
THE POWER OF COLLABORATION ON CHP

Utility Ownership of Combined Heating & Power (CHP) as a Least Cost, Base Load Supply Resource at Key Customer Sites

***Lowest LCOE, Reduced Emissions and T & D Losses, Increased Resiliency,
Economic & Community Development, Industrial Competitiveness & Jobs Growth***

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Duke Energy
June 27, 2017***

Four Brief Segments for Today's Discussion



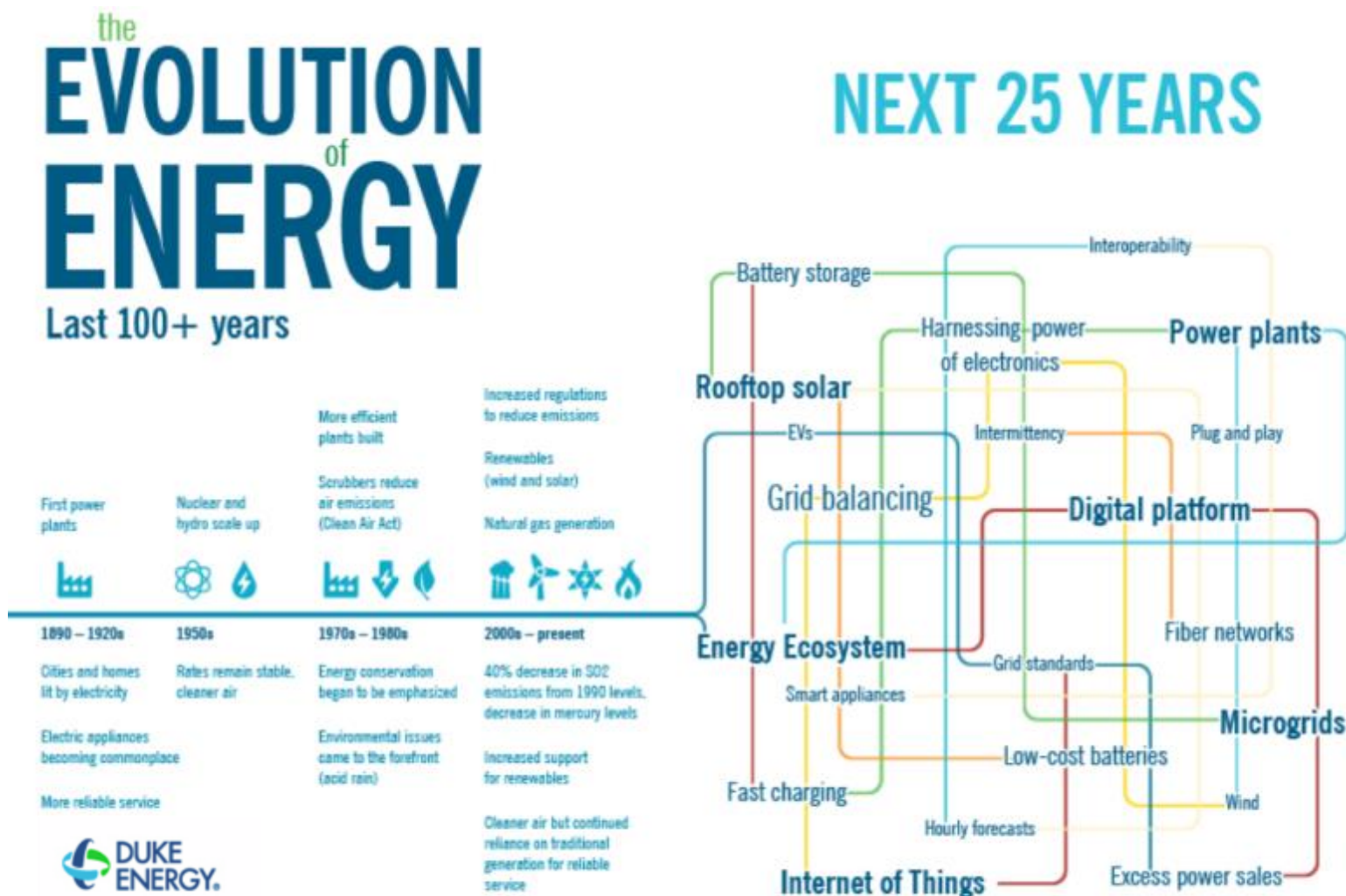
Clemson University / Duke Energy 16 MW CHP
Under Development – Clemson, SC



FPU / Eight Flags Energy 22 MW CHP
at Rayonier Advanced Materials, Amelia Island, FL

- 1) **Recap Fast Facts** – the Rapidly Changing Energy Industry and implications for 21st century grid
- 2) **Rethinking CHP** – as a *Collaborative* Base Load Supply Resource
 - Overcoming traditional Impediments
 - Benefits to Utility, Host, All Customers, Community
- 3) **Review of Utility Planning Methodology & Ownership Model for CHP**
- 4) **Overview Case Studies & Review of Benefits**
 - Clemson University, Duke Energy CHP under Development
 - Duke University, Duke Energy CHP Development
 - Eight Flags Energy CHP, Florida Public Utilities at Rayonier Advanced Materials Amelia Island, FL - operating

In Case You Haven't Noticed . . . The Industry is Changing



Source: Duke Energy's 2017 graphic representing the historic and current evolution of the Energy Industry

Electric Industry is in Midst of Biggest Transition of past Century . . .

- **From More Centralized to More Decentralized**
- From Steady High Load Growth to Uncertain Low, even No Growth
- **From Coal and Nuclear based to Natural Gas and Renewable based**
- From analog, one-way flow, to Digital, multi-directional flow
- **From Fuel Driven to Increasing penetration of Intermittent resources**
- From “Nothing we can do about outages” to “We can offer uninterrupted power supply”
- From this is your tariff, to what kind of tariff do you want?

And . . .

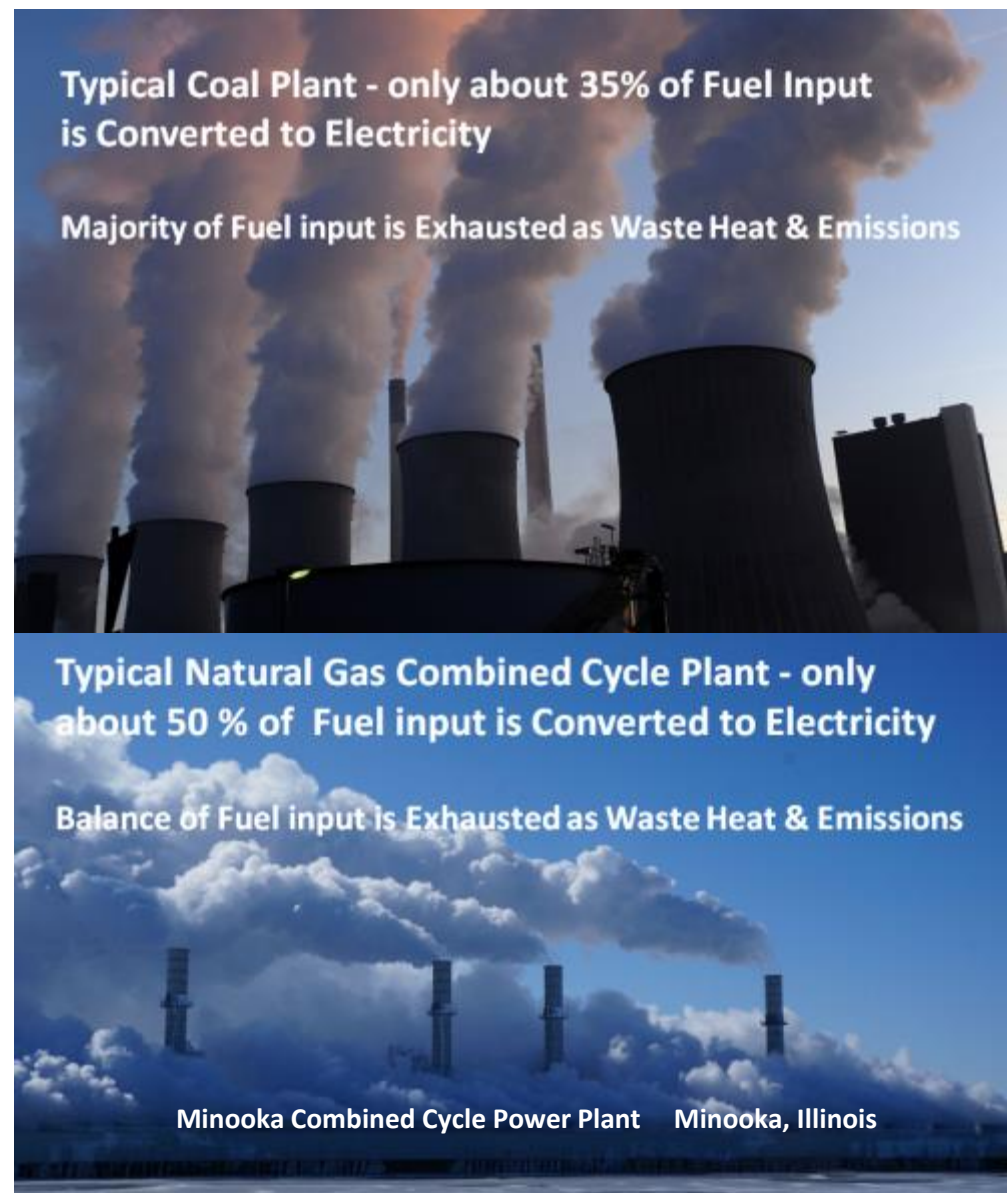
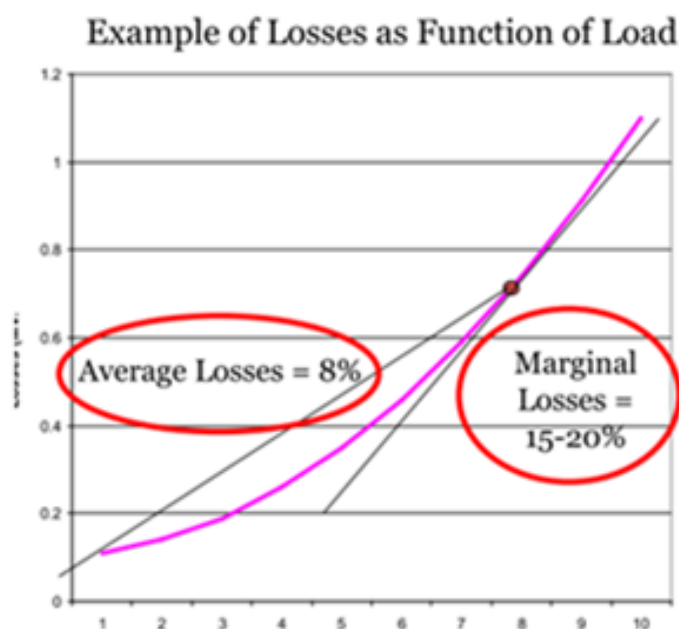
- **From Cogeneration not Allowed (without jumping through costly hurdles), to Would you like to be Our Thermal Host Partner to Build CHP with you**

Context Matters: Fast Facts About the Electric Industry . . .

