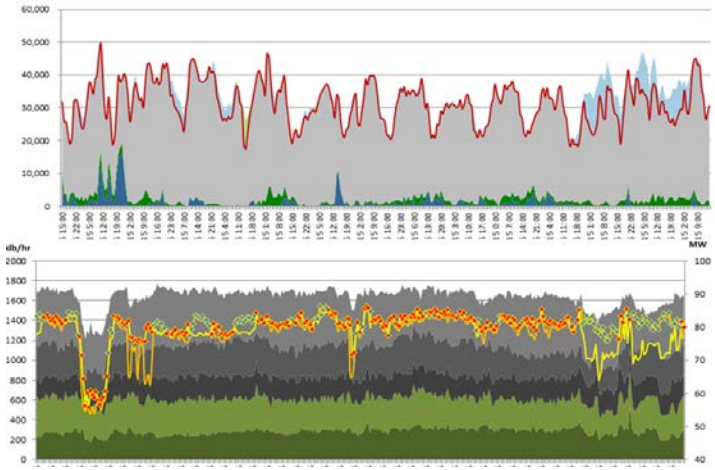
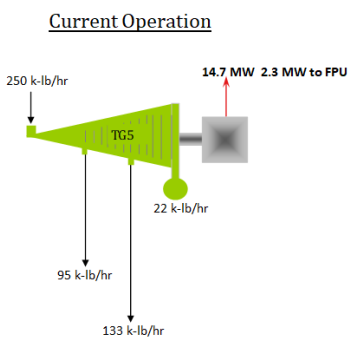
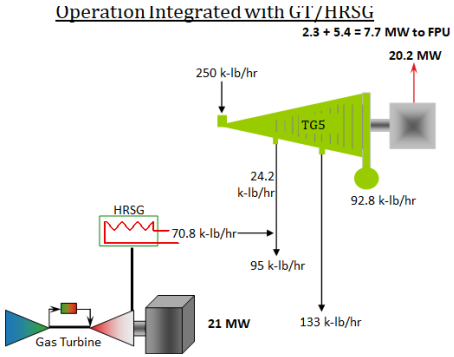
The Development Process

Optimize Heat Balance & Negotiate Required Long Term Agreements

- **Collaboration with Thermal Host (Mill) and Utility Ownership were <u>Prerequisites</u>**
- **Developed Comprehensive Heat and Power Balance Prepared for Both Mills**
  - Modeling 8760 mill operations of boilers, turbine generators, and process requirements
  - Integrated Mill thermal with FPU Current / forecasted Electric Profiles
- **Developed optimized sizing based upon thermal requirements at Rayonier Advanced Materials mill with FPU power requirements**
  - Solution: FPU owned $40MM, 21.7 MW Solar Turbines gas turbine with 200 kpph Rentech HRSG built at Rayonier Advanced Material as Thermal Host
- **Project Met All Established Criteria**







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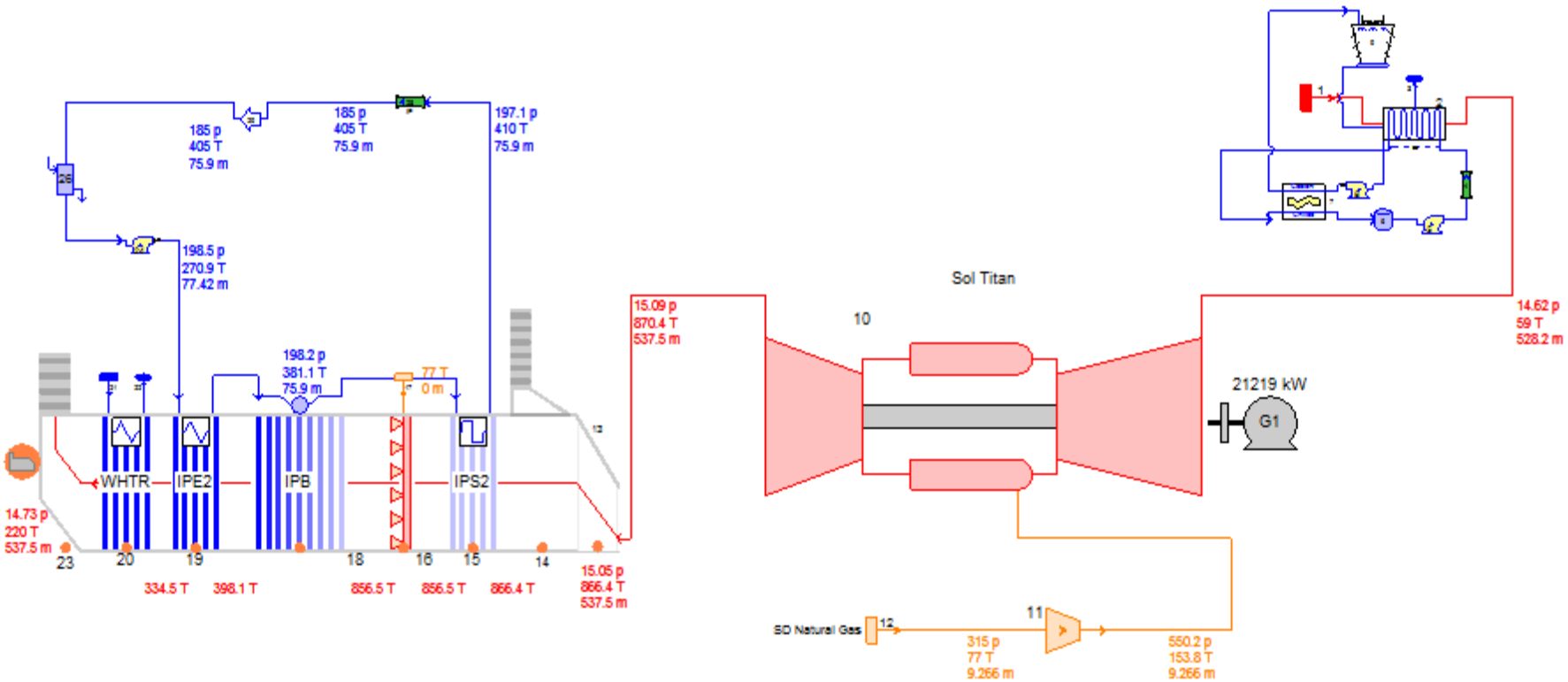
Heat Balance: FPU – Eight Flags CHP

21 MW / 200kpph 160 psig 420F steam & 550 gpm heated water



Total Efficiency: 77.6% (HHV) / 83.8% (LHV)

Fuel input: 62 MW 211.6 MMBtu/hr

(Net) Power output: 20.7 MW 70.5 MMBtu/hr
Steam: 21.7 MW 74.1 MMBtu/hr

Total Thermal output: 26.2 MW 89.6 MMBtu/hr
Heated Water: 4.5 MW 15.4 MMBtu/hr

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The Results - FPU Built & Owned 21.7 200 kpph CHP at Rayonier Advanced Materials host for steam/hot water

Formal Decision to Proceed: August 2014
Construction Team Mobilized July 2015
Gas Turbine & HRSG arrive Nov & Dec 2015
Commercial Operation: June 30, 2016
CHP Operated at 98.5% Availability since last Summer
$40MM Investment by Utility under Long Term Steam /Land Agreement with RYAM

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Recap: Benefits to FPU and their Customers/Community

- **15% Lower electric cost to customers than ppa alternatives**
- ***Increased reliability with on-island generation designed to survive CAT 4 storm***
  - ***Established microgrid capability for Amelia Island (vs 30 mile radial transmission line) – CHP can serve all critical loads and up to 50% of total island customer load***
- **Increased local tax base $800k and employment (100 temp and 6 permanent jobs) plus millions in related economic value**
- **Achieves 78% HHV efficiency ~ 50% more than next best grid asset**
- **80% lower NO_X & 38% lower CO_2 Reduced > 100,000 MTCO2e/year**
- **5000 Dth/day natural gas base load for FPU**
- **On line within 24 months from approval, construction < 12 months**

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Microgrid established with CHP for 20,000 on Amelia Island – previously supplied only by ~30 mile radial 138 kV line

FPU 69 kV and 138 kV lines on Amelia Island shown – Designed to separate incoming transmission to serve island load with CHP

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Recap: Benefits to RYAM and Community

- Increases mill steam capacity and electric reliability -- no investment
- Up to a week of additional production days when mill would otherwise be down when mill boilers out for planned or unplanned maintenance
  - Avoids bypassing Steam Turbine in high demands periods
  - Makes RYAM process more efficient by heating demin water
- Added Steam Capacity and electric resiliency - key to mill being selected for expansion
  - RYAM Board approved $125 MM expansion at site – announced Dec 2016 to be operational Spring 2017
  - Adding 50 permanent jobs plus over 100 construction jobs and
  - Projected $28MM/year in economic benefits to NE FL economy
  - Increased local tax base

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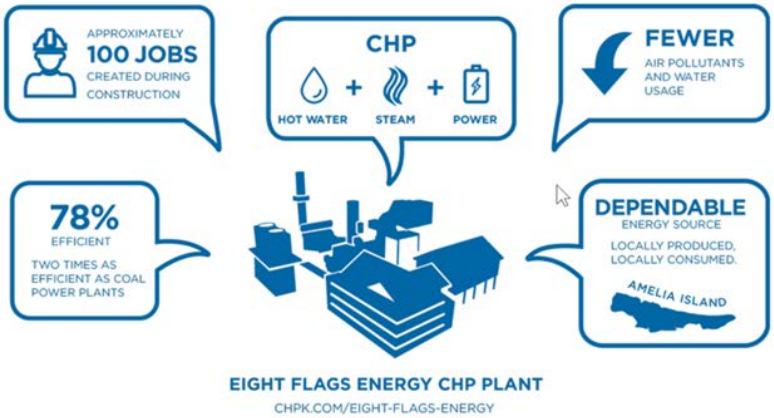
What Others are Saying about Project . . .

Gov. Scott: LignoTech Florida to Create 50 Jobs in Nassau County

Dec 09, 2016

FERNANDINA BEACH, Fla. – Today, Governor Scott announced that Borregaard ASA (BRG) and Rayonier Advanced Materials Inc. (RYAM) have chosen Fernandina Beach as the location of their new venture, LignoTech Florida (LTF). The new manufacturing facility will be housed at RYAM's Fernandina Beach site and will create 50 jobs in Nassau County.

Rayonier Advanced Materials plans new venture with 50 new jobs in Fernandina Beach



Eight Flags Energy combined heat and power plant (CHP) named best CHP Project of 2016

Media Release
December 22, 2016 10:17 a.m.

Power Engineering magazine has named the Chesapeake Utilities Corporation Eight Flags Energy Combined Heat and Power (CHP) Plant "Best CHP Project of the Year." The award was announced during the POWER-GEN International exposition in Orlando, Florida on December 13.

Power Engineering lauds power plant

Christi Milligan · December 22, 2016 · 0 Comment · energy, natural gas, power, Technology

DOVER – Power Engineering magazine has named Chesapeake Utilities' new natural-gas Eight Flags Energy Combined Heat and Power Plant as its "Best CHP Project of the Year."

"This award is meant to recognize innovative and creative power projects that play a unique role in meeting local and regional demand for power," said Power Engineering Editor-in-Chief Russell Ray. "The Eight Flags Energy CHP Plant goes above and beyond in meeting these standards."

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Comments by Art Graham – Chairman of Florida Public Service Commission

Demonstrating Regulator Support for Utility-Owned CHP at Customer Sites

"To see the two economic drivers in this area decide to come together and form this synergy, I think is a fantastic idea and is something that is great to do.

I know there are a lot more opportunities to do this in the Southeast. I would encourage you guys to move forward and drive hard ahead. I'd be more than happy to go to other regulators to let them know what this means for their states."

Source: https://www.youtube.com/watch?v=K2LSkEMKn70

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Paul Boynton, Chairman, President and CEO of Rayonier Advanced Materials

On the FPU/Eight Flags Energy CHP collaboration: September 2016

- By partnering with FPU on this CHP facility, we have a stable cost source of steam coming into our facility that as we have operational changes, whether by design or not by design, even by unfortunate circumstances, it allows us to take on additional steam or power, as we may need to and stabilize our operation. So it should help us produce more product year round for the customers in a very reliable way for us. It helps us stabilize our operations and reduce the cost of our products.