- **The “Grid” is only about 35-38% Efficient**
 - Two Thirds of fuel input energy is lost in conversion and delivery (exhausted into atmosphere as waste heat and emissions)
- **Gas Turbine Combined Cycle plants have become the Backbone of base load power as Coal and Nuclear Retirements continue**
 - GTCC maximum efficiency is 55% HHV and fleet average is ~ 50% while typical coal fired plant efficiency is about 35%
 - T&D losses in US average 7% but can double during hottest peak hours
- **Wind and Solar PV are by far the fastest growing capacity resource, Still . . .**
- **Fossil fuels will supply over 50% of all electricity produced in the US beyond 2050, RE peaks @ 29%**
 - Current EIA Jan 2017 reference case, no CPP, fossil fuel will supply 60% 2050
 - Under either scenario, latest DOE/EIA forecast indicates well over half of electricity production will be fossil fuel based in 2050

Natural Gas CC only about 50% efficient, Coal about 35%

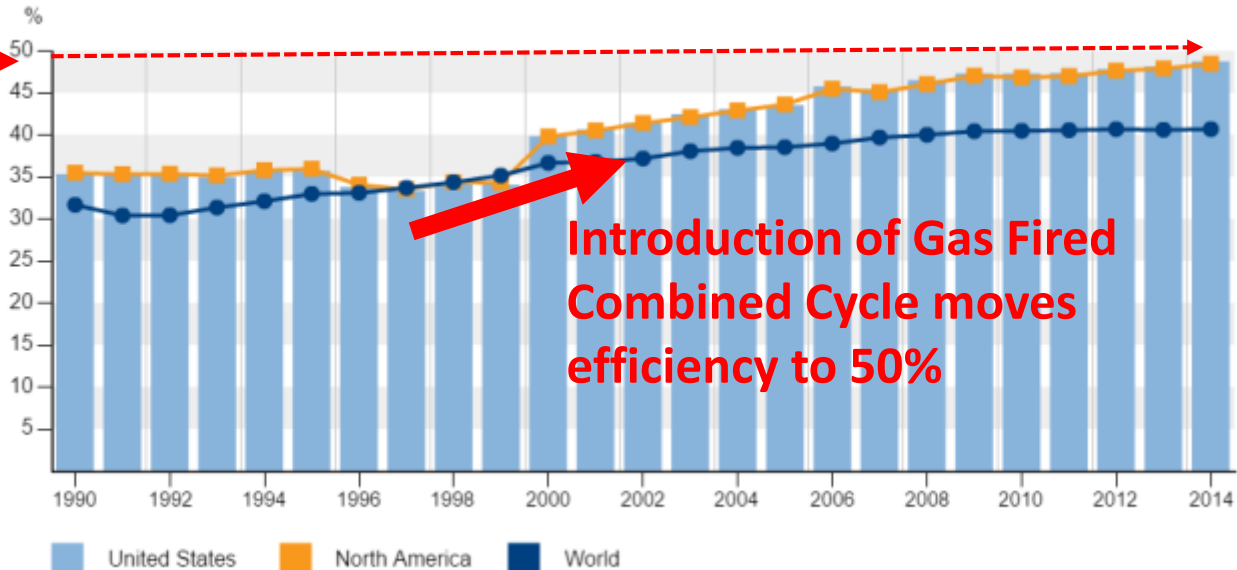
- Over 60% Fuel input to produce electricity is lost in conversion and delivery (waste heat & emissions)
- The most efficient, base load plant on the grid today is GT CC @ ~50%
- T&D losses average 7-8% but I²R losses can double in peak hours



Grid Efficiency Has Seen Very Little Improvement in Decades

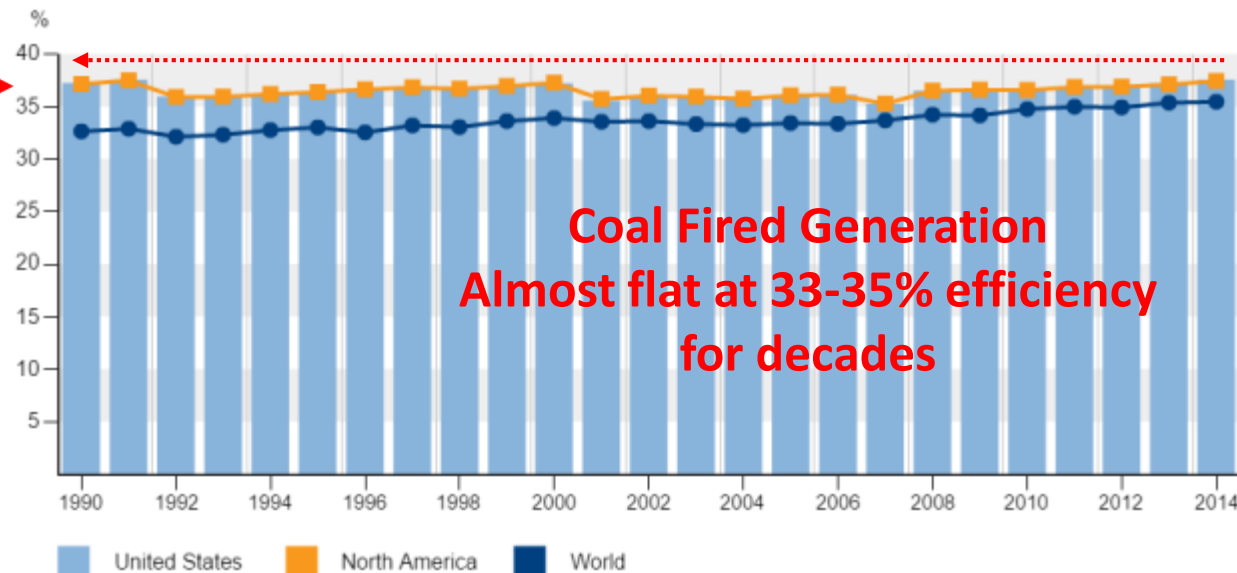
Gas Turbine Combined Cycle
under 50% efficient

United States



Coal fired generation
Approximately 35% efficient

United States



FAST FACTS -- Over 50% Electricity from fossil fuels past 2050

DOE electricity forecast below is with CPP

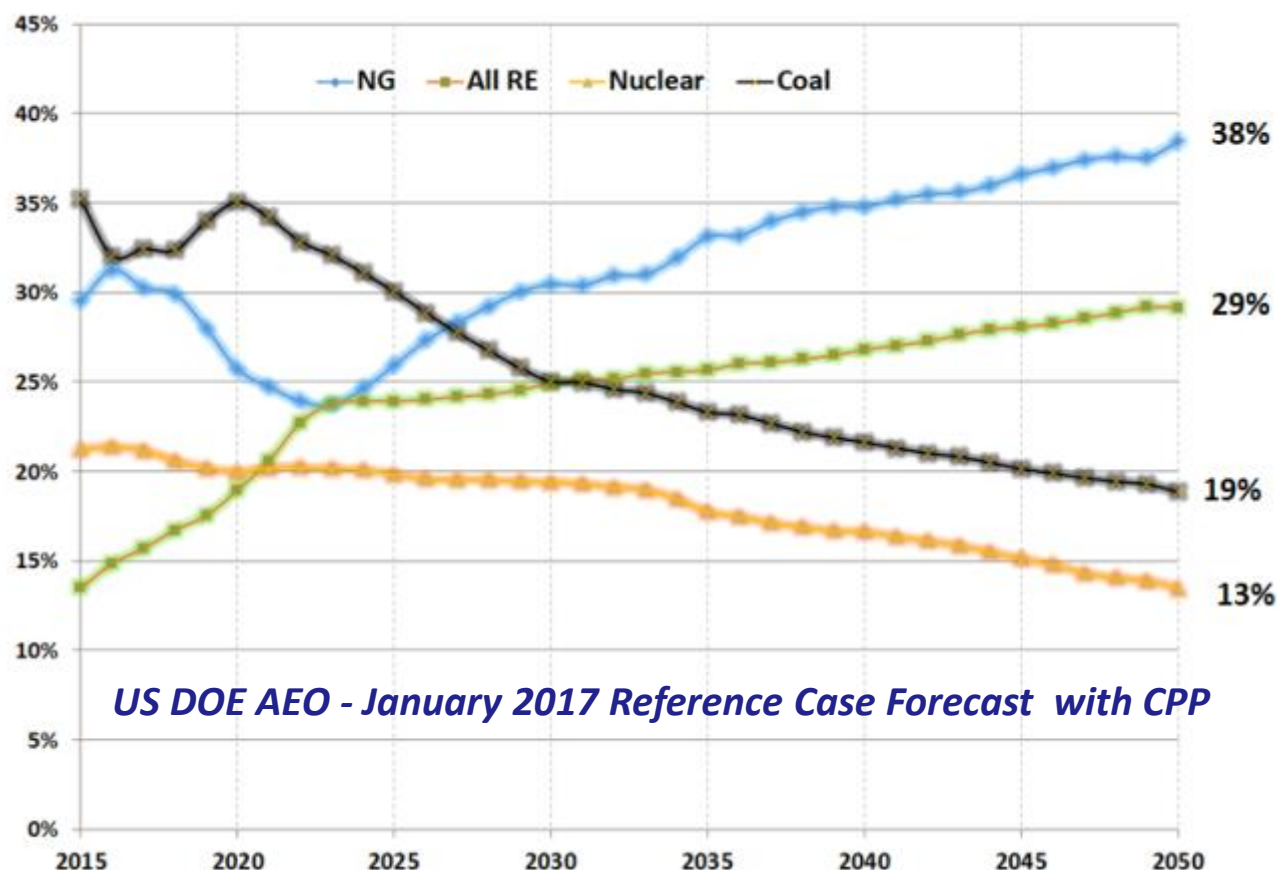
- While RE (wind and Solar/PV) are by far the fastest growing capacity resources, the Grid will continue to be dependent on fossil fuels well past mid-century for base load & peaking energy – even in California

Jan 17 forecast with CPP

- Latest EIA Forecast with CPP. Updated forecasts push fossil fuels higher than shown

2050 Forecast by Fuel

- Nuclear = 13%
- Coal = 19%
- Natural Gas = 38%
 - Simple cycle
 - Combined cycle
- All Renewable = 29%
 - Solar
 - Wind
 - Hydro
 - Biomass



US DOE AEO - January 2017 Reference Case Forecast with CPP

RE-THINKING CHP

Given the Industry Transition . . .

Re-thinking means answering these and other questions

- **Why Have Utilities Traditionally Viewed CHP as a Competitive Resource?**
- **How does CHP compare with Gas Combined Cycle and Other Base Load & RE Utility Supply Resources ?**
 - **Levelized Cost of Energy?**
 - **What Other Benefits are Available with CHP?**
- **Of the 82,000 MW CHP Installed Why do Utilities only own 2-3%?**
 - **How Can we Capture the Enormous Untapped Efficiency Potential of 150,000 MW Undeveloped CHP at Sites > 5MW**
- **CHP uses Natural Gas – How does CHP Emissions Compare with Other Resources ?**
 - **Coal, Gas SC, Gas CC, Wind and Solar PV**
- **How do the Risks of Building CHP Compare with Other Resources?**

Fast Facts About Combined Heating & Power

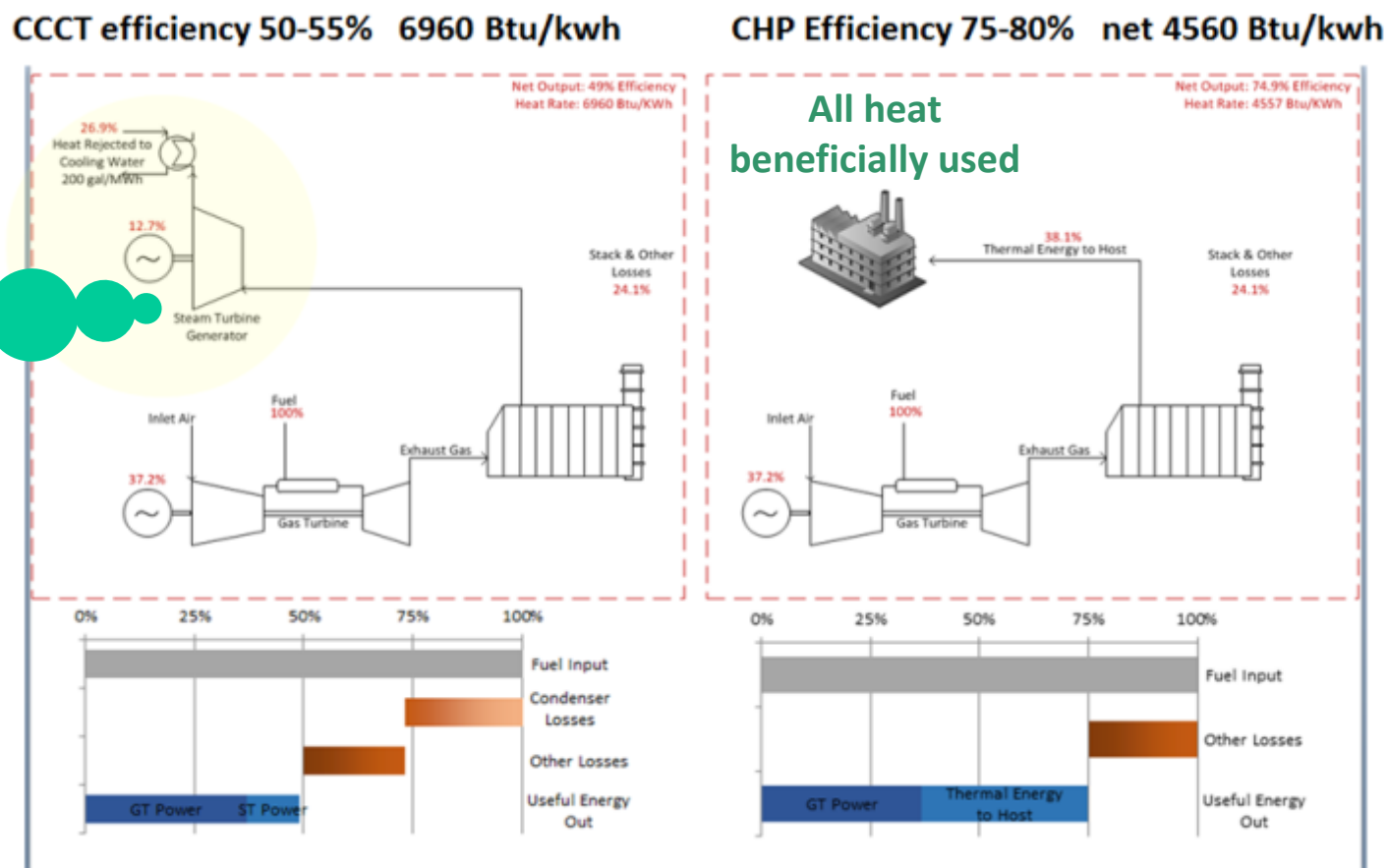
Properly Applied CHP is the Most Efficient Method of Generating Power on the Planet – Can achieve delivered efficiency of 75-80% HHV

- *50% more efficient than next best grid resource & lowest levelized cost of energy (LCOE) among any resource*
- CHP is based upon long proven GT/HRSG equipment (same as CC)
 - There is no technology curve to get up or cost curve to get down
- In addition to superior efficiency, CHP provides many additional benefits
 - Unloads Grid, Reduces Congestion and reduces T&D losses – supports higher penetrations of RE
 - Increased Resiliency from grid disturbances in our digital economy
 - Significantly reduces emissions and water use per MWh
 - Lowers Investment Risk / Must Faster Planning, Permitting & implementation
- And, CHP produces benefits on both sides of the meter
 - Lowers costs, Increased competitiveness for host /Customer
 - Increased local tax base, economic development & jobs

So How Can a 20 MW CHP have Lower LCOE than an 800 MW CC?