On the $135MM Expansion at RYAM Fernandina Beach mill: December 2016

- "We're excited to move forward with this new business to produce environmentally friendly alternatives to many fossil-fuel based products. Our partnership with Borregaard will create over 50 high-paying jobs and contribute more than $28 million annually to Northeast Florida's economy. LignoTech Florida creates value for the stockholders of Borregaard and Rayonier Advanced Materials and is great for our community and Fernandina plant."

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Jeffry Householder, President, CEO of Florida Public Utilities

- **This project is really a great project from the benefits perspective. We see several things:**
  - 1) the power we are going to generate and own from this facility will be substantially less in price than the wholesale power we are currently buying from other providers,
  - 2) this is an on-island generator system so the reliability of the system is quite a bit more reliable than via the existing transmission system,
  - 3) this is a very low emissions, substantially less than emissions from any wholesale providers we purchase from now, and
  - 4) we will create local jobs and investment in the community that will last for the next 20-30 years.

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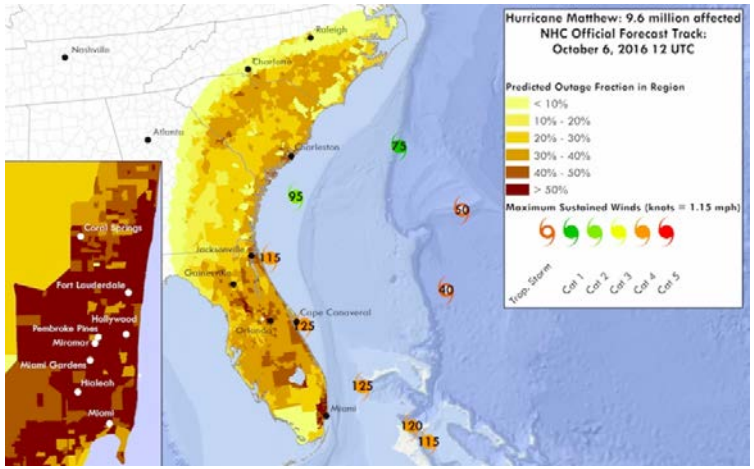
First Test of Resiliency only 3 months after startup

(Only one hurricane hit Amelia Is in 20th Century, Hurricane Dora in 1964)

Hurricane Matthew in October 2016

Provided Glancing blow to CHP site – no damage incurred

Water over berm to base of CHP Platform



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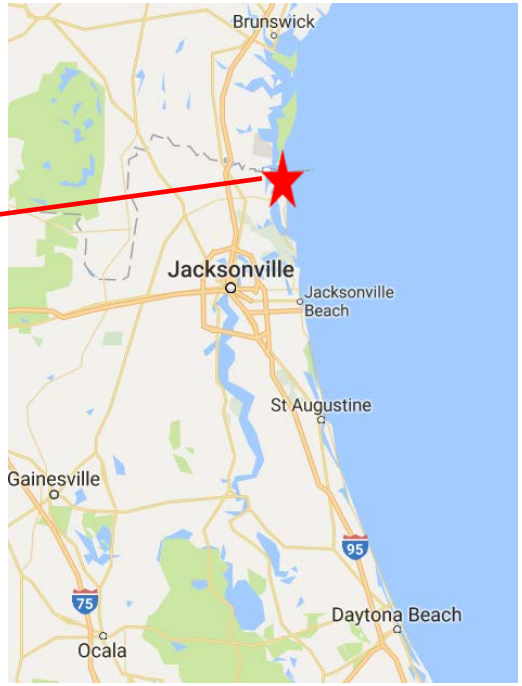
So How was the Project Accomplished?

Turning two acres of waste land into an efficient and highly reliable power supply for 20,000 customers



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With Site Flood Zone Map like This

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The Process: Piling installation began July 2015

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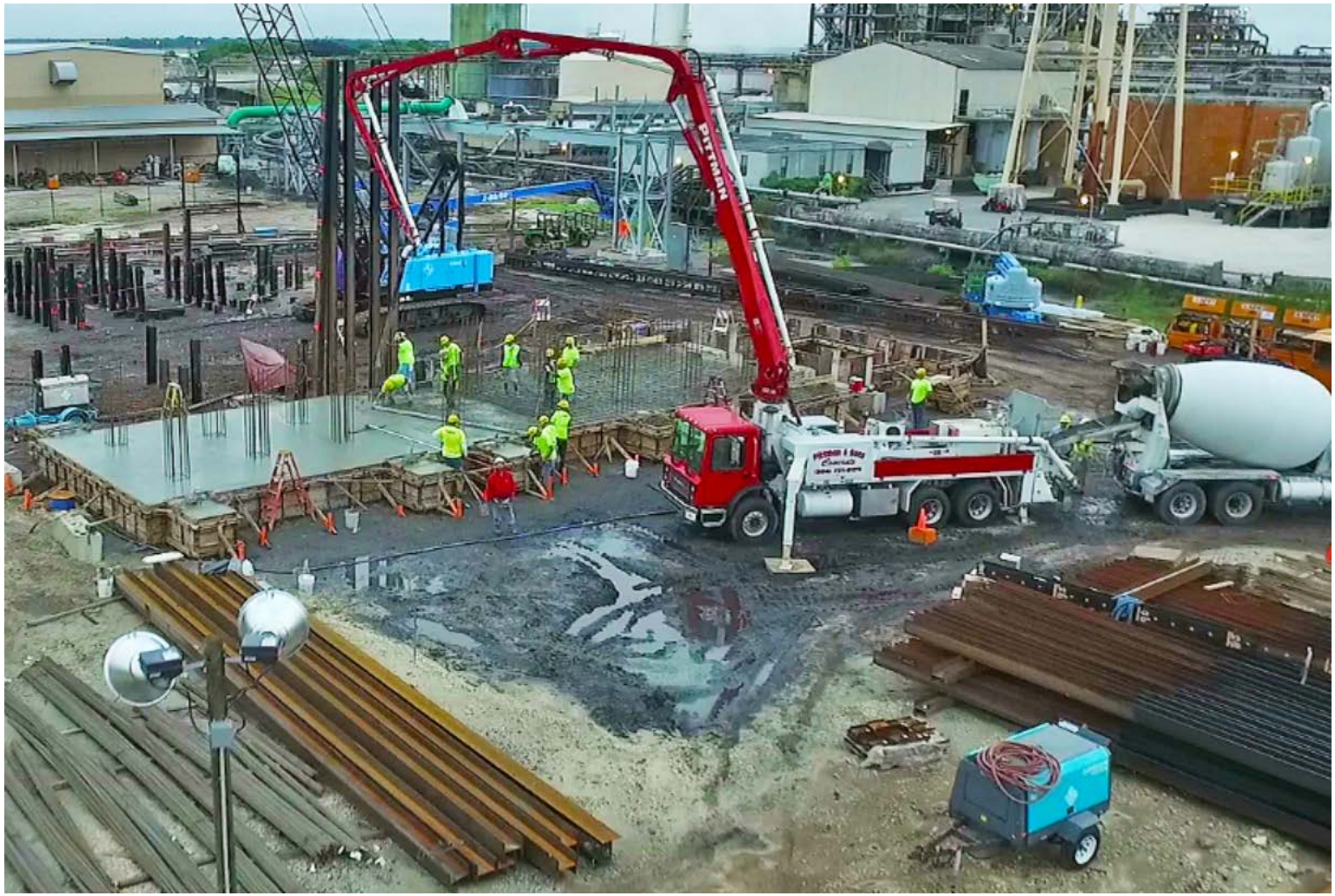
Turbine Platform Foundations

Over 700 60-70' pilings for CHP, Switchyard and Pipe Bridge



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Turbine platform

.....must isolate vibrations for 65 Ton Gas Turbine and 72 Ton Generator.....

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Setting the Titan 250 gas turbine next to generator

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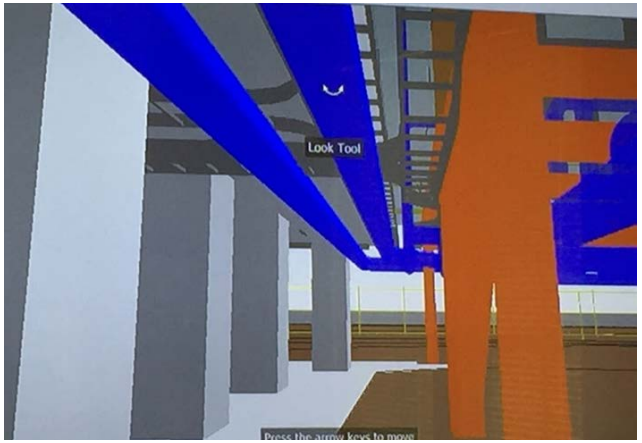
Setting Solar Turbines Titan 250 on platform next to Generator 21 MW CHP Constructed in less than One Year

50% More Efficient than Grid, Faster to Permit & Build, No/Low T&D Losses, Minimal Water Use. Resiliency Benefits, Customer / Host Benefits including 80% lower NO_X & 38% lower CO_2

Space under Elevated Platform used for Parts room & Storage



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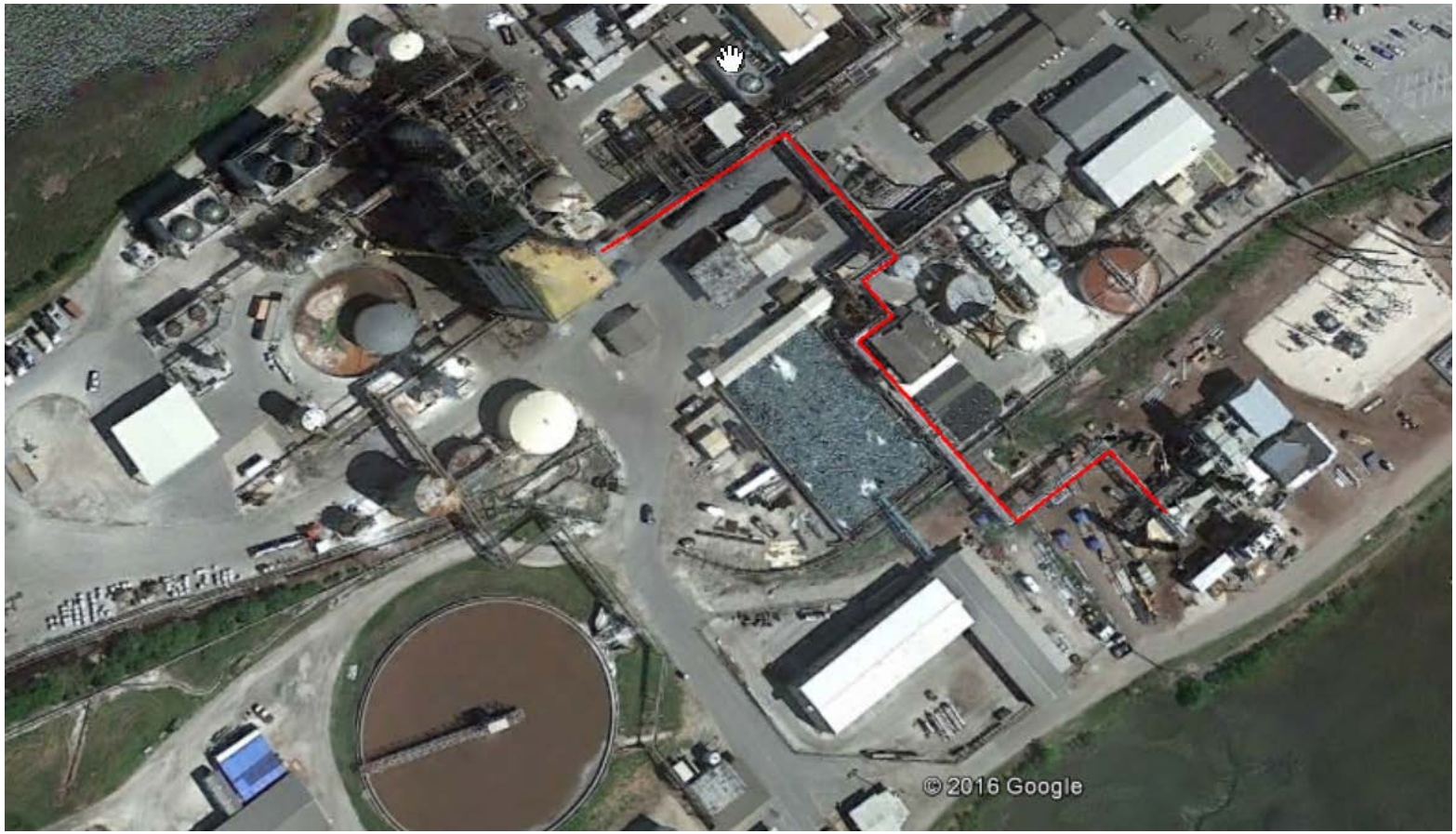
800' Primary Pipe Bridge to Rayonier connection

Steam, feedwater, heated demin water

275 F feedwater from RYAM 160 psig 420 F steam back to RYAM
70F demin water in circulated in closed loop from RYAM returned at 155F



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Control and Electric Rooms going up on platform

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Solar Turbines Titan 250 21.7 MW gas turbine

Operated since July 2016 with 98.5% availability

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Birds Eye View of CHP, Pipe Bridge & Switchyard

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Completed Control Room

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FPU / Eight Flags CHP Overview

Click link for video https://youtu.be/mMuaJfLiAJo

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A Quick Look Back at CHP for a Few Minutes . . .