- It's Efficiency** -- Properly applied CHP is consistently more efficient with lower levelized cost of energy basis than any base-load resource including advanced CCCT

70 % of the latent heat in steam is exhausted to atmosphere in CC condensing cycle where this heat in CHP useful work in CHP applications



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Utilities and CHP – a Longstanding *Conundrum*

- **CHP is the Most Efficient Method of Generating Power, yet Traditionally Utilities do not even Evaluate CHP as an IRP Supply Resource**
 - Of 82,000 MW of CHP (8-9% of all MWh's generated) utilities only own 3% of total
- **Utilities have Viewed CHP as a *Customer Resource*, thus Competitive to Utility Supply . . .**
 - **Why? Customer builds & owns CHP – Utility loses load, revenue and income \$\$**
 - Lost “contribution to fixed costs” is spread to all other customers raising costs for all
 - 25 year NPV of lost ‘contribution to fixed costs’ from customer installing 20 MW CHP can be over \$55 MM (more than cost of building CHP)
 - In past, CHP seldom evaluated as a base load supply resource in IRP process – even though CHP is the most efficient method of generating power available
- **Understandably, most Utilities support CHP *intellectually*, many still take a *NIMBY* (not in my back yard) position – instead of evaluating the benefits available**
- **This is changing -- Duke Energy, FPU and others are now actively evaluating and incorporating CHP into their Resource Planning**
 - Evaluating *Portfolios* of CHP capacity to collaborate with customer and capture wider values for hosts and all customers

Barriers have Limited CHP Developments for Decades

Hurdles to Increased Use of CHP

- Financial uncertainty
- CHP cost and performance uncertainty
- Regulatory uncertainty
- Electric utility uncertainty
 - Utility goal is affordable and reliable power
 - Generally neutral to negative on CHP
 - CHP represents a loss of revenue to the utility and can result in the deferral of investment
 - This often results in unfavorable tariffs, drawn out interconnect and other roadblocks to CHP



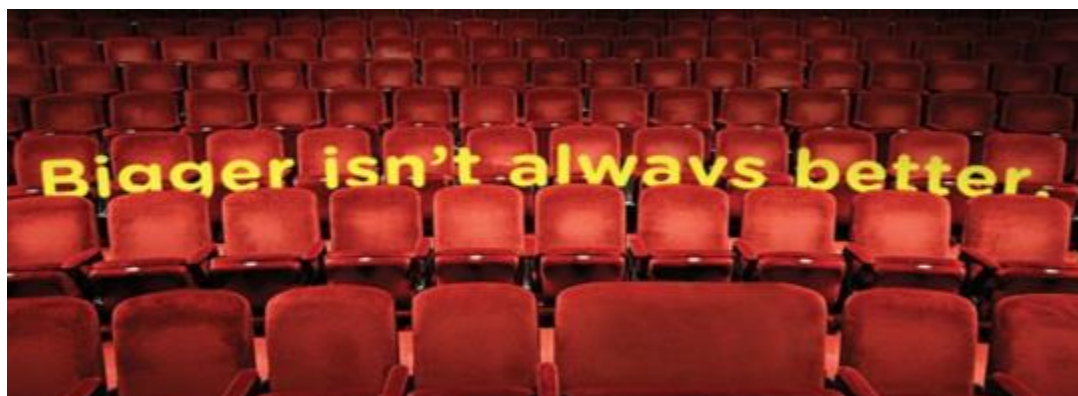
Policy actions can reduce perceived risks of CHP and expand the economic potential

- Possible federal policies
 - Continuation of investment tax credit
 - Include CHP as a qualified compliance option under the CPP
 - Federal procurement requirements
 - Encourage CHP participation in ancillary services markets
- Possible state policies
 - Include CHP as a qualified resource in energy efficiency resource standards and rate-payer efficiency programs
 - Standardized interconnection requirements
 - Reasonable standby rates
 - Consider utility ownership
 - Include as a CPP compliance option in state plans



- **Structural & investment hurdles have Kept Excellent CHP sites from being developed**
 - Industrial sector requires 30+% IRR after tax for non core business investment – Can't achieve this in many regions
 - Concern over spark spread / fuel risk over 20 - 30 year life cycle
 - Unfamiliarity with technology and O&M risks
 - Interconnection and Regulatory hurdles
 - Utility Tariff policies
- 82,000 MW of CHP in the US, but DOE Studies confirm over 150,000 MW undeveloped CHP potential remain of 5MW and larger sites
- Can supply base load power at efficiencies up to 50% better than next most efficient grid resource

RE-THINKING CHP AS A COLLABORATIVE - NOT COMPETITIVE BASE LOAD RESOURCE



- The 21st Century Grid will be more distributed, with smarter, faster to develop, cleaner and smaller resources than 20th Century Grid
- Utilities that do not evaluate and develop CHP as part of their Portfolio of supply and demand resources lose many benefits
- It starts with evaluating CHP as an IRP Resource and valuing benefits on both sides of the meter . . . Win / Win instead of the historic Win/Lose

Evaluating CHP in Utility Integrated Resource Planning

RE-THINKING CHP AS A COLLABORATIVE RESOURCE

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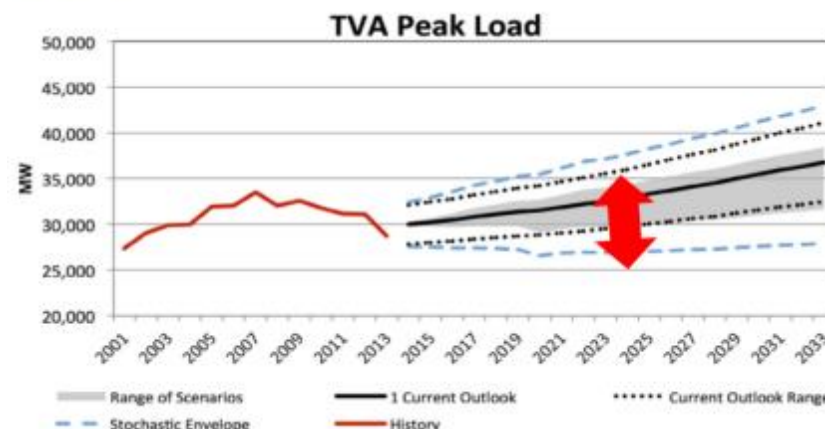
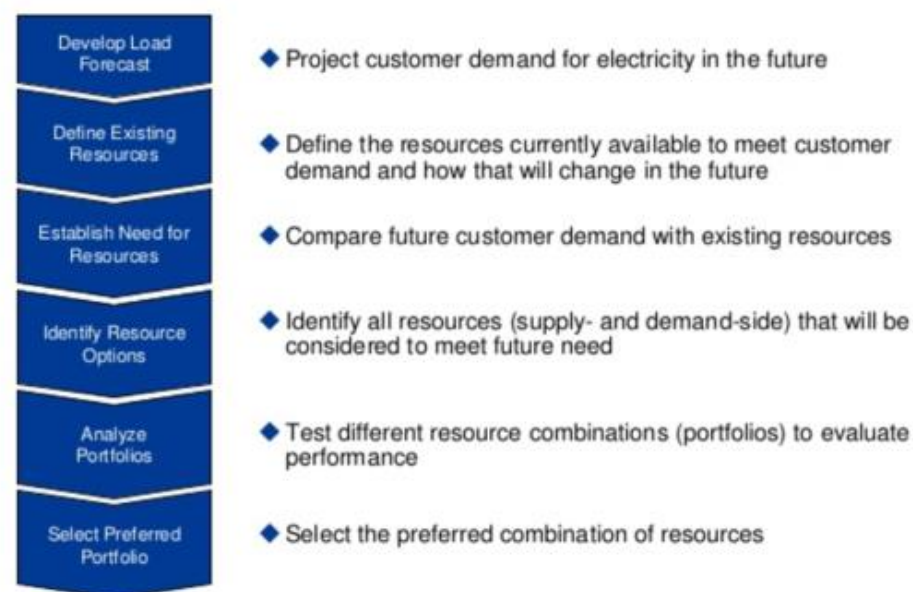


"Hold on, where's the forest again?"

Typical Electric Utility Integrated Resource Planning Process

- Most states require an IRP process evaluating both supply & demand solutions & technologies – they do not specify technologies to evaluate
- After demand forecasts are established multiple supply and demand side technologies are evaluated over life cycle 25-35 years
- Options are evaluated based on common criteria for all -
 - Fuel forecasts
 - Environmental regulations
 - Cost of capital/ depreciation
 - Fixed and variable O&M
 - Capacity factors
 - Reliability criteria

TVA The TVA Resource Planning Process Step by Step



Planning Results - Busbar Analysis of Dispatchable Resources (no CHP)

Figure 5.2.1 - Dispatchable Levelized Busbar Costs (2022 COD)

\$/kW-year for fixed costs or resource

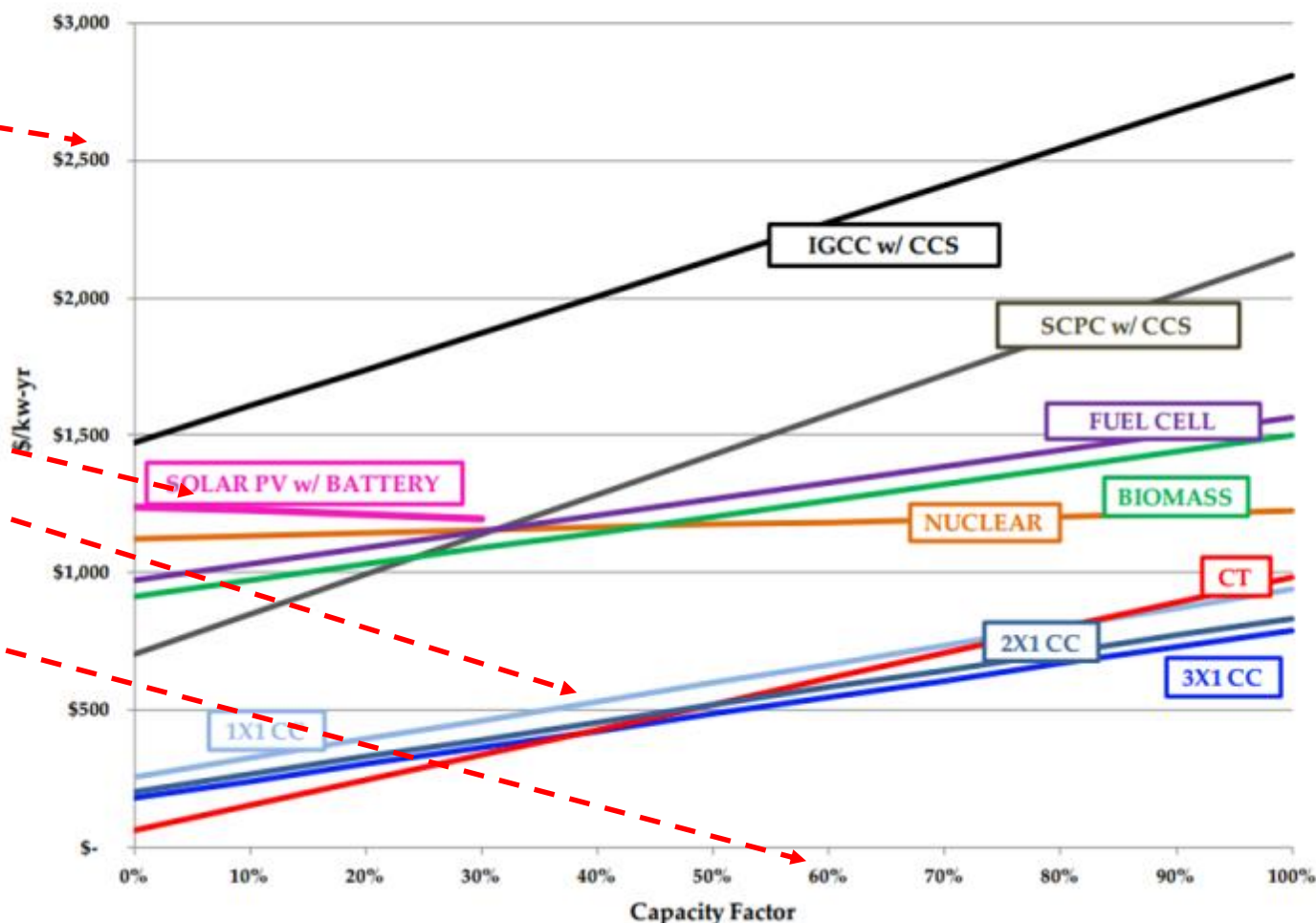
Slope of resource cost line is fuel + variable O&M forecasted over life

Capacity Factor

Simple Cycle CT is least cost up to 35% CF

CCCT is least cost for base load

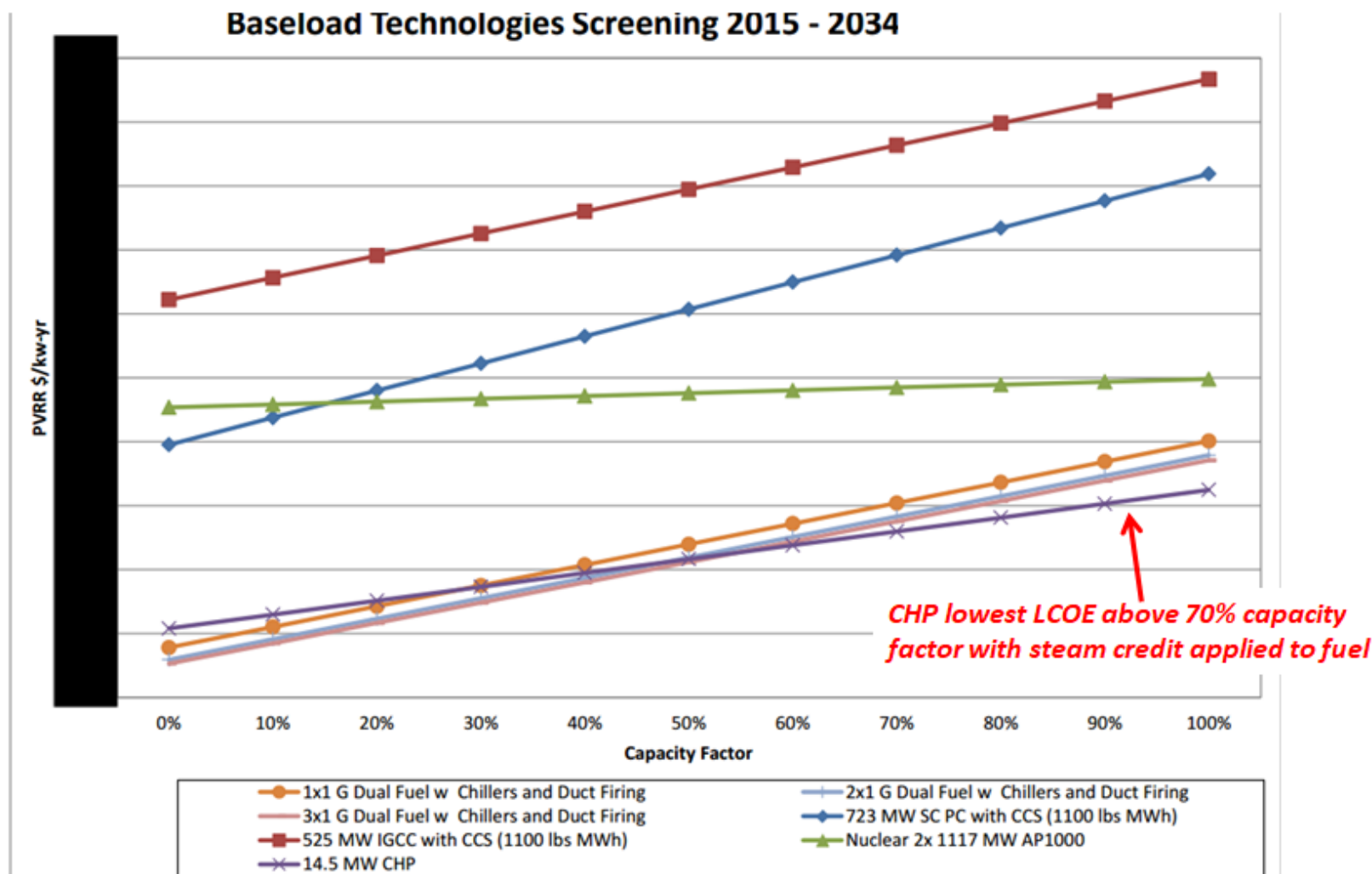
Utility Owned CHP not evaluated



Source: Dominion 2016 Integrated Resource Plan

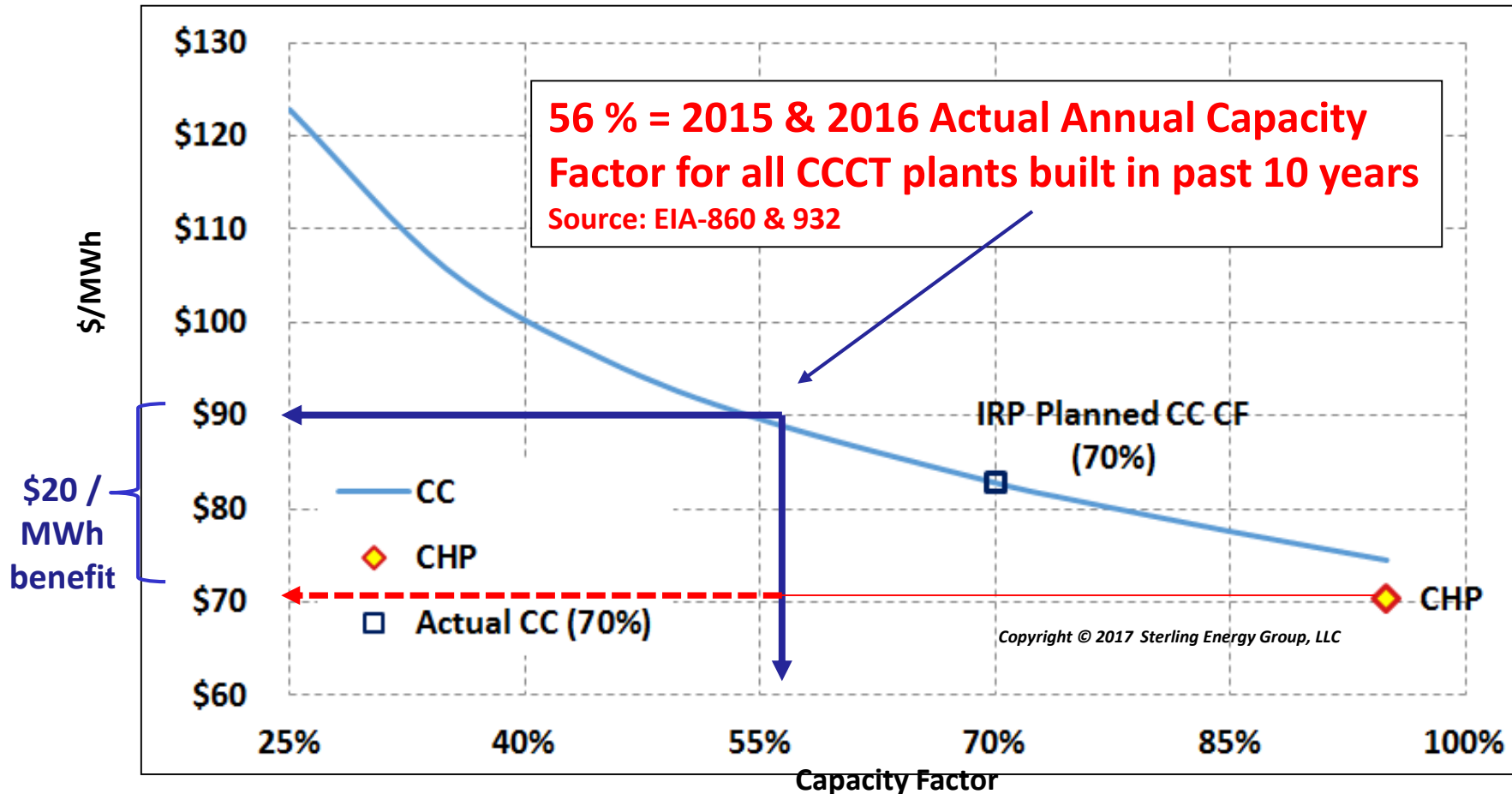
Duke Indiana IRP with CHP Evaluated

Duke Indiana 2015 IRP Public Version



A Closer Look - Levelized Cost of Energy Comparison

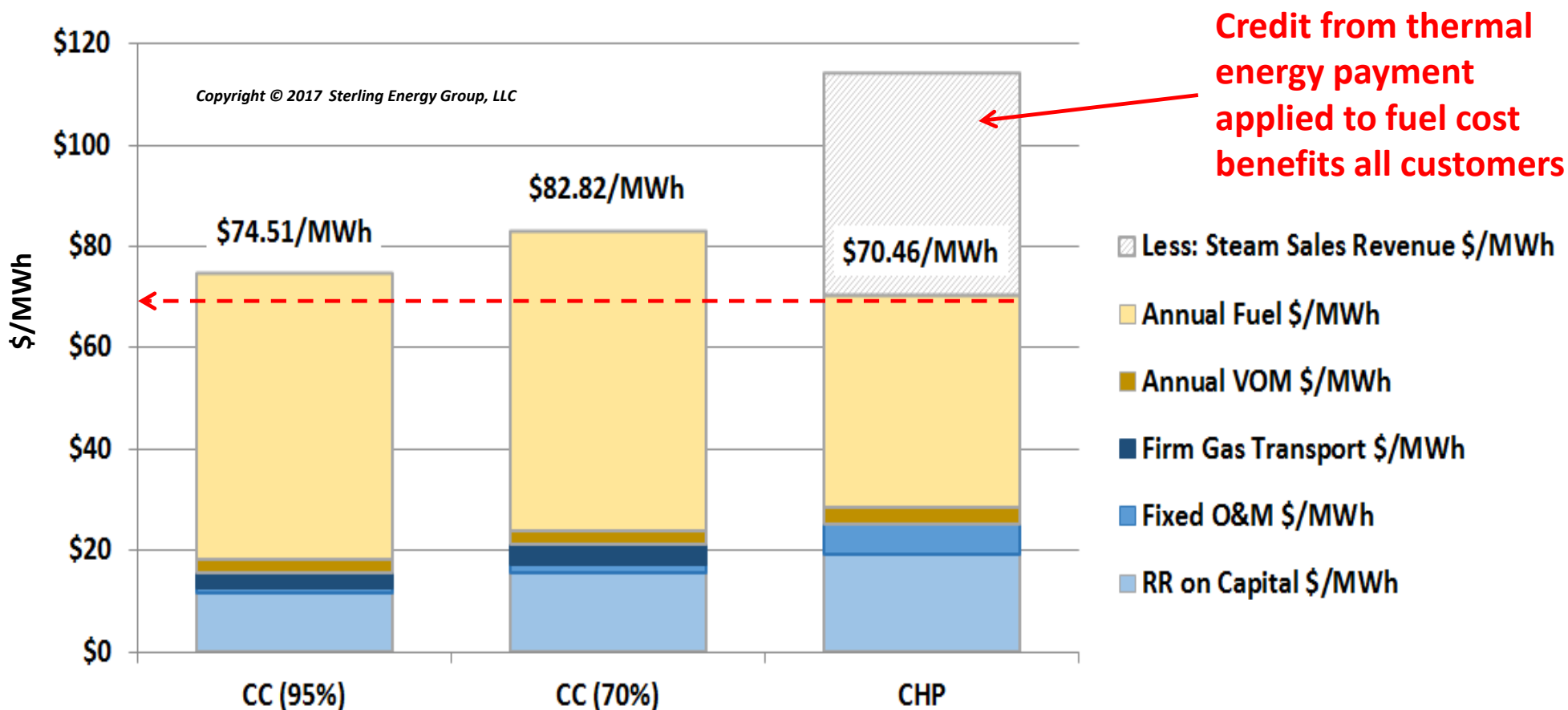
800 MW Advanced CCCT vs 21 MW CHP - with thermal credit to fuel



Notes: LCOE calculations are based upon standard IRP life cycle methodology, for cost of capital, depreciation F & V O&M taken from 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

Levelized Cost of Energy Comparison (life cycle)