The FPU Eight Flags Project would Not Have Happened Without Utility Ownership & Close Collaboration with a Key Customer, RYAM

- There are over 150 GW of Documented but Untapped CHP Available in US
- Utility Ownership Overcomes all Traditional Barriers to CHP Developments and Requires no Tax Credits or Incentives / Decoupling
  - When customers develop and own Utilities lose revenue and load – recovered from all
  - In addition to superior efficiency, CHP provides many additonal benefits –
  - Increased resiliency from grid disturbances, Unloads T&D system, Reduces T&D losses, Significantly reduces emissions, Lower Risk / Faster Planning
- **Collaboration on CHP Opens Values on both sides of the meter**
  - Increased competitiveness for host /Customer, lower costs
  - Greater Resiliency for host and community
  - Opens door to Jobs and Industrial expansion w/o industrial capex
  - Utility Ownership turns win/lose into Win /Win

Thomas Edison in 1882 introduced the 1st commercial power grid by the name of "The Pearl Street Station" in lower Manhattan.

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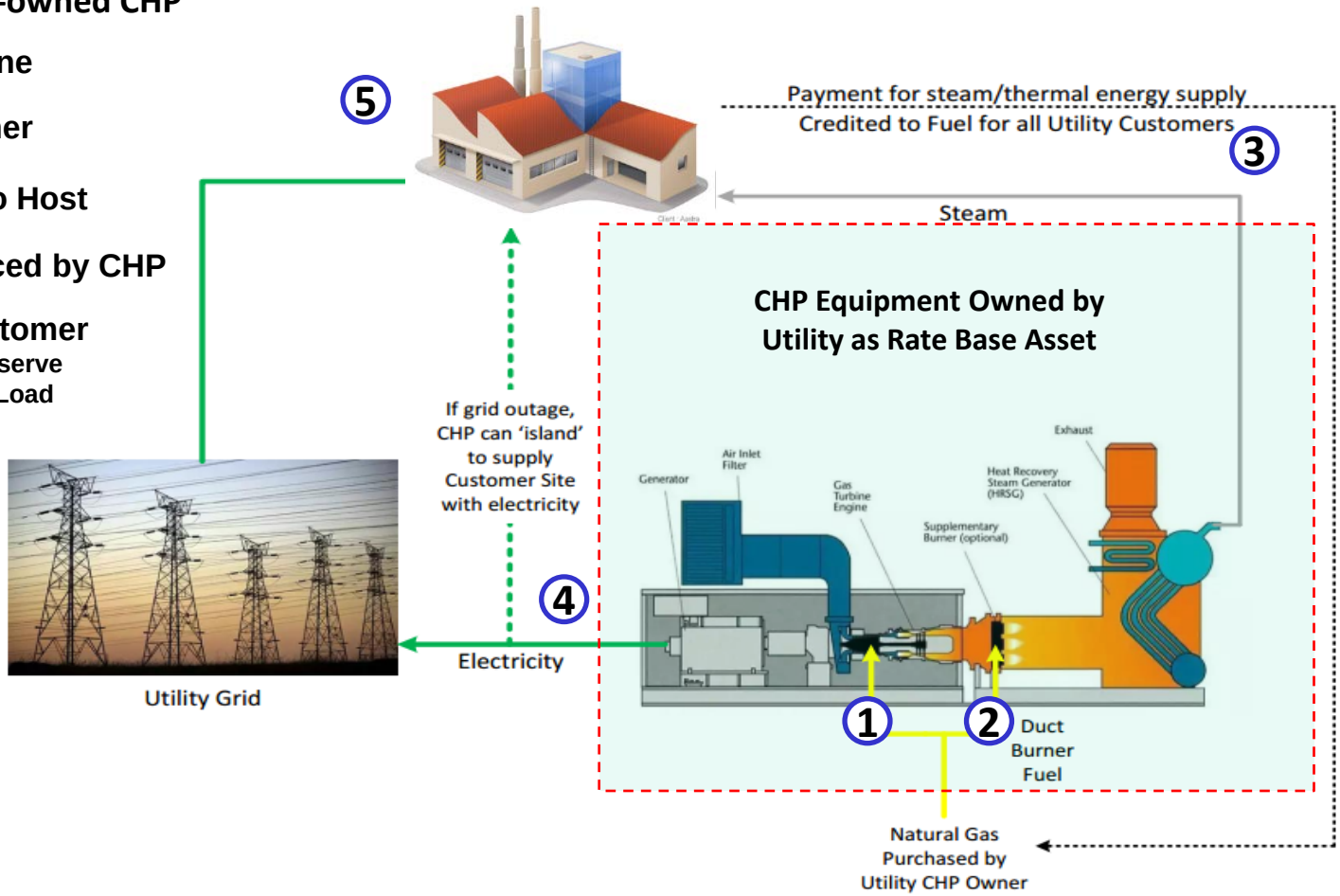
Structurally, just moving the CHP to become a Grid Asset

Simplified Structure for Utility-Owned CHP

Meter Points for Utility-owned CHP

1. Fuel to Gas Turbine
2. Fuel to Duct Burner
3. Steam/Thermal to Host
4. Electricity Produced by CHP
5. Electricity to Customer
   Utility continues to serve Customer Electric Load



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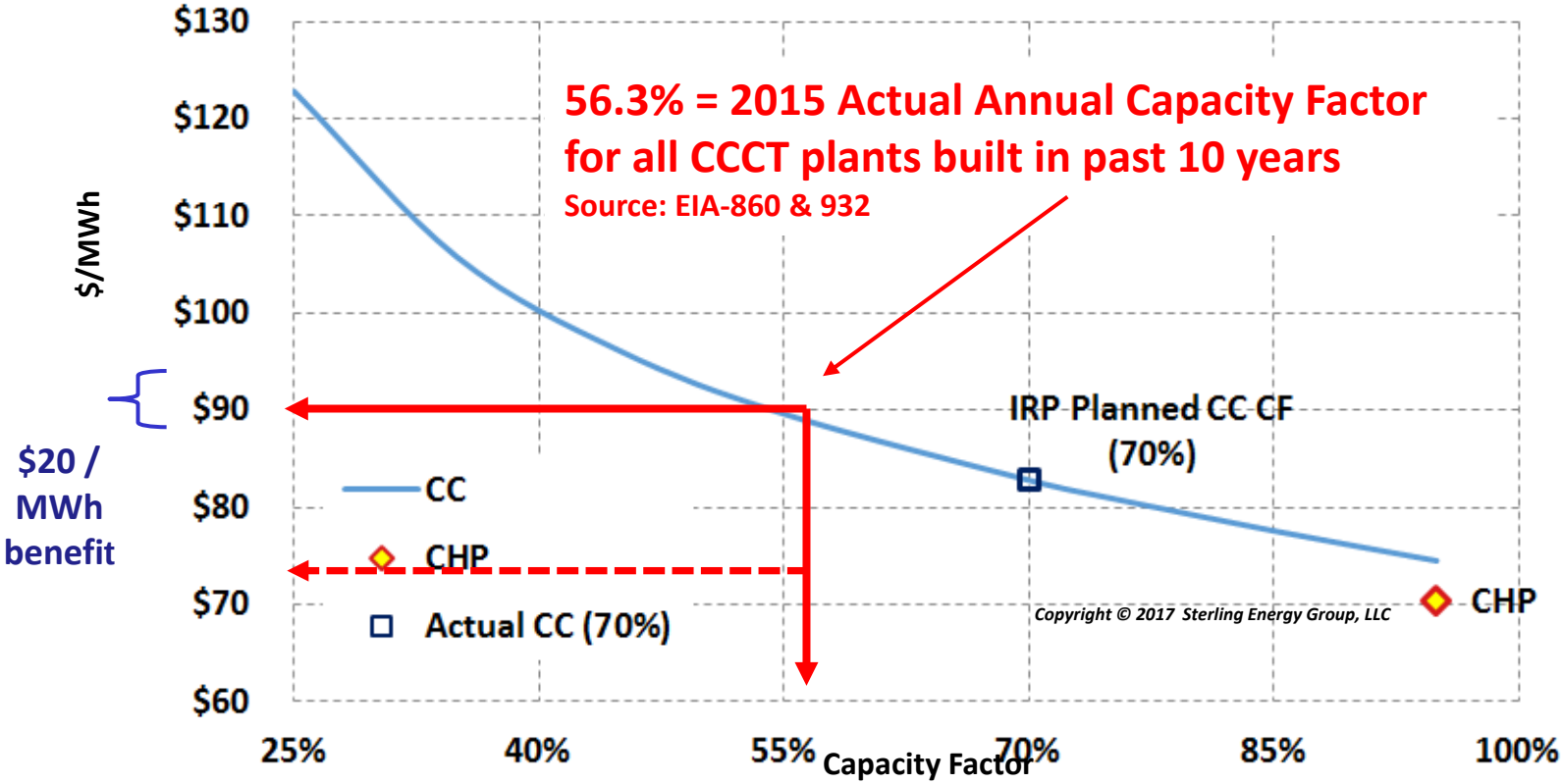
How CHP Compares with CCGT

800 MW Advanced CCCT vs 21 MW CHP - with thermal credit to fuel

Levelized Cost of Energy Calculation Using Consistent Utility Planning Methodology



Notes: LCOE calculations are based upon standard IRP life cycle methodology, for cost of capital, depreciation F & V O&M taken from actual Utility IRP data and cost to construct CCCT and CHP plants. Capacity factors for CC are 95% and 70% with CHP 95% Actual CCCT capacity factor of 56.3% from EIA-860 for 2015

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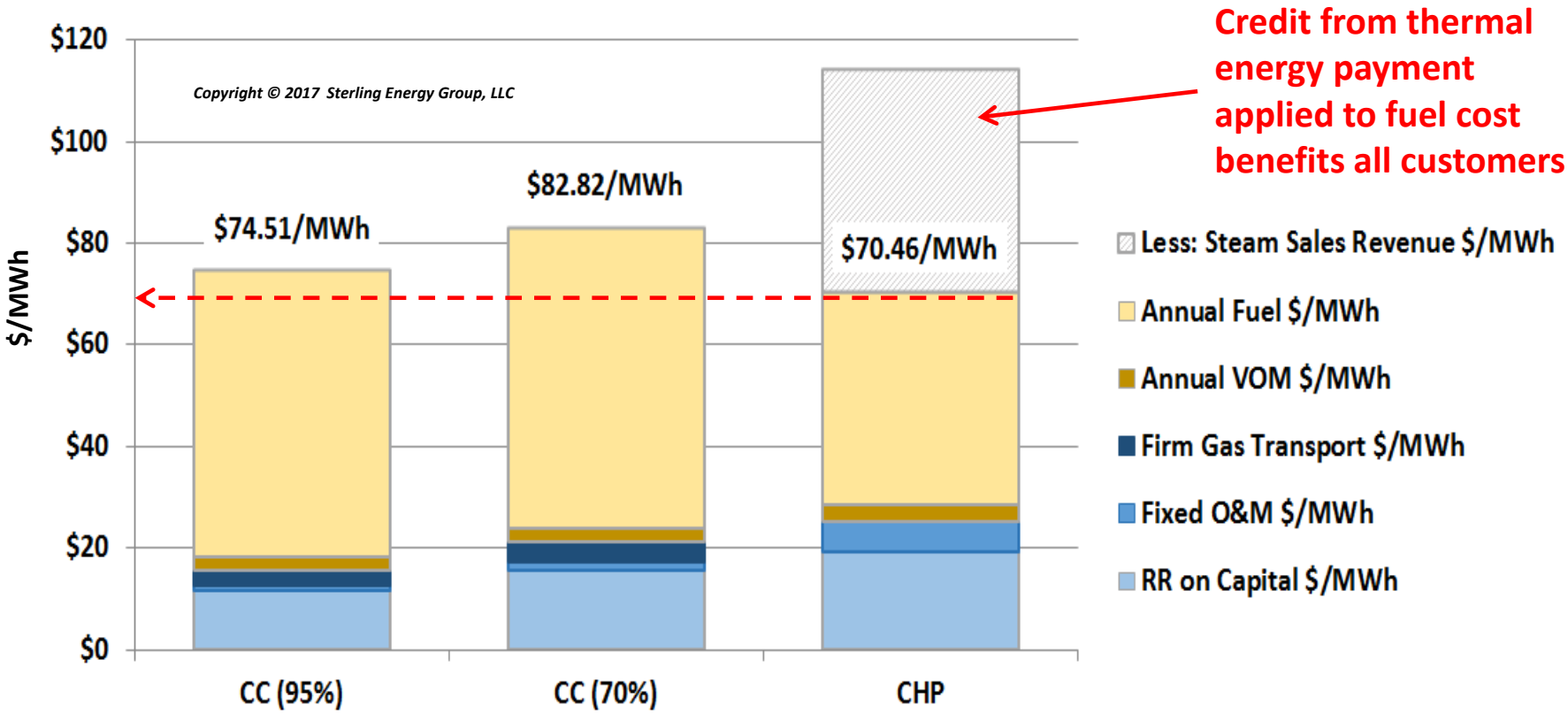
Utility Owned CHP Should be Evaluated in all IRPs as a Least Cost LCOE Supply Asset

800 MW Advanced CCCT vs 21 MW CHP - with thermal credit to fuel



Notes: LCOE calculations are based upon standard IRP life cycle methodology, for cost of capital, depreciation F & V O&M taken from several published Utility IRP data and cost to construct CCCT and actual CHP plants costs. Capacity factors for CC are 95% and 70% with CHP 95%

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Collaboration with Utility Ownership of CHP is Key

To Realizing the Enormous Benefits on Both Sides of the Meter

- *Properly Applied* CHP is the Most Efficient Method of Generating Power on the Planet. 75% vs 35 to 50% for Coal and CC respectively
  - For Utility Investment, has Lowest Levelized Cost of Any Base Load Resource with No need for tax credits or incentives
  - Unloads T&D Systems – Reduces Losses & Grid Congestion
  - Can defer or prevent need for New T&D Investment while opening Grid capacity for Rapidly Expanding Intermittent Renewables
- Increases Resiliency Serving Load at Point of Use
  - Adds Electric as well as Steam System Resiliency for Host Customer & Community – Can operate thru lengthy Grid outages
- Significantly Reduces Emissions and Water Use per MWh
- Supports Economic Development, Manufacturing Competitiveness, Expansion of Production, and Job Grow

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Thanks for your Time . . .

FPU/Eight Flags Energy 21 MW CHP at Rayonier Advanced Materials Amelia Island, FL

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Sharon Nolen

Eastman Chemical

U.S. DEPARTMENT OF ENERGY

CHP at Eastman Chemical Company

Sharon Nolen, CEM, PE
Eastman Chemical Company

Who we are

- A global specialty chemical company headquartered in Kingsport, Tennessee
- Approximately 14,000 employees and 50 manufacturing sites around the globe
- Serving customers in more than 100 countries
- A company dedicated to environmental stewardship, social responsibility and economic growth
- A Responsible Care® company for more than 25 years
- 2017 ENERGY STAR® Partner of the Year Sustained Excellence
- 2016 revenue of $9 billion

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Self sufficiency mindset

CHP since the 1920's

Incineration complex

Hazardous and non-hazardous landfills

Wastewater treatment

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Eastman's first encounter with CHP

Kingsport, Tennessee plant

- Eastman Chemical Company's Tennessee Operations (TNO) is one of the largest chemical manufacturing sites in North America, covering approximately 900 acres
- This facility produces a variety of chemicals, fibers, and plastics and also serves as the worldwide headquarters for Eastman Chemical Company
- The facility began operating its first CHP system in 1920's and has continued adding to the system until its most recent expansion in 1993
- TNO's experience with CHP predates the construction of a reliable electric grid in the Kingsport area
- When it first came online, the CHP system was the only reliable source of electricity for the facility

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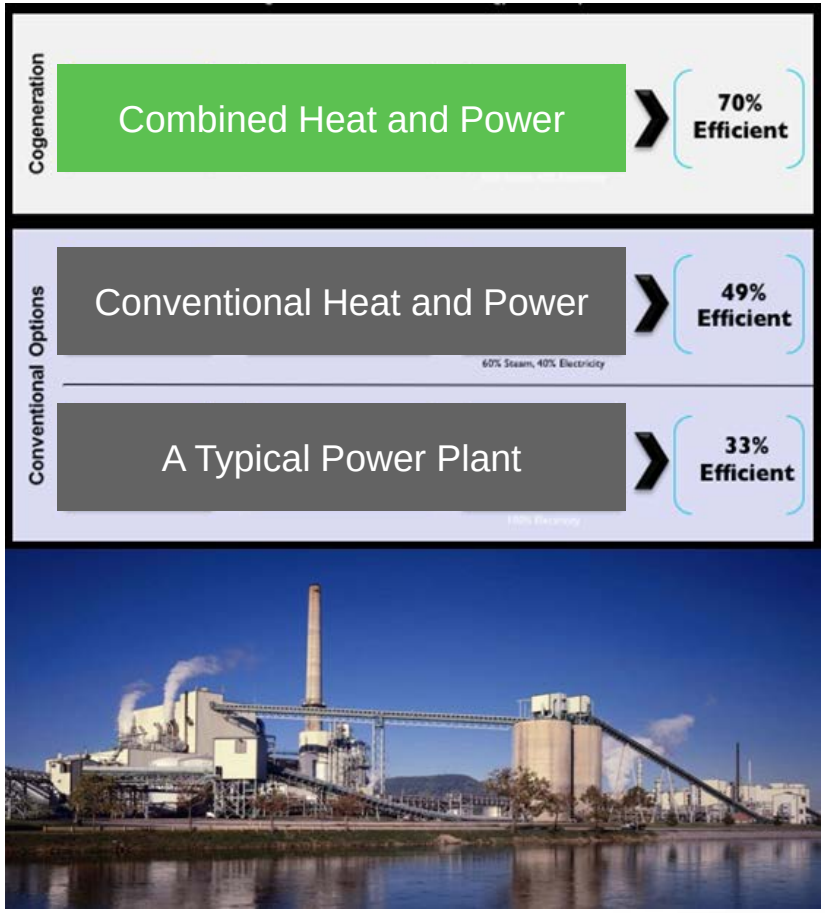
Benefits of Combined Heat and Power (CHP)

- Dramatically improves Eastman's footprint: ~70% energy captured versus ~40%
- ~90% of the electricity at Eastman comes from CHP technology
- CHP has broad support from environmental groups and the Department of Energy



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Steam and electricity generation at TNO

- One of the most energy efficient plants in the country
- TNO received ENERGY STAR® Combined Heat and Power (CHP) Award
  (requirement: use at least 10 percent less fuel than *state-of-the-art* separate heat and power generation)
- Steam generation
  - 17 boilers
  - Typical steam load: 3.6 million lb/hour
  - Similar to 700 MW power station
- Electricity generation and distribution
  - Generate 90% of plant's electricity needs
  - Electrical nameplate capacity = 190 MW (enough for a city of ~170,000 homes)
  - 19 turbine-generators
  - ~200 substations

B-325 powerhouse

View inside a tangentially-fired boiler

B-83 powerhouse

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CHP at Eastman today

- Benefits of CHP at the TNO site:
  - CHP total efficiency: >70%
  - Avoided CO_2 emissions: 358,000 tons/yr
  - Yearly savings: $~45M
  - Reduced demands on existing transmission and distribution infrastructure
- Two other Eastman sites currently make use of CHP
  - Longview, Texas
    - Two GE 7241(FA) combustion turbines
    - Two heat recovery steam generators (HRSG)
    - One GE condensing/extraction steam turbine-generator
  - Indian Orchard, MA
    - Generates ~4 MW as steam pressure is reduced from 650 to 125 psig for process use
- 87% of Eastman's worldwide production occurs at sites with co-generation
- Enables a source energy reduction of several trillion Btu's each year

Longview, TX

Indian Orchard, MA

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Improving CHP efficiency at the Kingsport site

TNO cogeneration system evaluation

- Energy is a significant cost to Eastman
- In today's environment, we need to make operations as efficient as possible, including energy efficiency improvements
- A detailed internal study of the system took place in 2016
- Involved Technology, Utilities, and Worldwide Energy Program personnel
- Led to significant learnings

Goal

Determine the proper strategy to maximize profits by improving system efficiency

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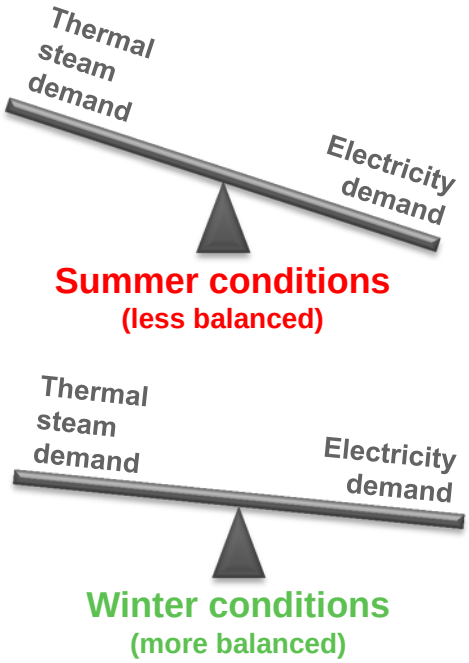
TNO cogeneration imbalances

- Over time, various changes have led to periods of time when the steam electric system at TNO is unbalanced
- Although the overall efficiency is very high, this imbalance does reduces the ability to operate the power plant as efficiently as possible with current equipment
- Primary factors include:
  - Shift towards specialty chemical company has changed energy demand profile
  - Move to public company and automation increased HVAC load
  - Improved efficiency has reduced thermal steam demand in processes (which reduces electricity cogeneration)
  - Sub optimization of the use of mechanical drives throughout the plant
  - Ambient temperature reduces thermal steam demand in warmer months

Higher ambient temperature exacerbates imbalance



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Path forward after evaluation

Ensure users are valuing utility cost savings appropriately

Identify and implement attractive capital projects to bring the system into balance

Educate manufacturing, technology, and engineering on findings and promote involvement

Form the Utilities System Balance Team to review projects and oversee the health of the system

Determine if it is viable to add external customers of 15 & 100 psig steam

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Path forward after evaluation

Ensure users are valuing utility cost savings appropriately

Identify and implement attractive capital projects to bring the system into balance

Educate manufacturing, technology, and engineering on findings and promote involvement

Focus of DOE Steam System In-Plant Training

Form the Utilities System Balance Team to review projects and oversee the health of the system

Determine if it is viable to add external customers of 15 & 100 psig steam

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DOE Steam System In-Plant Training

- Held in June, 2016
- Led by Dr. Greg Harrell
- Focused on identifying options to improve the steam / electric balance at the Kingsport site
- Several potential projects were identified and are now in various stages of implementation:
  - Absorption chiller operation strategy
  - Backpressure turbine loading strategy
  - Fan drive turbine → motor replacement