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



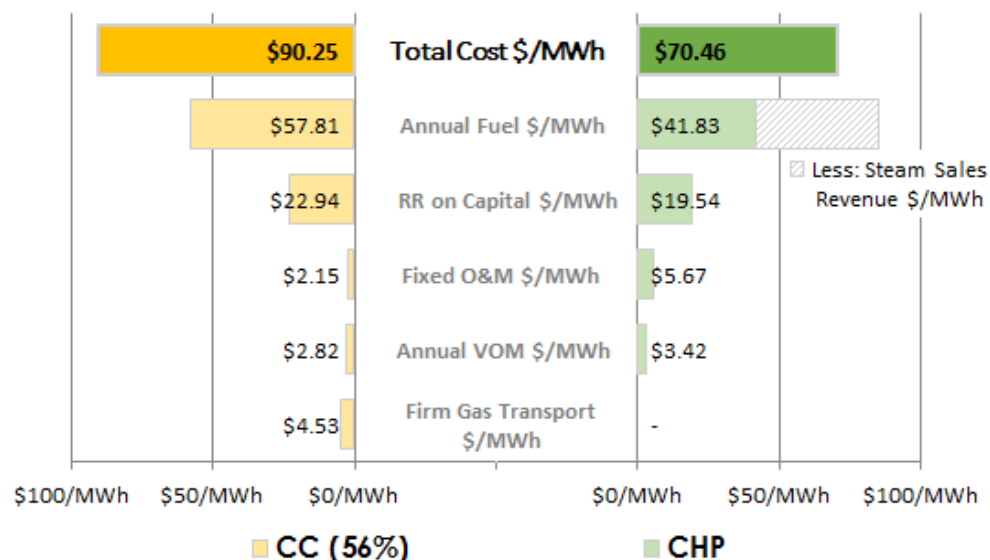
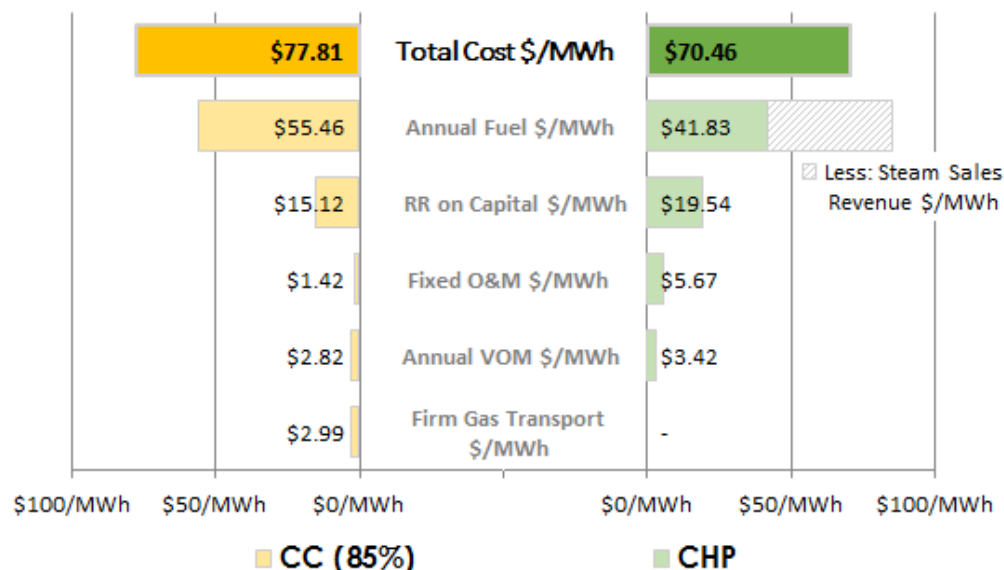
Notes: LCOE calculations are based upon standard IRP life cycle methodology, for cost of capital, depreciation F & V O&M taken from several published Utility IRP data and cost to construct CCCT and actual CHP plants costs. Capacity factors for CC are 95% and 70% with CHP 95%

Impact of Planned / Actual Capacity Factor on LCOE

Distributed Base Load Capacity is Built in Smaller Sizes

- CHP Benefit of \$7.36 / MWh at Planned CC CF of 85%
- Marginal fuel for CHP with thermal credit is ~ 14/MWh less than CC
- CHP Benefit of \$19.79 / MWh at Actual CC CF of 56%

Note: LCOE comparisons do not include T&D, environmental and customer benefits also available via CHP not via traditional central station supply

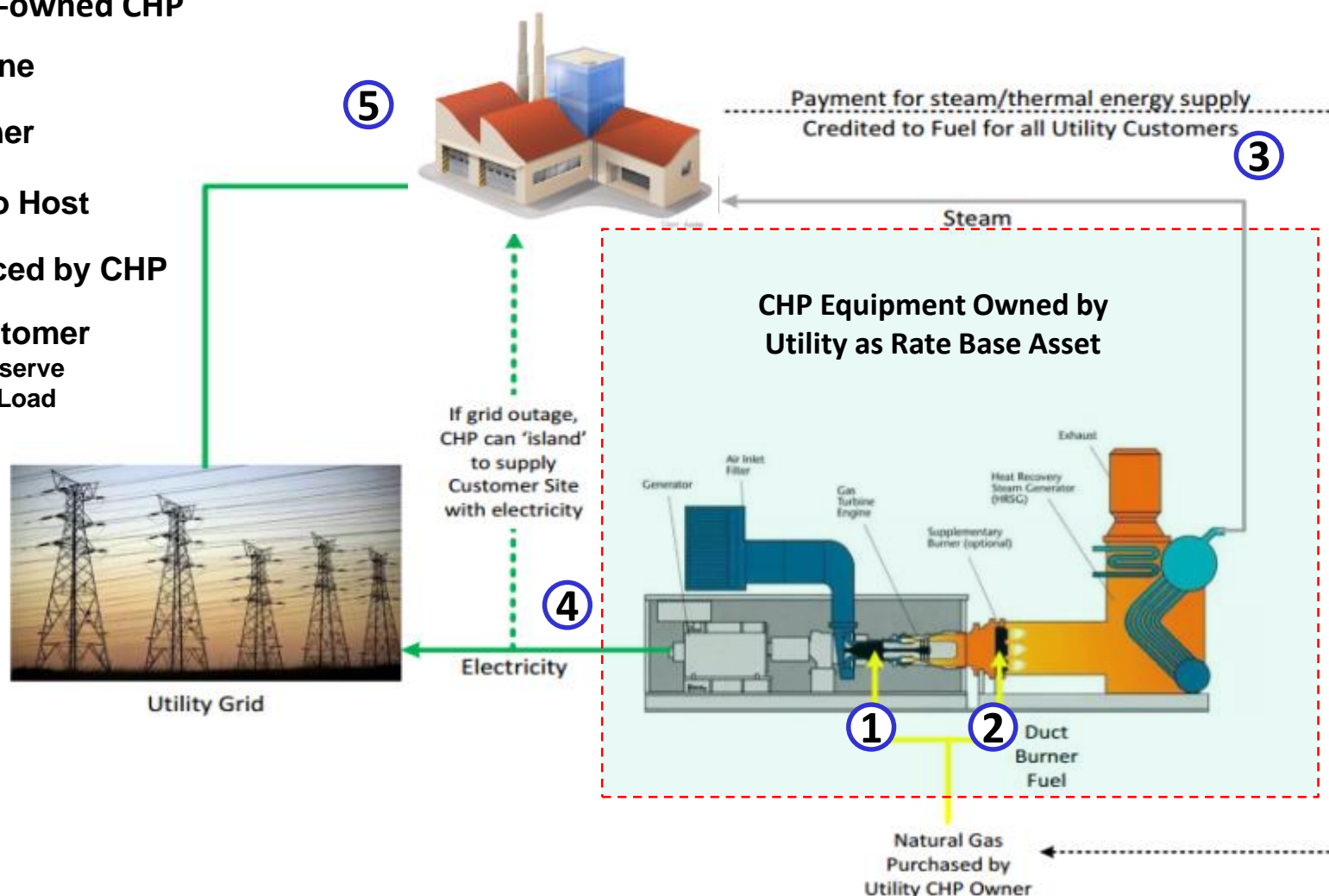


What does Utility-Owned CHP look like – Structurally?

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



Utility Ownership Model Eliminates Every Traditional Barrier to CHP

- **Utility Ownership Overcomes EVERY traditional barrier to CHP development**
 - Utilities want to make rate base investment for allowed ROE of 10-12%
 - Utilities have no fuel or spark spread risk – all fuel costs pass thru fuel clause with thermal/steam revenue credited to all customers
 - Utility handles both sides of electric and gas interconnections
 - No ‘standby or backup tariff’ impacts as CHP is a utility grid asset
 - No incentives or decoupling for lost revenue recovery required as with incentives
 - Utility continues to sell same MWh to host, with steam credit to fuel for all customers – no loss of revenue as with customer owned CHP
- *Helps Key Customers / Host be more Competitive in their Respective Markets*
 - Helps Create Jobs and increases competitiveness of highest load factor customs serving as thermal hosts
 - Expands Local Tax Base, Jobs and contribution to local economy
- *No Tax Credits or Other Incentives required to develop CHP as a least cost resource*

Enormous Untapped CHP Capacity Means Lost Efficiency & Resiliency

- CHP can be a Cleaner, More Efficient, Collaborative Solution for the Industry
- DOE studies confirm there are over 150 GW of undeveloped CHP potential of 5MW and larger – which can supply base load power at efficiencies up to 50% better than the next most efficient grid resource
- Developing just 2.5%/year of untapped potential over 5 MW size would add 50 GW & meet over half of future based load requirements at 40-50% efficiency gain in the Grid

Table III-1: Total CHP Technical Potential across All Facility Types

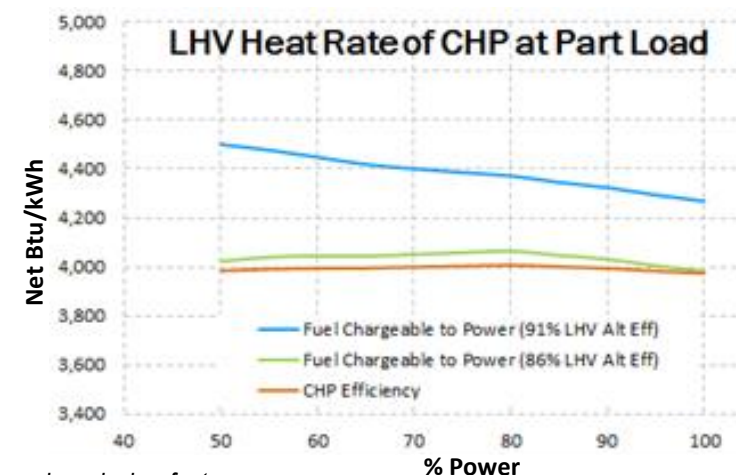
Business Type	50-500kW		0.5 - 1 MW		1-5 MW		5-20 MW		>20 MW		Total Sites	Total Capacity (MW)
	# Sites	Capacity (MW)	# Sites	Capacity (MW)	# Sites	Capacity (MW)	# Sites	Capacity (MW)	# Sites	Capacity (MW)		
On-site Industrial CHP	34,502	6,281	6,069	4,341	7,424	15,541	1,901	17,036	479	22,157	50,375	65,381
On-site Commercial CHP	185,625	20,068	37,939	18,100	15,535	20,284	1,084	9,452	174	8,026	240,358	75,930
On-site WHP CHP	332	73	132	95	341	868	204	2,003	96	4,585	1,105	7,624
Export Industrial CHP	na	0	na	7	na	3,929	na	11,535	na	65,578	na	81,048
Export District Energy CHP	0	0	0	0	5	18	8	75	51	10,567	64	10,660
Total	220,459	26,422	44,140	22,543	23,305	40,666	3,197	40,101	800	110,913	291,902	240,644

U.S. DOE CHP Deployment Program, 2016.