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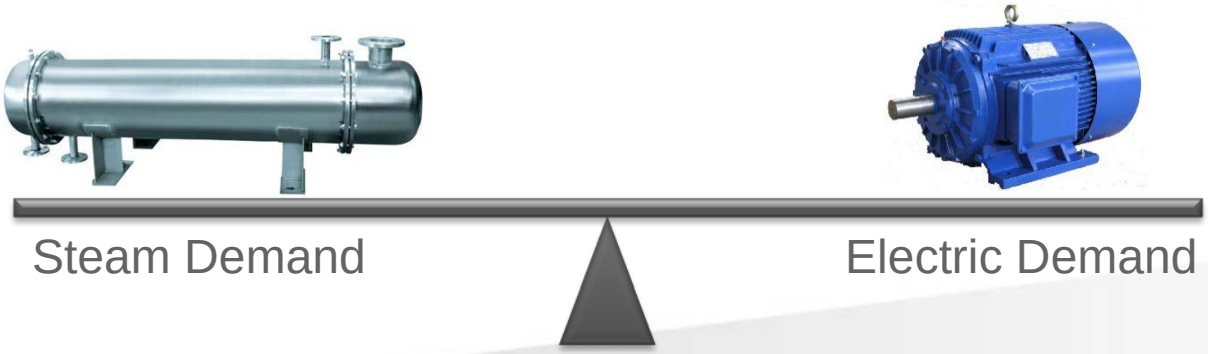
Future improvement strategy

- Some modes of operation are less efficient
- In most cases, these inefficiencies occur due to constraints in our very complex system
- Power Department operations continuously monitors plant needs for steam and electricity and attempts to optimize the system within constraints
- The newly formed **Steam Electric Balance Team** will monitor the system and recommend equipment / operational changes to improve system efficiency
- Over time, these actions are expected to remove current operating constraints for Power Department and effectively eliminate time spent in inefficient operating modes



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Summary

- CHP systems may not be the lowest upfront capital cost approach to supply energy, but they are clear winners when evaluated on a life cycle cost basis
- Over time, the users and configuration of a CHP system may change in a way that impacts overall efficiency
- Operating a CHP system at optimal efficiency requires continual focus to ensure users are not sub-optimizing
- The Department of Energy provides valuable resources to Partners including software, training, and technical support

ENERGY STAR AWARD 2017
PARTNER OF THE YEAR
Sustained Excellence

Better Plants CHALLENGE
U.S. DEPARTMENT OF ENERGY

“A truly sustainable company is one that creates significantly more value in the world than the resources it uses.”

David Golden, senior vice president, chief legal & sustainability officer, and corporate secretary

EASTMAN

Denise Brinley

Pennsylvania Department of Community & Economic Development

U.S. DEPARTMENT OF ENERGY

pennsylvania
DEPARTMENT OF COMMUNITY
& ECONOMIC DEVELOPMENT

LEVERAGING PENNSYLVANIA'S ENERGY ASSETS FOR ECONOMIC GROWTH

May 16, 2017
US DOE
Better Buildings Forum

Denise Brinley
Senior Energy Advisor
EXECUTIVE OFFICE

pennsylvania
DEPARTMENT OF COMMUNITY & ECONOMIC DEVELOPMENT

ENERGY: PENNSYLVANIA'S BUILDING BLOCK

#1 net exporter of energy in U.S.

2nd
for nuclear generation

2nd
for natural gas production

3rd
for total energy production

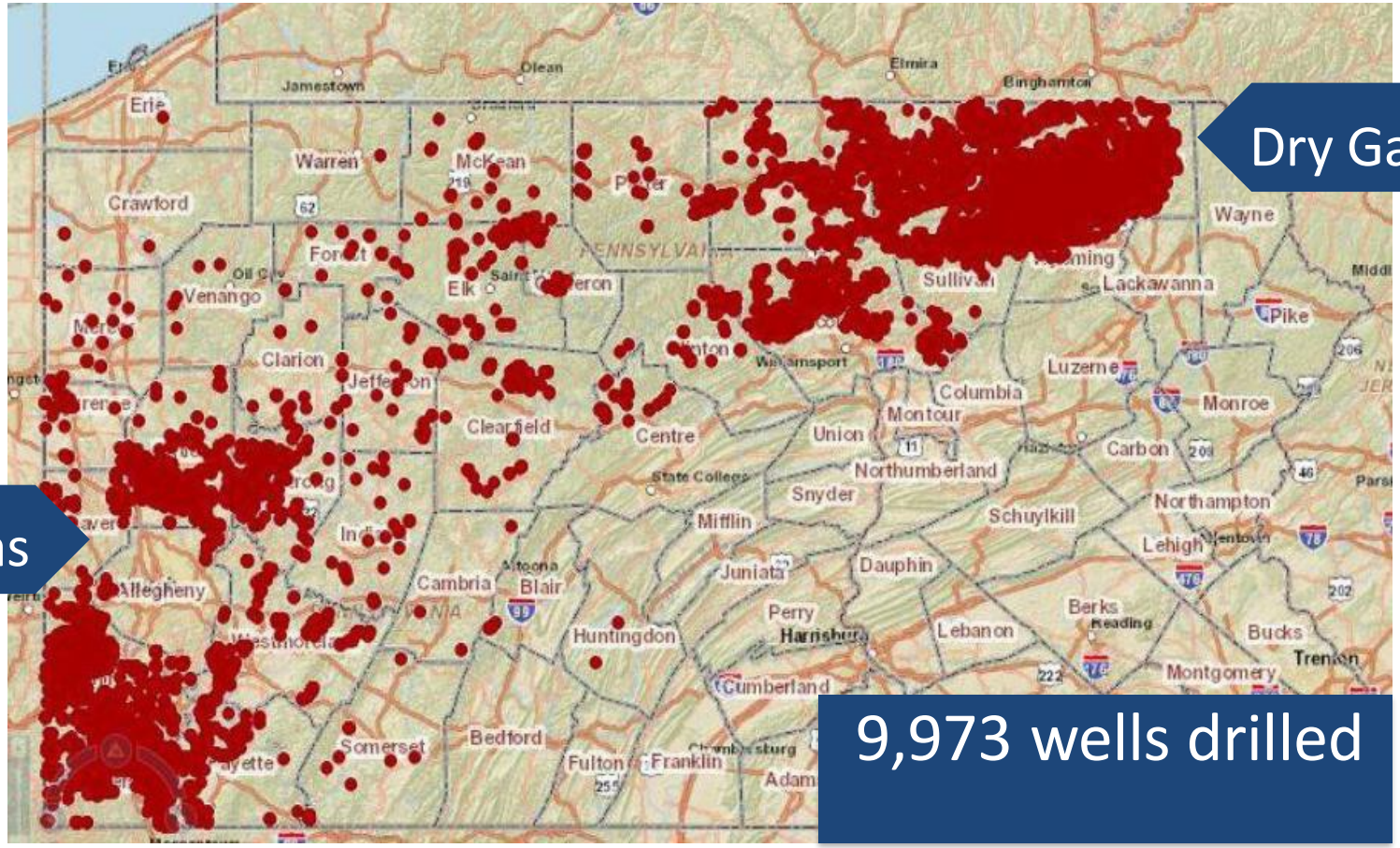
4th
for coal production

3rd
for electricity generation

Home to the 2nd largest energy field in the world

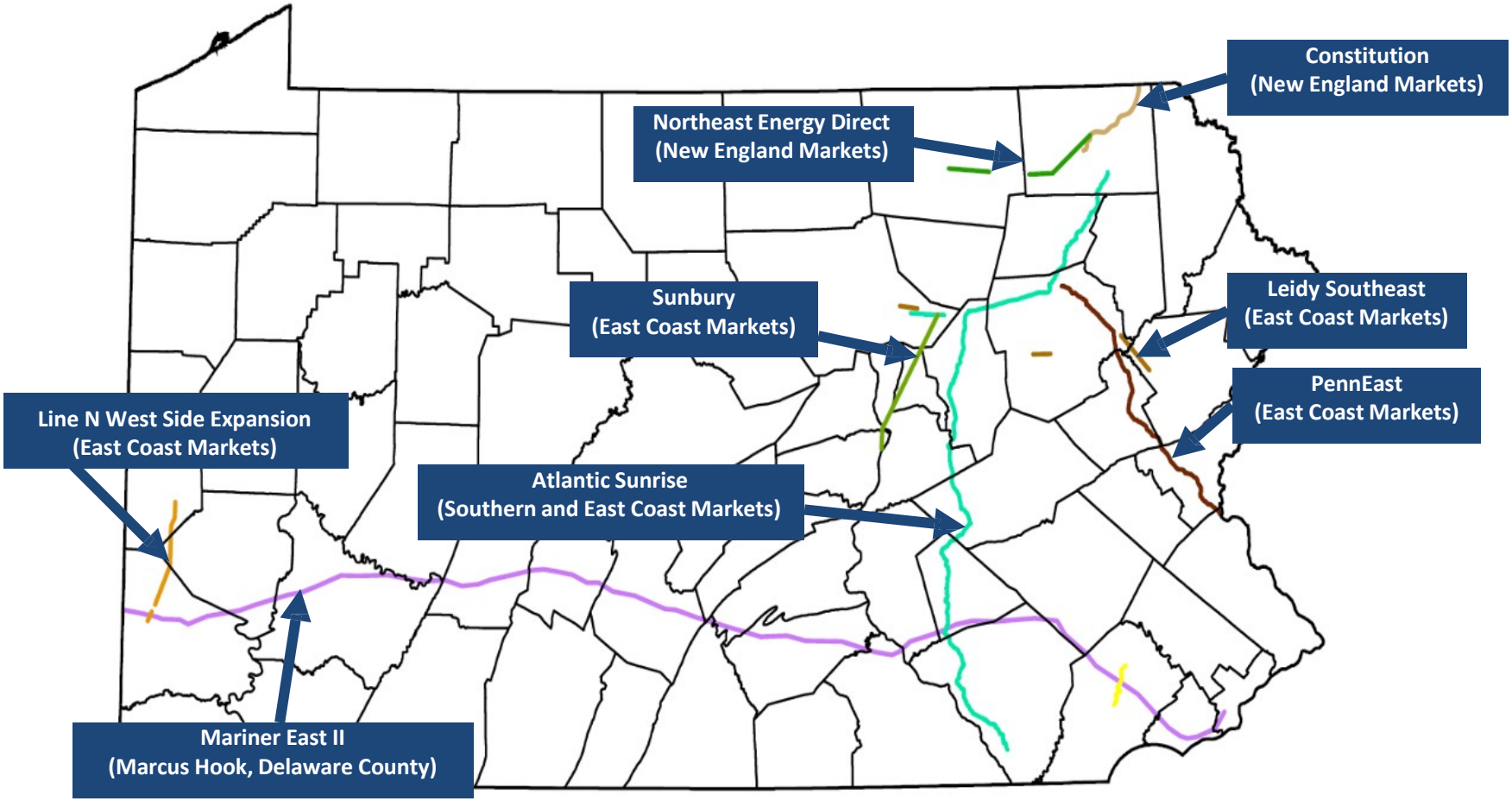
pennsylvania
DEPARTMENT OF COMMUNITY & ECONOMIC DEVELOPMENT

MARCELLUS SHALE EXPLORATION & PRODUCTION



PENNSYLVANIA'S $12 BILLION PIPELINE INFRASTRUCTURE BUILDOUT

pennsylvania
DEPARTMENT OF COMMUNITY & ECONOMIC DEVELOPMENT



Note: Map is generated from ArcGIS Online and the lines are approximations and generalizations.

STRATEGIC OPPORTUNITY - ENERGY

Current Activity & Investments

Use of natural gas at petrochemical manufacturing plants

NGL manufacturing (feedstock for chemicals and plastics)

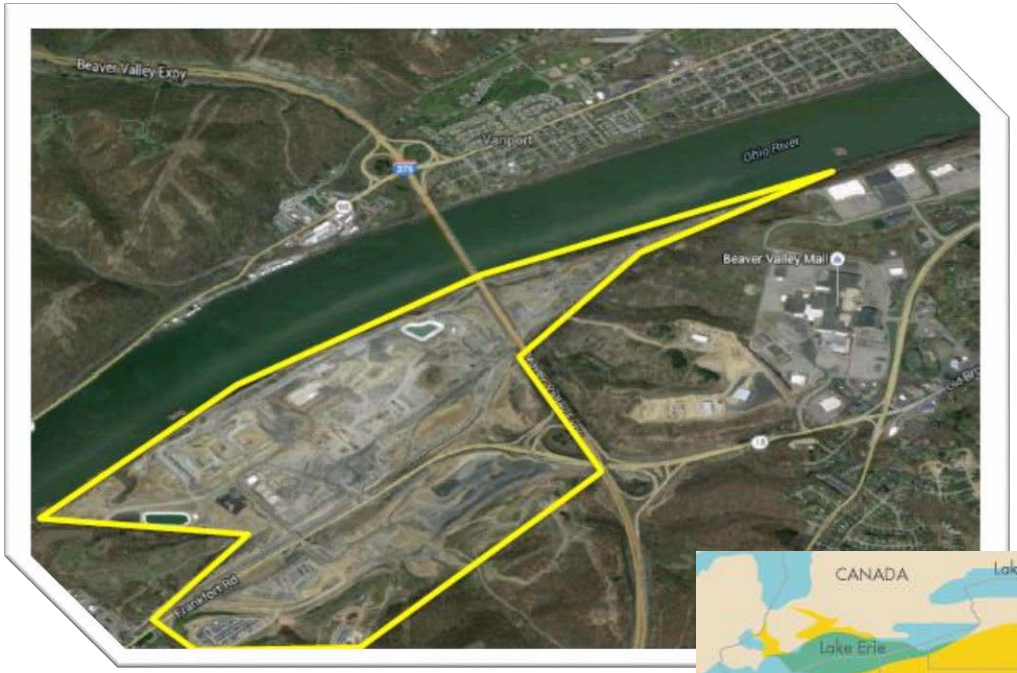
LNG facilities (world-class and small-scale)

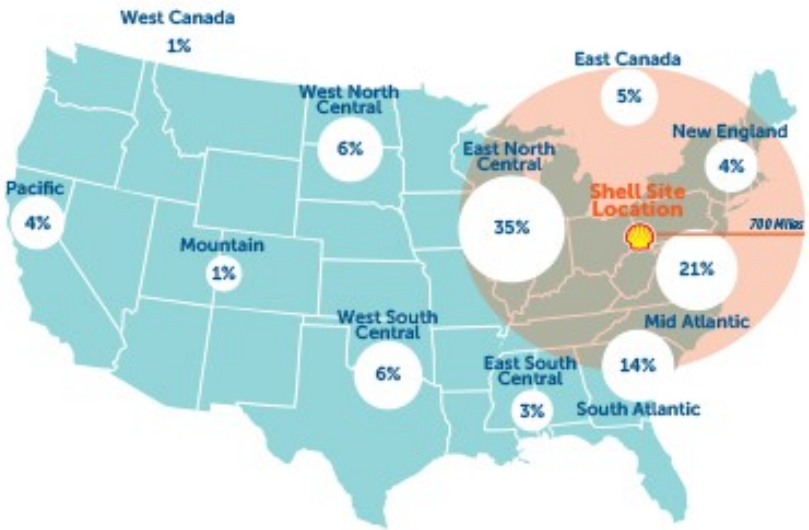
Fertilizer production

Conversion or development of power plants for electricity generation

Use of natural gas as power source for businesses and residents

NGLs: SHELL'S BEAVER COUNTY SITE





STRATEGIC OPPORTUNITY - ENERGY

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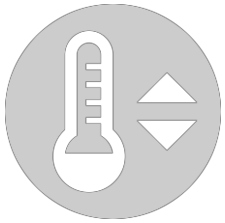

Use of natural gas as power source for businesses and residents

POWER PLANTS

Panda Power Funds Commissions Nation's First Marcellus Shale-Gas Power Plant – 829 MW

First new generating station sited on Marcellus Shale gas formation will power up to 1 million homes
Plant supports long-term market for Pennsylvania natural gas royalty owners
Plant expected to contribute up to $5.97 billion to Northern Tier economy

STRATEGIC OPPORTUNITY - ENERGY

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Fertilizer production

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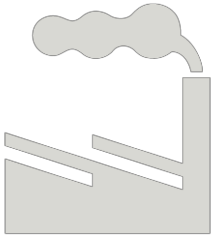


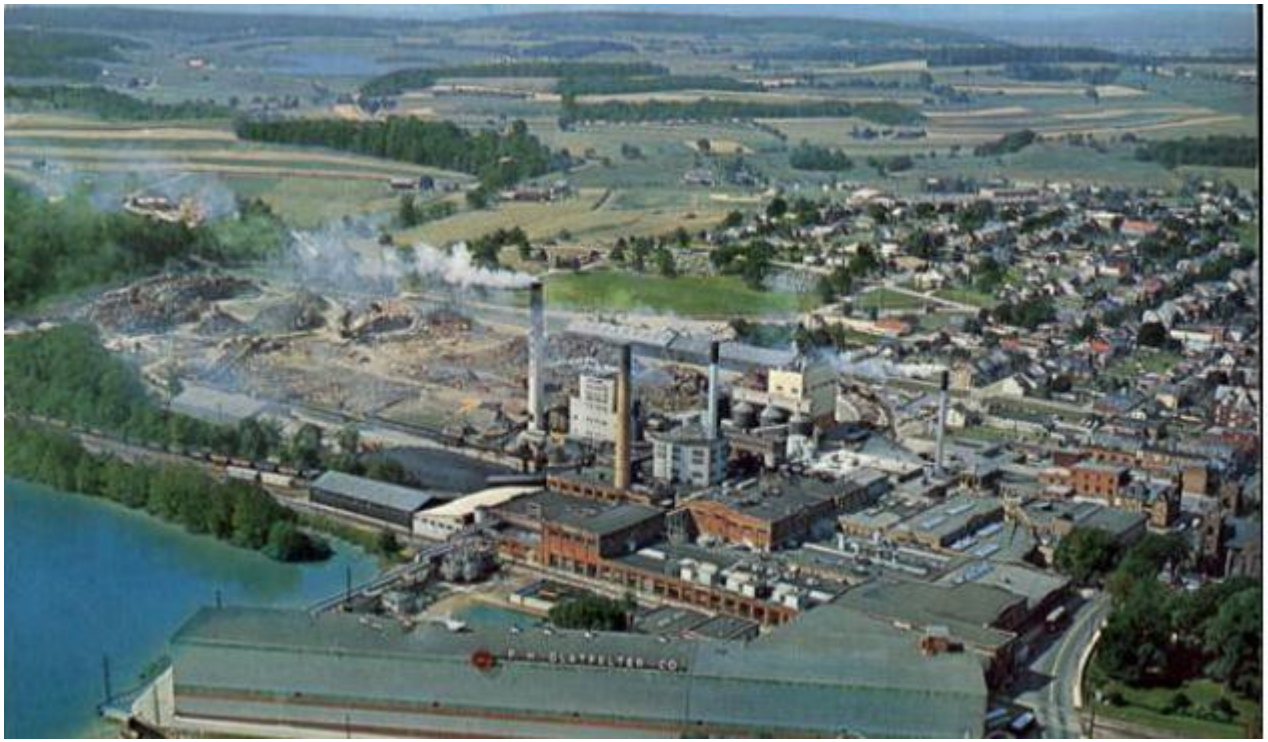
Conversion or development of power plants for electricity generation

Use of natural gas as power source for businesses and residents

LOCAL USE – MEHOOPANY, PA

- Proctor & Gamble's largest manufacturing facility in the world
- CHP an effort to save money and reduce CO_2 emissions
- 64 MW of electricity
- Gross savings of $16.5 million per year
- Reduced CO_2 emissions of 850 pounds per year

LOCAL USE – YORK, PA



- P.H. Glatfelter completed $63 million in renovations to convert from coal to natural gas
- Global leader in manufacturing of specialty papers
- State assistance played role in conversion ($8 million)

FUNDING MATRIX

ACE

PIPE

ISRP

PennVest

PA First

Business in Our Sites

Thank You!

Questions? Contact:
dbrinley@pa.gov
dced.pa.gov

pennslvania
DEPARTMENT OF COMMUNITY & ECONOMIC DEVELOPMENT

Jim Freihaut

Mid-Atlantic CHP TAP

U.S. DEPARTMENT OF ENERGY

The CHP Solution for Growth, Economics, Business Continuity

DOE CHP Technical Assistance Partnerships

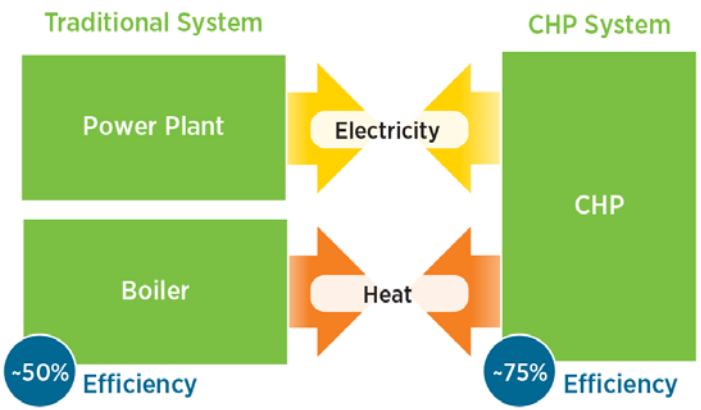
Jim Freihaut, Ph.D.
Director, DOE Mid Atlantic CHP TAP Center

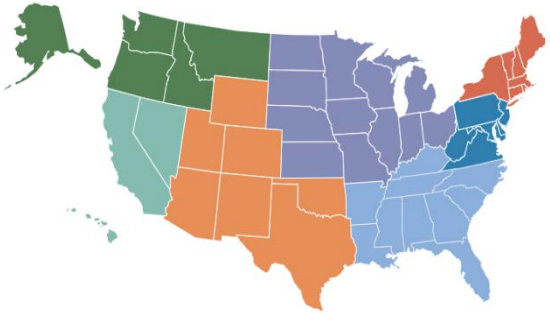
May 16, 2017
Washington, D.C.

DOE CHP Technical Assistance Partnerships (CHP TAPs)

DOE's CHP TAPs promote and assist in transforming the market for CHP, waste heat to power, and district energy or microgrid with CHP throughout the United States. Key services include:

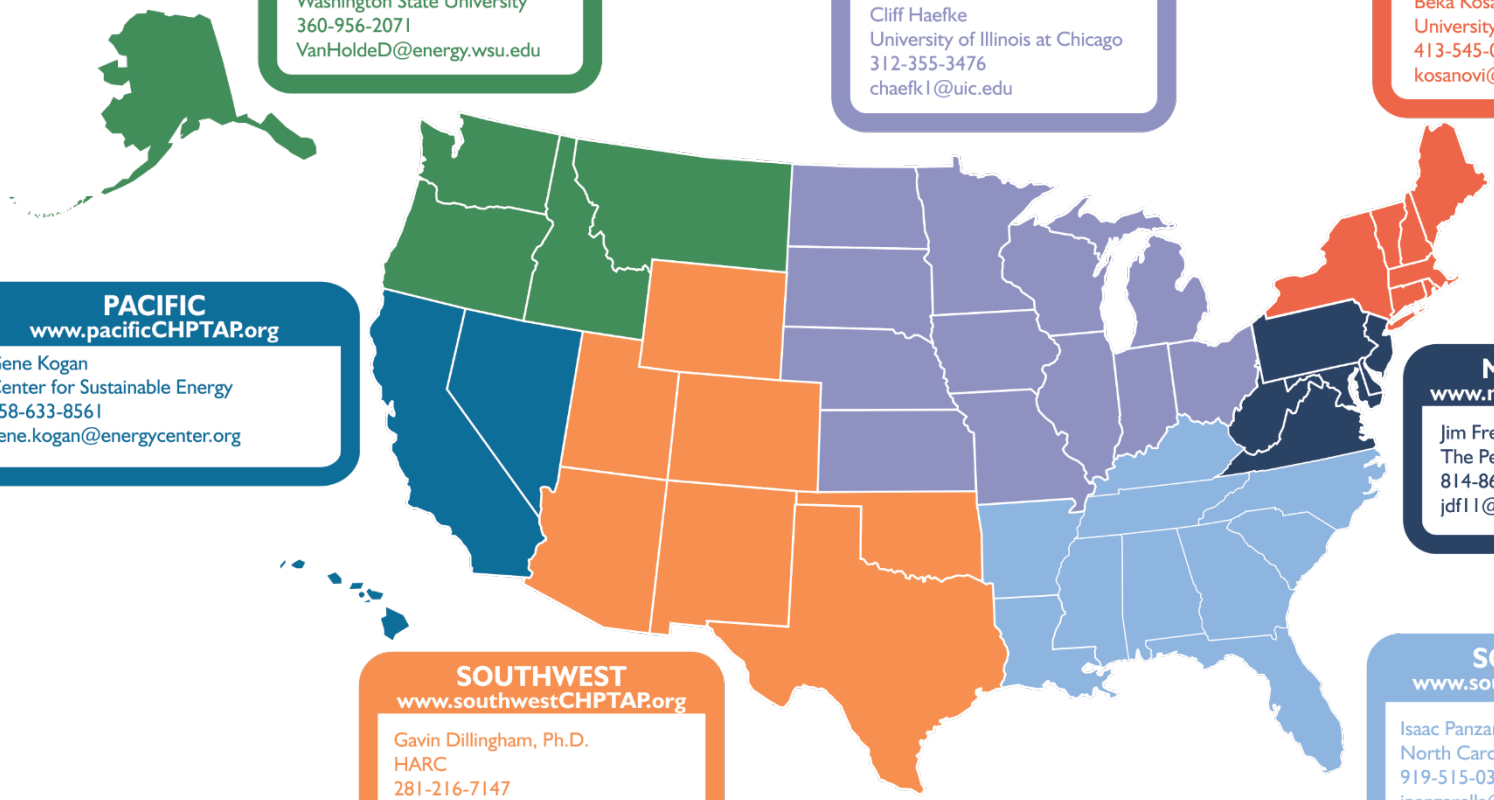
- **Market Opportunity Analysis**
  Supporting analyses of CHP market opportunities in diverse markets including industrial, federal, institutional, and commercial sectors
- **Education and Outreach**
  Providing information on the energy and non-energy benefits and applications of CHP to state and local policy makers, regulators, end users, trade associations, and others.
- **Technical Assistance**
  Providing technical assistance to end-users and stakeholders to help them consider CHP, waste heat to power, and/or district energy or microgrid with CHP in their facility and to help them through the development process from initial CHP screening to installation.