RE-THINKING CHP ENVIRONMENTAL BENEFITS

- Even though well documented, confusion remains around the environmental benefits of CHP . . . Statements such as:
 - *CHP gets dirtier as grid gets greener*
 - *Gas fired CHP would be worse for the climate than the Grid - When methane emissions are included a gas fired CHP could have a GHG profile up to 112% greater than purchasing from the Grid*
- Base loaded CHP displaces marginal (highest cost, least efficient, highest emission) grid resources not average resource – not Nuclear, Hydro or RE
- **Average Emission Rates CO₂ lb/MWh**
 - Coal = 2,167 CO₂ lb/MWh
 - Simple Cycle gas turbine = 1,403 CO₂ lb/MWh
 - Combined Cycle gas turbine = 935 CO₂ lb/MWh
 - Well applied CHP = 550-650 CO₂ lb/MWh

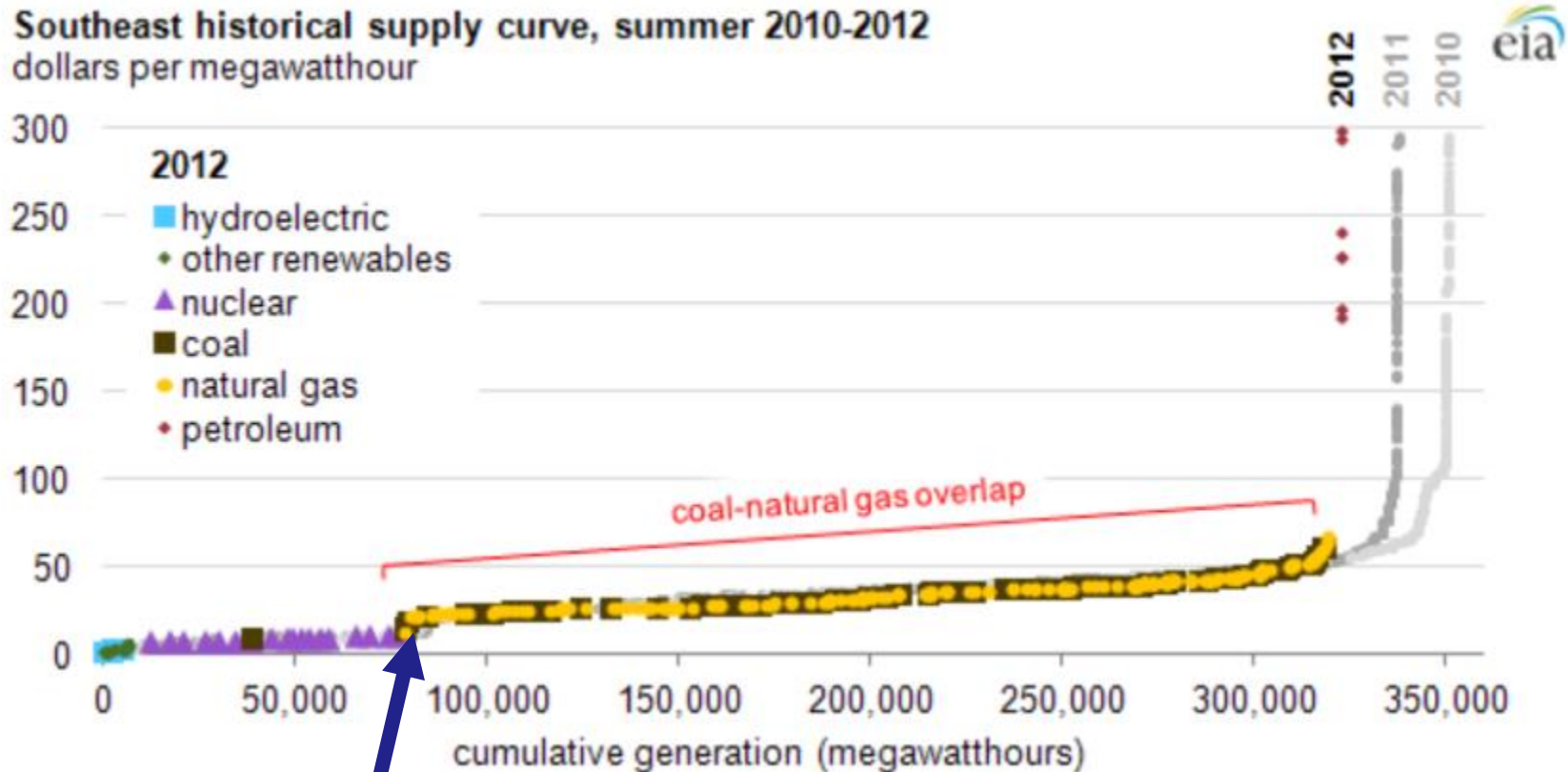
CHP can be dispatched down to 40% load with little impact on heat rate if needed



<https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors>

How the Electric Grid is Dispatched

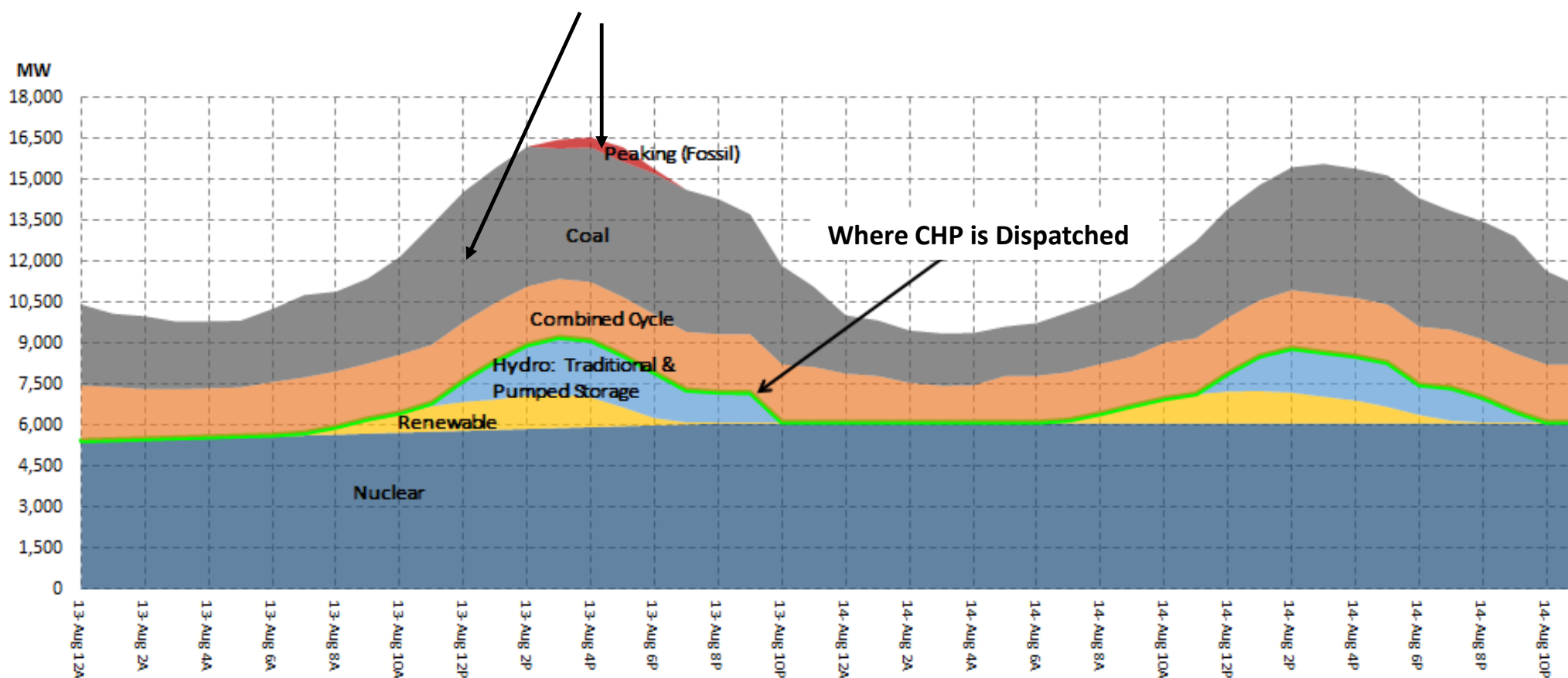
Representative Electric Grid Dispatch Curve



Base Loaded CHP is Dispatched Here just above Nuclear and Renewables but before other fossil - coal and gas turbines

Example of Daily Utility Dispatch with CHP included

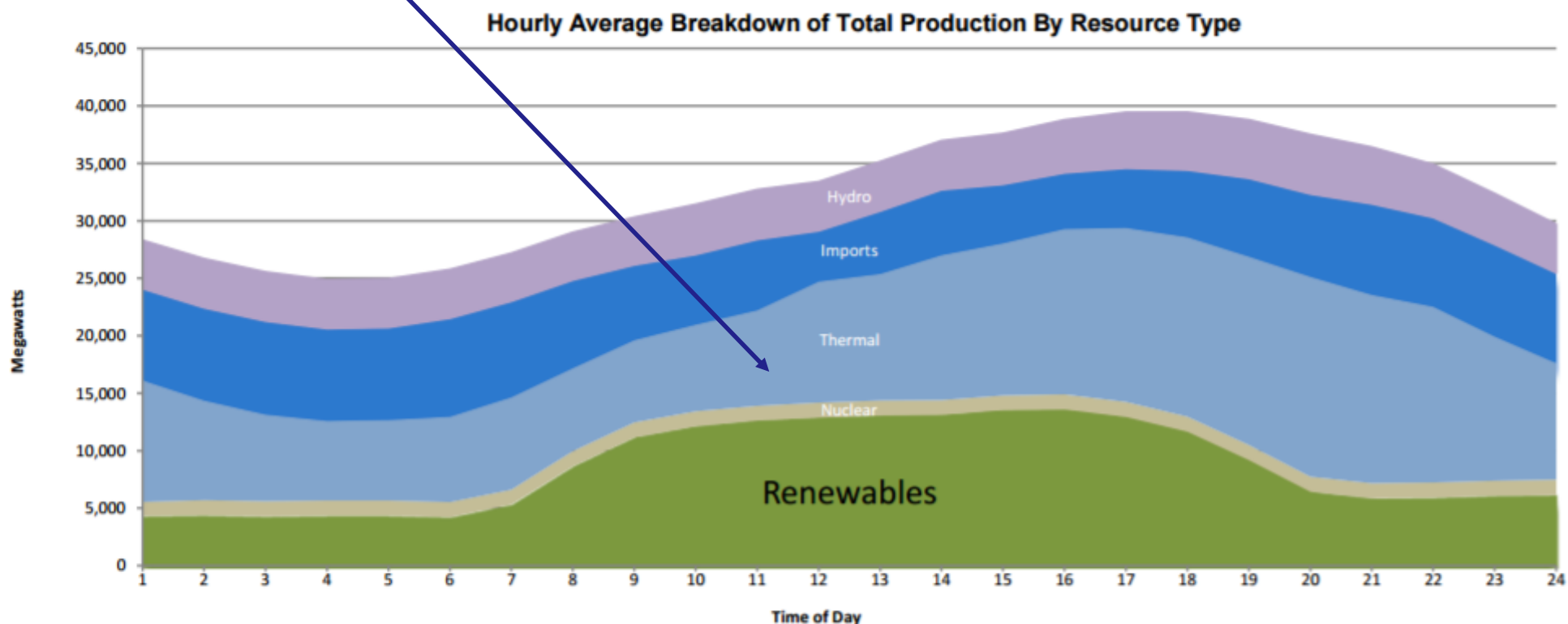
Coal is displaced all hours except 4 hours peaking gas on first day
 – 8760 hour dispatch shows no hours of year when Nuclear, RE and CHP curtailed



CALISO Dispatch Report for Friday June 23, 2017

California is dependent on fossil fuels from in-state and via interchange imports

Fossil thermal is displaced all hours of day – CALISO fuel forecast 2030, 22% fossil



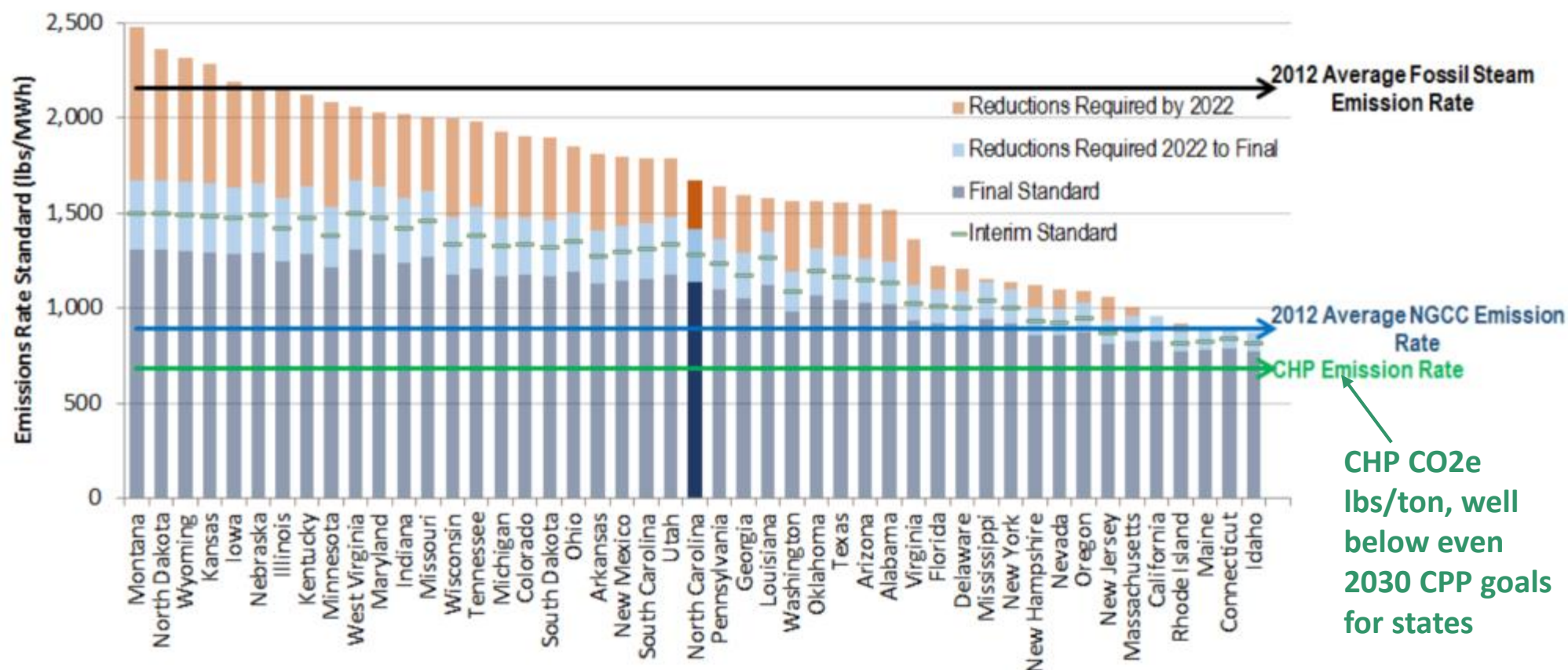
This graph depicts the production of various generating resources across the day.