www.energy.gov/chp

DOE CHP Technical Assistance Partnerships (CHP TAPs)



NORTHWEST
www.northwestCHPTAP.org

David Van Holde, P.E.
Washington State University
360-956-2071
VanHoldeD@energy.wsu.edu

MIDWEST
www.midwestCHPTAP.org

Cliff Haefke
University of Illinois at Chicago
312-355-3476
chaefk1@uic.edu

NORTHEAST
www.northeastCHPTAP.org

Tom Bourgeois
Pace University
914-422-4013
tbourgeois@law.pace.edu

Beka Kosanovic, Ph.D.
University of Massachusetts Amherst
413-545-0684
kosanovi@ecs.umass.edu

PACIFIC
www.pacificCHPTAP.org

Gene Kogan
Center for Sustainable Energy
858-633-8561
gene.kogan@energycenter.org

MID-ATLANTIC
www.midatlanticCHPTAP.org

Jim Freihaut, Ph.D.
The Pennsylvania State University
814-863-0083
jdf11@psu.edu

SOUTHWEST
www.southwestCHPTAP.org

Gavin Dillingham, Ph.D.
HARC
281-216-7147
gdillingham@harcresearch.org

SOUTHEAST
www.southeastCHPTAP.org

Isaac Panzarella, P.E.
North Carolina State University
919-515-0354
ipanzarella@ncsu.edu

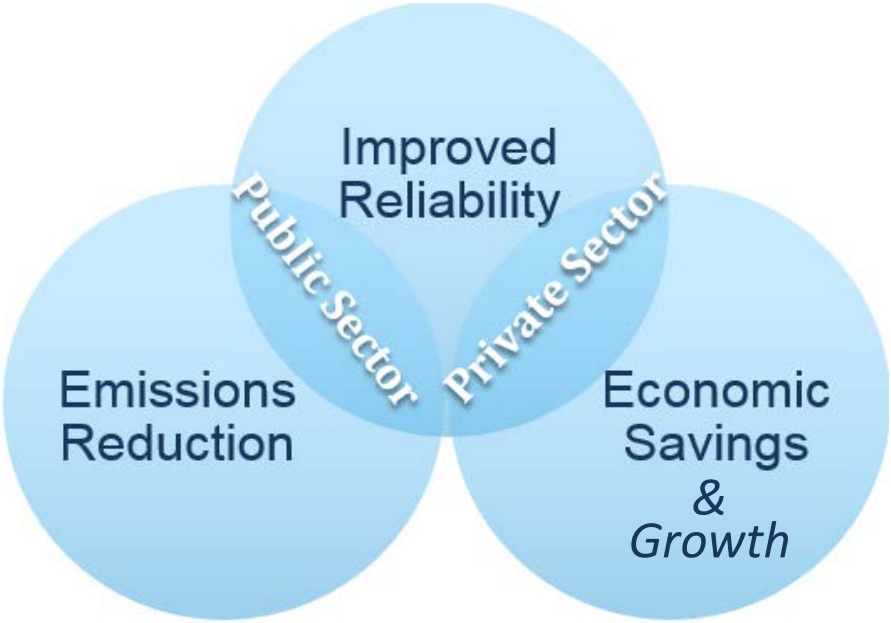
DOE CHP Deployment Program Contacts

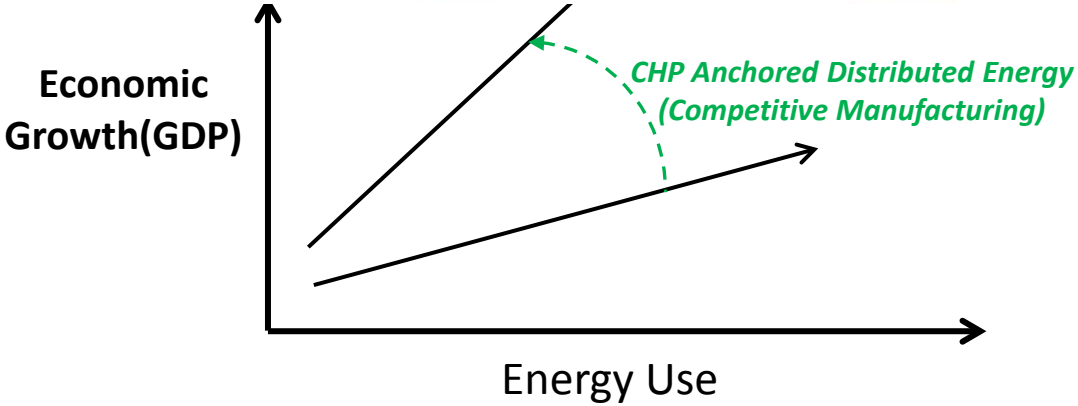
Tarla T. Toomer, Ph.D.
CHP Deployment Program Coordinator
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy
Tarla.Toomer@ee.doe.gov

Patti Garland
DOE CHP TAP Coordinator [contractor]
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy
Patricia.Garland@ee.doe.gov

Ted Bronson
DOE CHP TAP Coordinator [contractor]
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy
tbronson@peaonline.com

Distributed CHP Generation Driving Influences

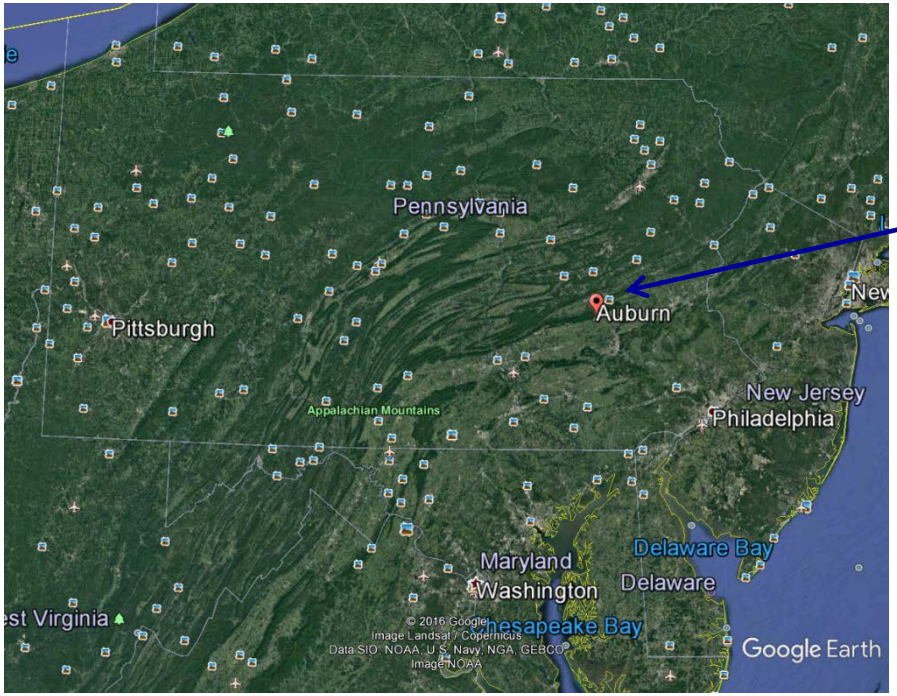


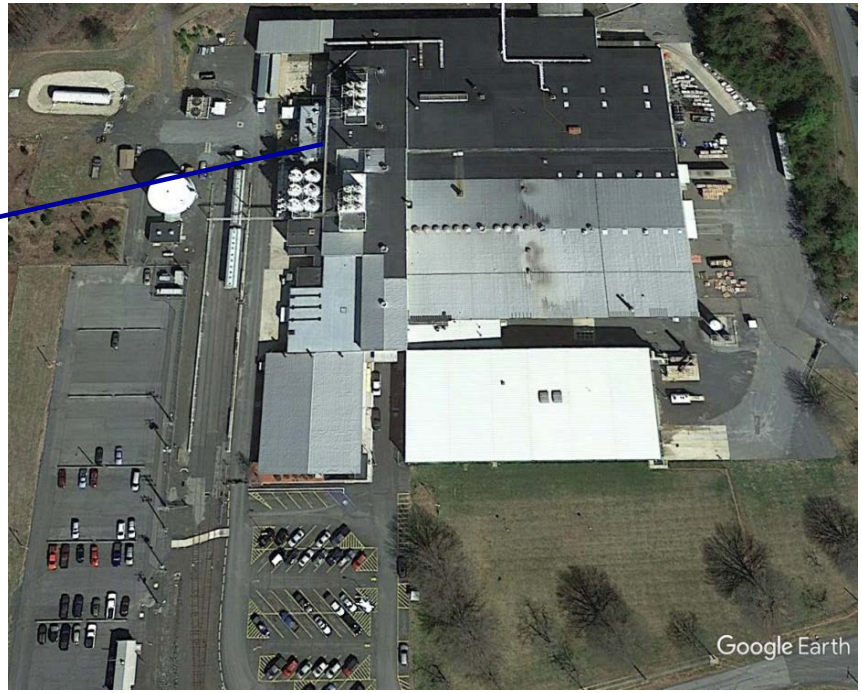


Distributed CHP Generation Benefits

- **Industrial/Commercial Facility** – CHP reduces operating costs, enhances energy reliability, improves economic competitiveness and lowers emissions
- **District Energy System** – Adding CHP capability increases energy efficiency, provides electric resiliency, and reduces emissions
- **Microgrids** - CHP provides a baseload anchor that provides electric and thermal resiliency, increases overall energy efficiency, supports integration of renewables, and reduces emissions

Omnova Solutions Inc. (Specialty Coatings), Auburn, PA

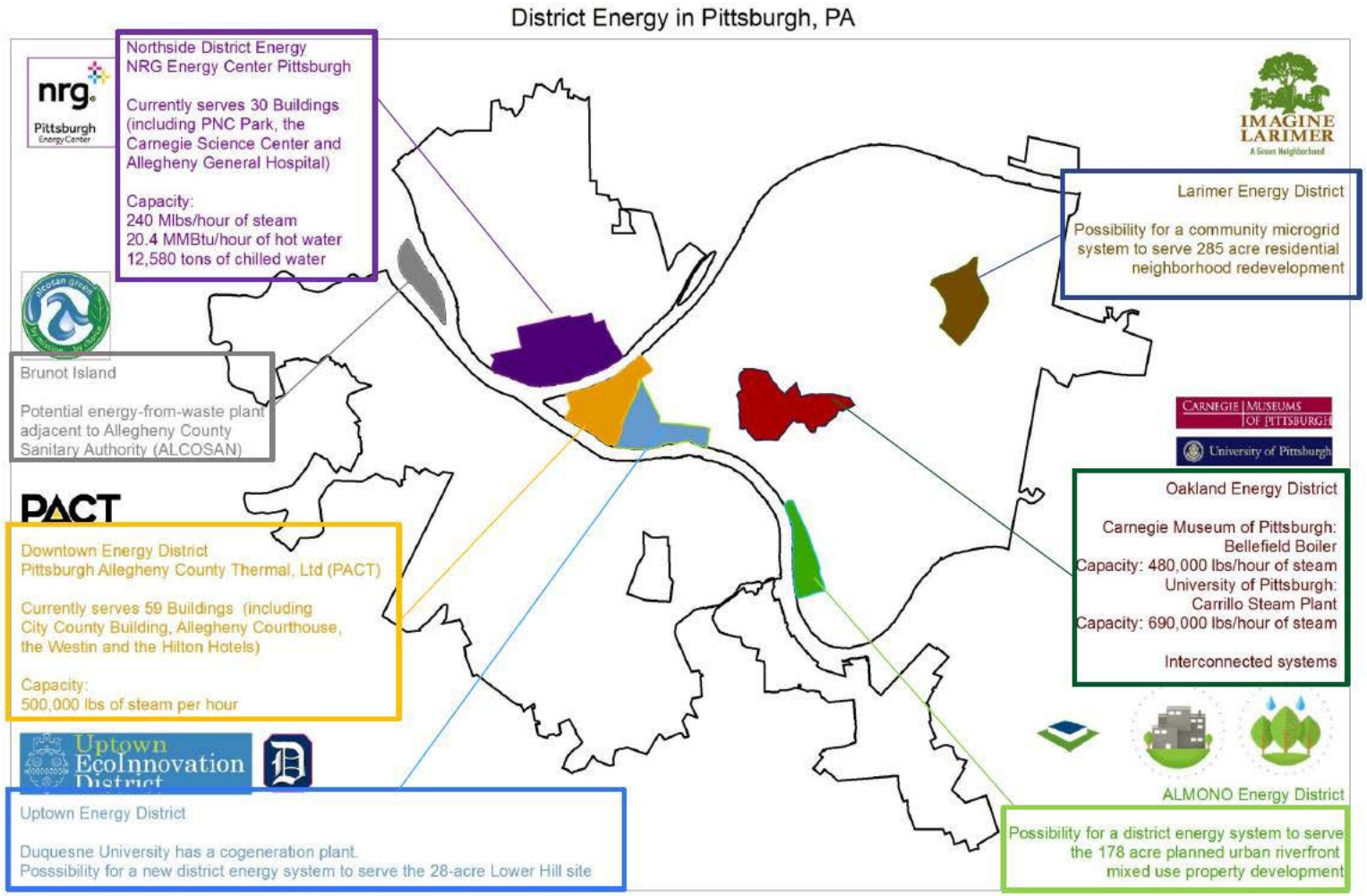




1.4 MWe Reciprocating Engine producing
1.0 MW useful thermal for coatings and laminates manufacturing

Lowering Manufacturing Costs & Meeting Corporate Goals for Carbon Footprint Reduction
275 Employees

Developing District Energy in Pittsburgh



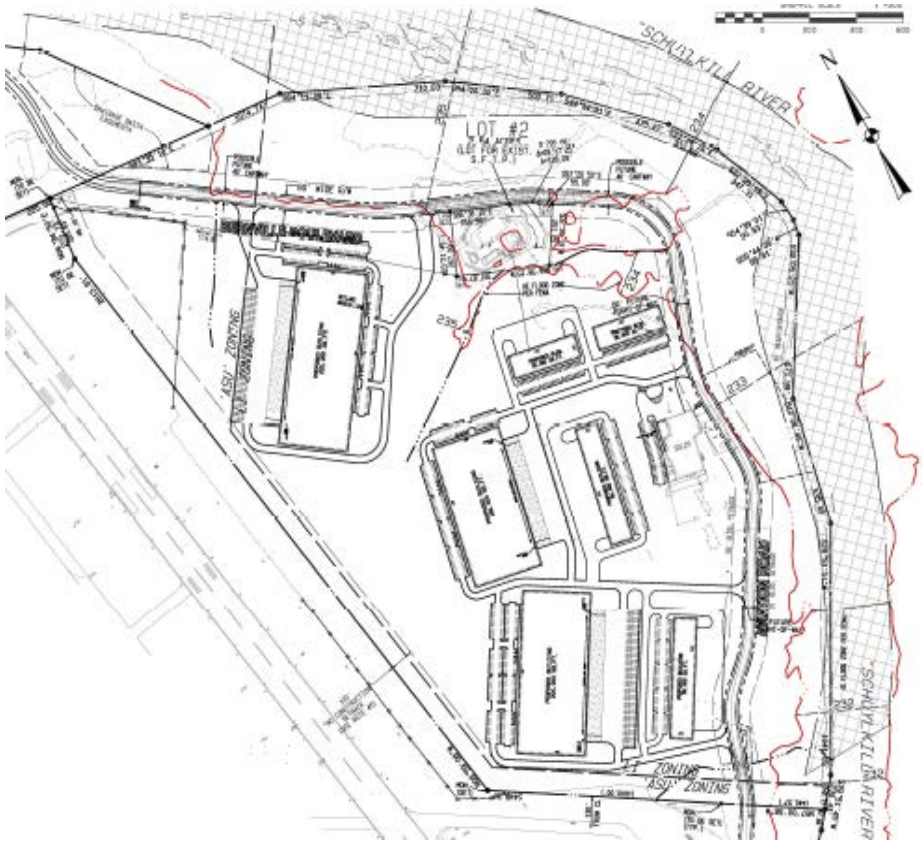
Unregulated Micro-grid in Utility Constrained Area

Electric Growth Power demand Projected: 25 MW → 80-100 MW

The Navy Yard at Philadelphia

The BCIDA Reading Airport Micro-grid

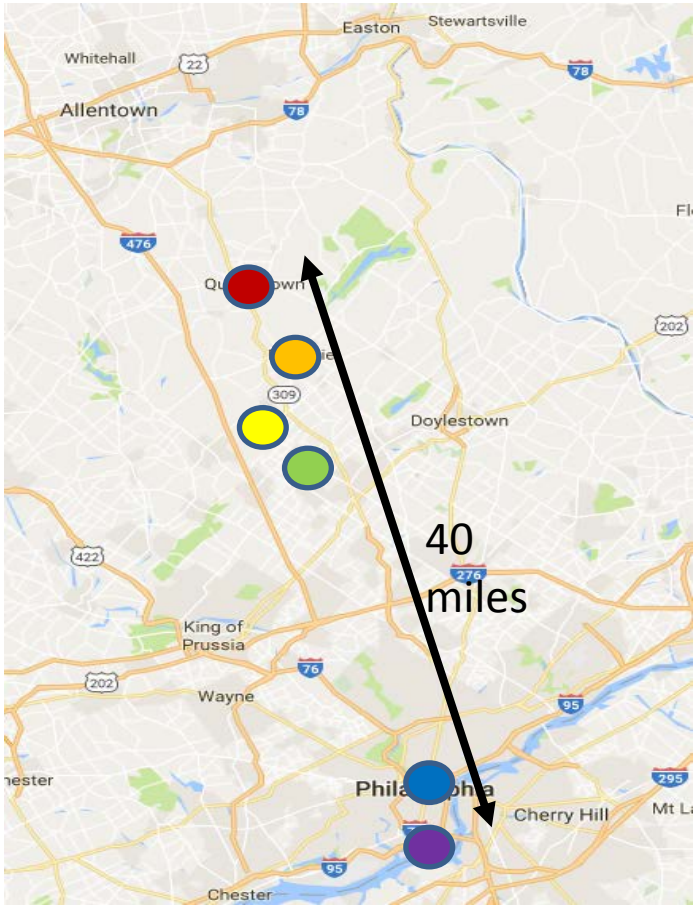
3MW Power Max Deliverable via Current Substations



Municipal Utilities Distributed Energy Microgrid

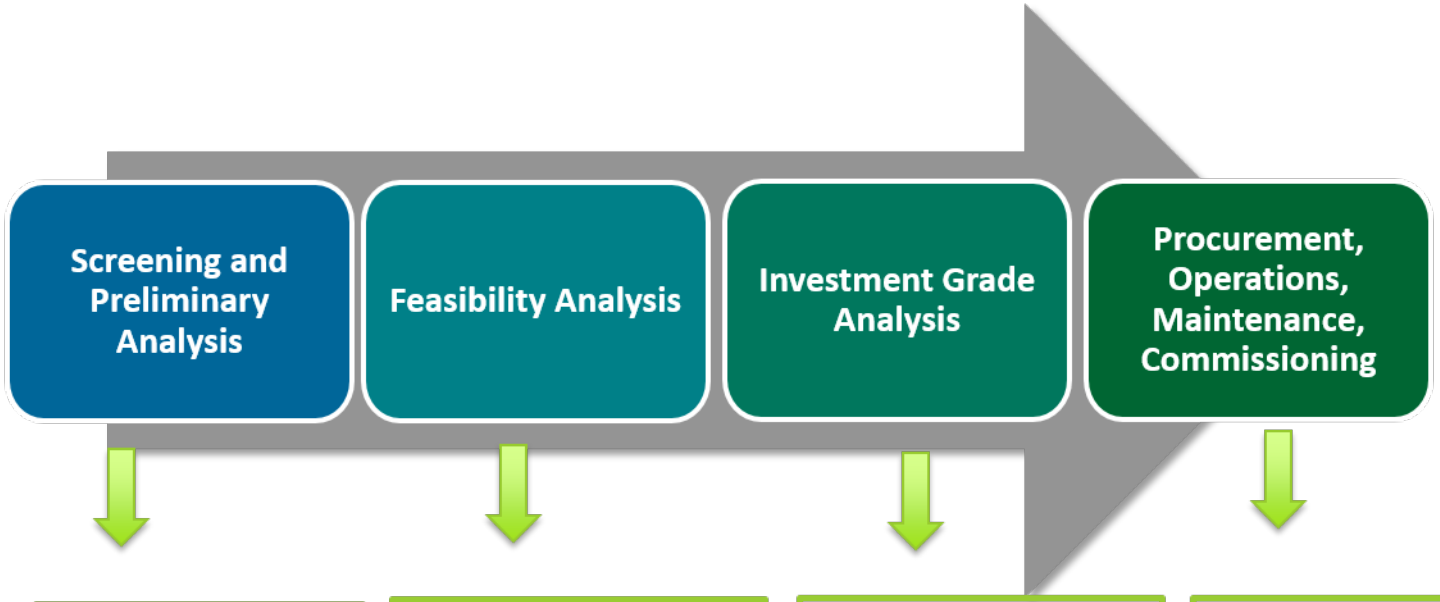
Aligns six independent electric utilities along regional transportation corridors to enable efficient manufacturing, transportation, communications

- Quakertown
- Perkasie
- Hatfield
- Lansdale
- Philadelphia
- •Navy Yard



CHP Project Development Steps

CHP TAP Technical Assistance



US DOE CHP TAP Services:

- Quick screening questions with spreadsheet payback calculator.
- Uses available site information. Estimate: savings, Installation costs, simple paybacks, equipment sizing and type.
- 3rd Party review of Engineering Analysis. Review equipment sizing and selection.
- Review specifications and bids. Limited operational analysis

Next Steps

Contact your regional CHP TAP for assistance if you:

- Are interested in having a Qualification Screening performed to determine if there is an opportunity for CHP at your site
- Already have an existing CHP plant and interested in expanding it
- Need an unbiased 3rd Party Review of a proposal

Thank You!

Questions?

Jim Freihaut, Ph.D.
Director DOE Mid Atlantic CHP TAP Center
Technical Director, PSU @ The Navy Yard
Professor, Architectural Engineering
E-mail: jdf11@psu.edu
Office: 814-863-0083

Thank You

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