source: http://content.caiso.com/green/renewrpt/20170623_DailyRenewablesWatch.pdf

A Quick Snapshot on CHP Emission Benefits Nationally

CHP Reduces Grid Emissions Even as RE Penetration increases

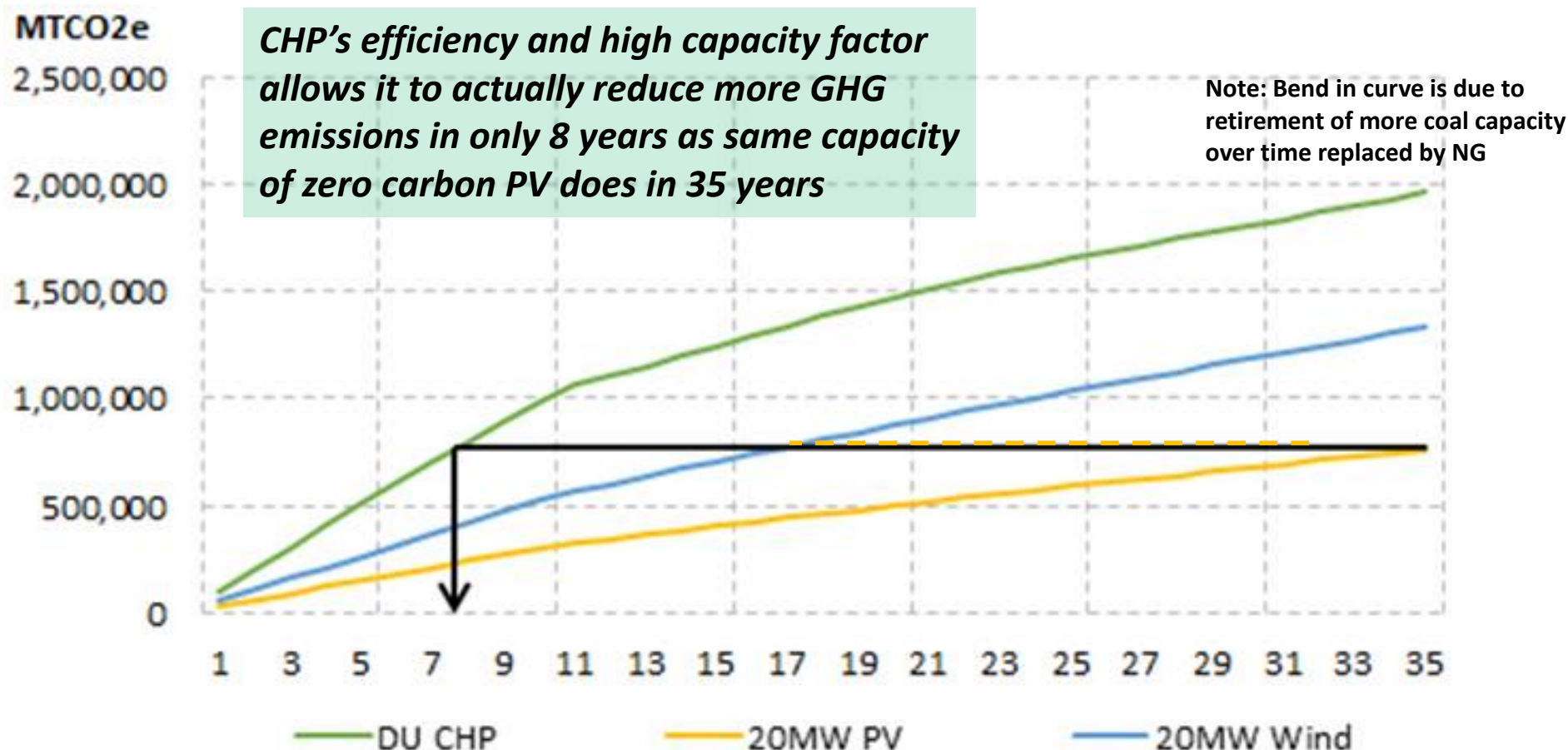
Dispatch studies demonstrate, CHP is a base load resource that sits on top of Nuclear & RE in dispatch order, always displacing highest fossil unit



Adapted from "The Clean Power Plan; Focus on Implementation and Compliance", January 2016, by The Brattle Group

Life Cycle Emission Benefits of 20 MW Capacity

natural gas fired CHP topping cycle, PV and Wind Capacity



Calculated using actual dispatch model results beginning 2020 for DEC North Carolina, demonstrating specific unit emissions displaced by year
Capacity Factors: 95% for CHP, 22% for PV, and 34% for Wind



Take Aways . . . Rethinking CHP

- **Industrial /Institutional Energy Users with continuous thermal loads**
 - If ‘inside the fence’ CHP does not work, talk to Electric Supplier about Collaborating on a CHP project -- can be least cost & add values on both sides of the meter
 - Evaluate heat and power balance and determine fit
- **Utilities**
 - Identify customers with continuous thermal loads and evaluate CHP as part of IRP resources – develop as part of base load supply
- **Regulators**
 - Ensure all utilities evaluate Utility owned CHP as a supply resource side by side with other base load technologies
- **Equipment Suppliers or ESCOs**
 - Where ‘inside the fence’ CHP does not work, review project with local utility for their participation . . .

Utility Ownership of CHP – Case Overviews

FLORIDA PUBLIC
UTILITY

RAYONIER
Advanced Materials



Operating since July 2016

DUKE
ENERGY

CLEMSON
UNIVERSITY



In Development

DUKE
ENERGY

Duke
UNIVERSITY



In Development

Clemson University / Duke Energy 21 MW CHP in Development

For Duke Energy Carolinas

- 16 MWe to Duke Energy grid and ~ 60 kpph steam to campus @ 94-95% CF
- Clemson University steam payment applied back to fuel for all Duke Energy customers making CHP least cost resource
- May help avoid future grid upgrade in Durham region

For Clemson University

- Increased energy security & resiliency of campus power supply with 16 MW CHP on campus designed for seamless islanding with Grid
- Eliminates need and significant cost of building second utility service point for growth and resiliency
- Permits aging steam plant facility to be closed in future with premier site repurposed for University needs



Duke University / Duke Energy 21 MW CHP in Development

For Duke Energy Carolinas

- 21 MWe to Duke Energy grid and ~ 80 kpph steam & hot water to campus @ 94-95% CF
- Duke University steam payment applied back to fuel for all Duke Energy customers making CHP least cost resource
- May help avoid future T&D upgrade in Durham region

For Duke University

- Increased energy security & resiliency of campus power supply
- 20 MW CHP on campus capable of serving 'critical' loads if major grid outage occurs (hospital, life safety)
- Lower cost of steam saving \$1-2MM annually



For Duke University, continued

- Reduced campus emissions
- ***University working on plan to deploy Directed Biogas in CHP to reduce methane emissions & GHG associated with Eastern NC swine industry and drive emissions lower – University will own/retire RECS***

Source of University benefits: Report by Duke University Facilities Management Group Oct 2016

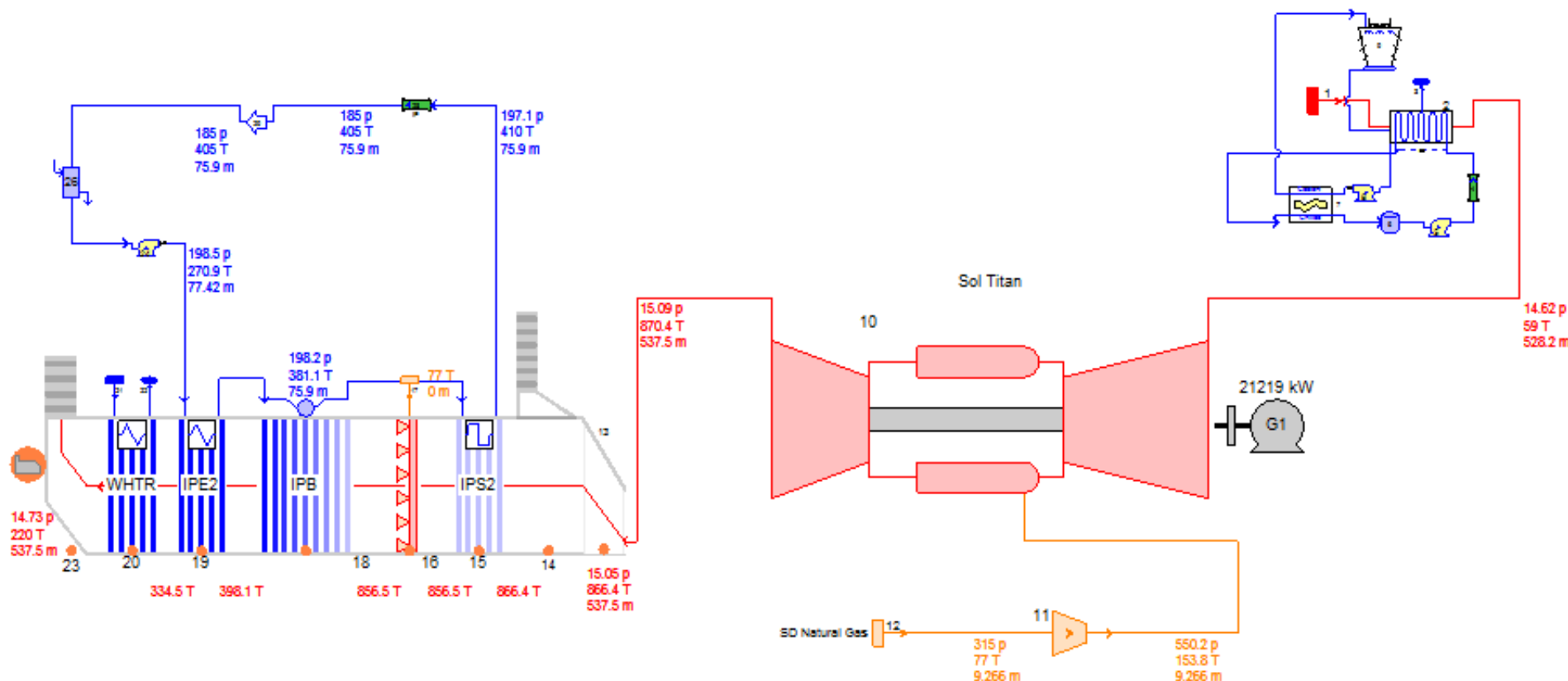
Florida Public Utilities/Eight Flags 21.7 200 kpph CHP Located at Rayonier Advanced Materials host for steam/hot water



- Construction Team Mobilized July 2015
- Gas Turbine & HRSG arrive Nov & Dec 2015
- Commercial Operation: June 30, 2016
- CHP Operated at 98.4% Availability past eleven months
- \$40MM Investment by Utility with Long Term Steam /Land Agreement RYAM
- Zero Investment by RYAM

Heat Balance: FPU – Eight Flags CHP

21 MWe / 76 kpph unfired / 200kpph fired 160 psig steam & 550 gpm water from 80 to 155F



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

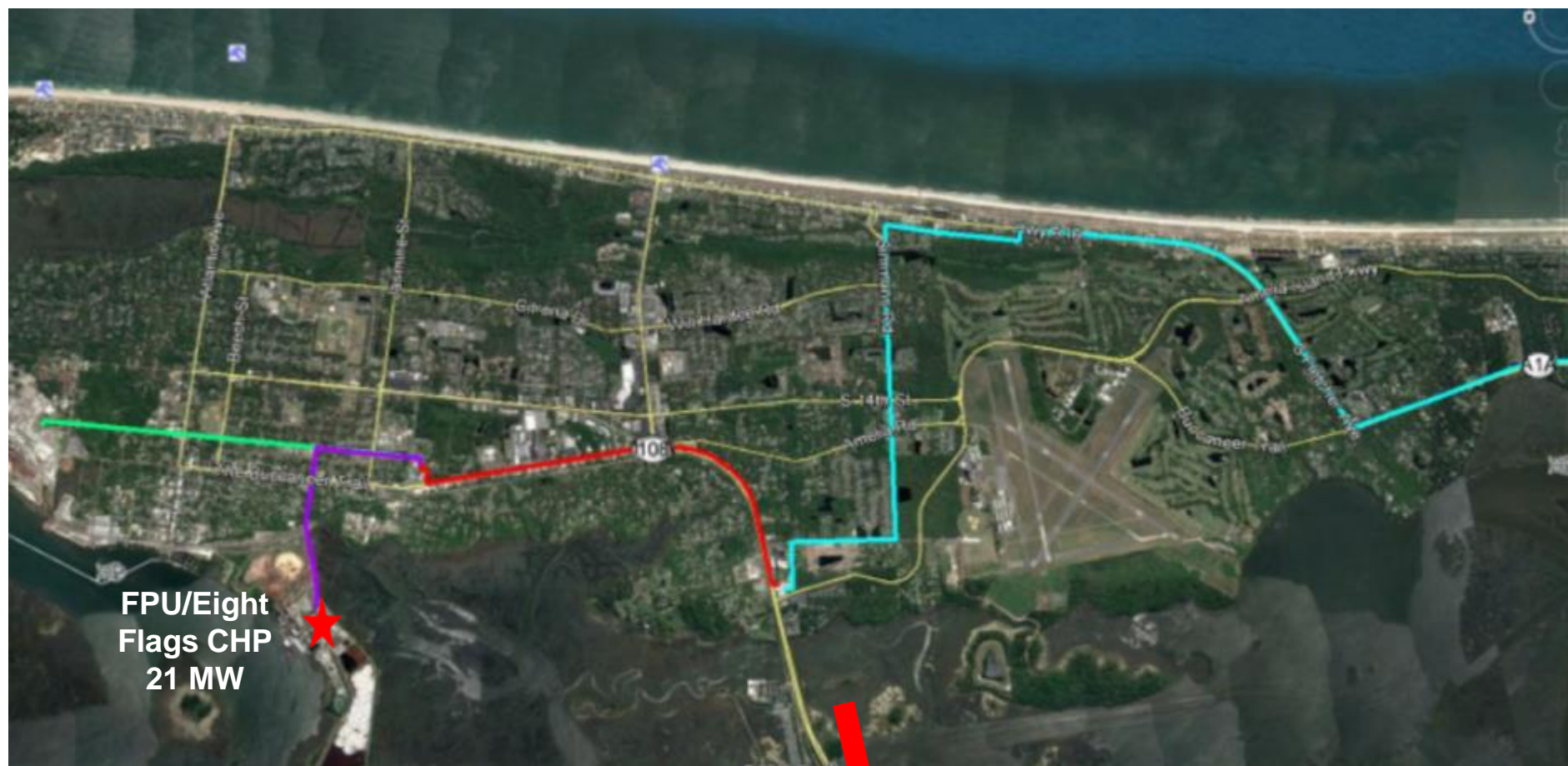
Total Thermal output: 26.2 MW 89.6 MMBtu/hr
Heated Water: 4.5 MW 15.4 MMBtu/hr

Benefits to FPU and their Customers/Community

- Lower electric cost to customers than alternatives
- *Increased reliability with on-island generation designed to survive CAT 4 storm surge*
 - *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 CO₂ Reduced > 100,000 MTCO₂e/year
- Over 5000 Dth/day natural gas base load for FPU
- On line within 24 months from approval, construction < 12 months
- Adding 5 MW and 10,000 Dth/day NG gas load from RYAM expansion

CHP Establishes “Microgrid” 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



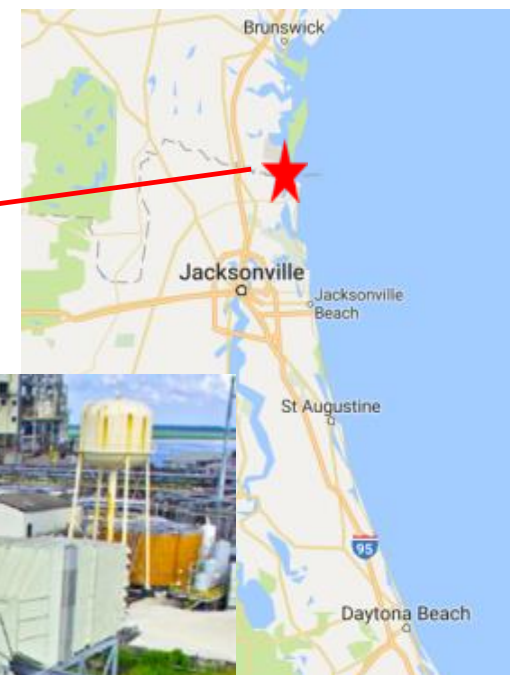
Nearest Generation ~ 30 miles south

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 major expansion**
 - **RYAM Board approved \$125 MM expansion at site – announced December 2016 to be operational Spring 2018**
 - **Adding 50 permanent jobs plus over 100 construction jobs**
 - **Projected \$28MM/year in economic benefits to NE FL economy**
 - **Increased local tax base**

FPU / Eight Flags / Rayonier Case Overview

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

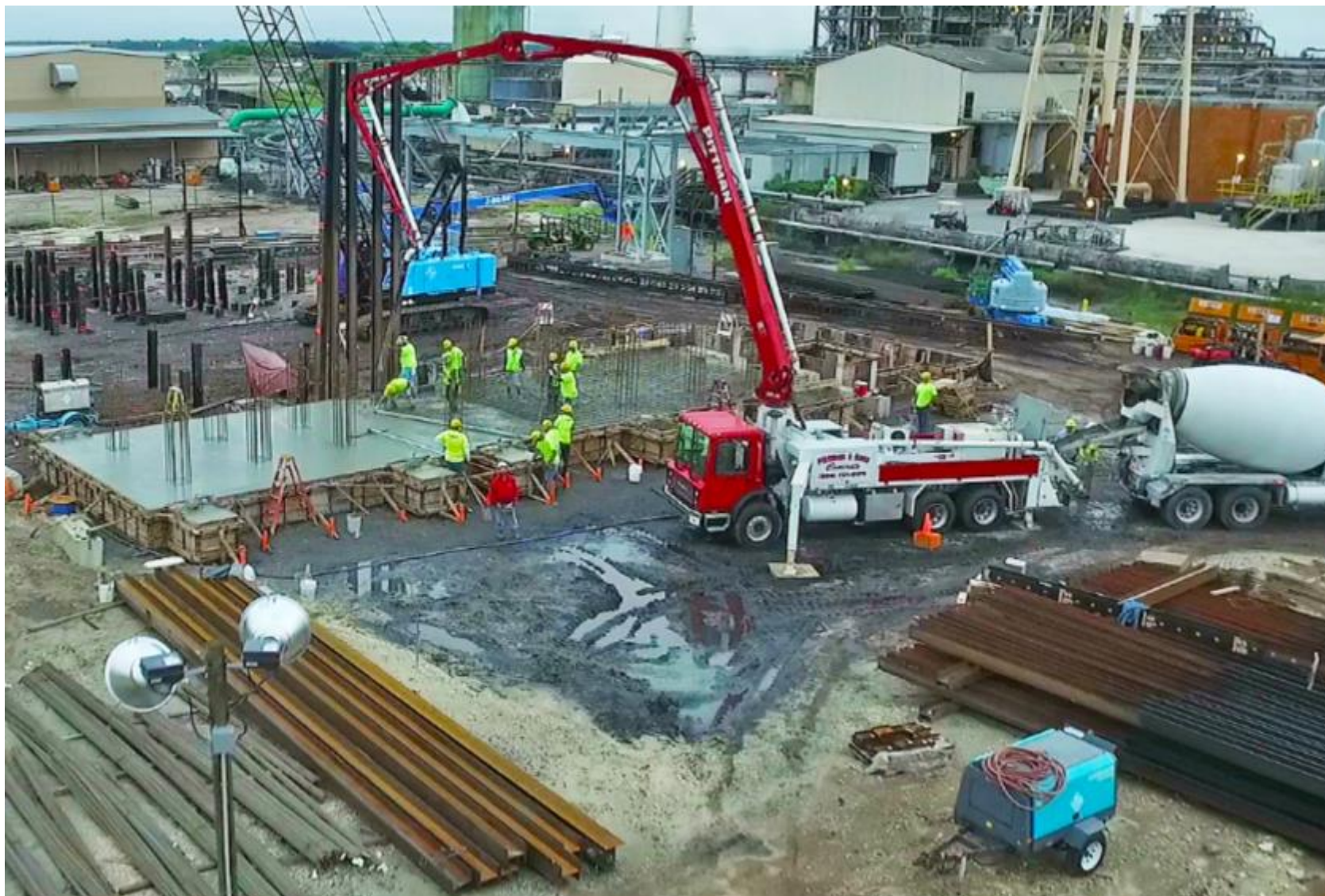


The Process: Piling installation began July 2015



Turbine Platform Foundations

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



Turbine platform

Isolating vibrations for 65 Ton Gas Turbine and 72 Ton Generator



Setting the Solar Titan 250 gas turbine next to generator



Elevation for
Storm Surge
Protection

Advanced Structural Design for Foundations

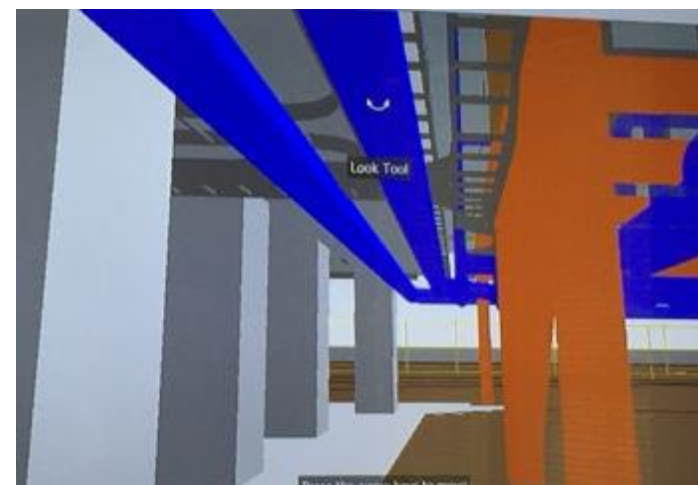
Setting Solar Turbines Titan 250 on platform next to Generator 21 MW CHP Constructed in less than One Year



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 CO₂

Built on Elevated Platform 10' Over Grade for CAT 4 Storm Surge

space under platform used for Parts room & Storage



800' Pipe Bridge tying to Rayonier Mill

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



Titan 250 21.7 MW gas turbine on platform

Operated since July 2016 with 98.4% availability



Site Overview & Control Room Operations



Project Overview video's located at:

<https://youtu.be/1UaNWrRBMpo>

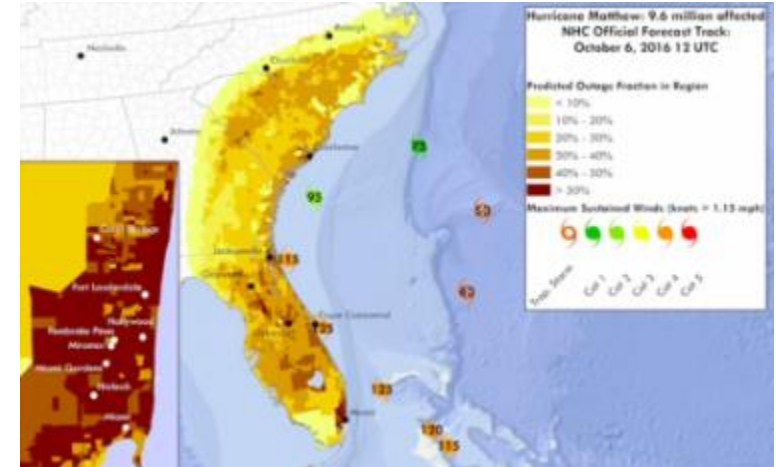
<https://youtu.be/MFTDwDwR7ok>

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
Even though water over berm to base of CHP Platform



Comments by Art Graham – Chairman of Florida Public Service Commission Demonstrating Regulatory 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>

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.”

What Others are Saying about Project . . .

Posted December 9, 2016 02:41 pm | Updated December 9, 2016 03:37 pm

By Roger Bull

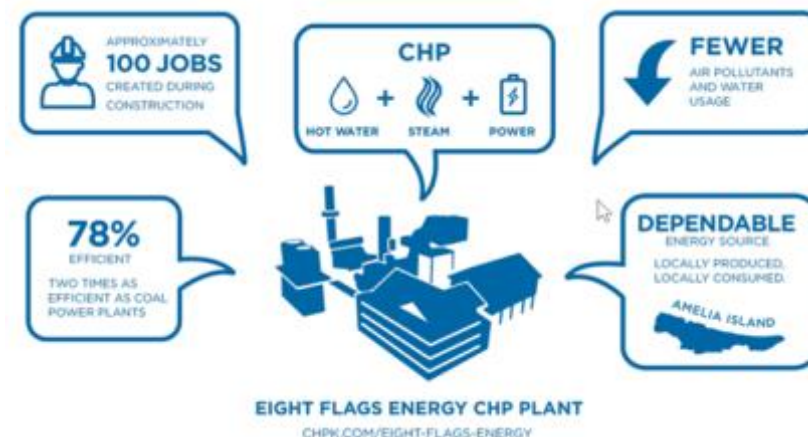
Rayonier Advanced Materials plans new venture with 50 new jobs in Fernandina Beach

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.

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.



Thanks for your Time . . .

RE-THINKING CHP

- **Questions**

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