Opportunities for Industrial Efficiency in the Commonwealth

Virginia Energy Efficiency Council
The Alliance for Industrial Efficiency
Siemens
WGL Energy

February 28, 2017

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VIRGINIA ENERGY EFFICIENCY COUNCIL

Who is VAEEC?

A broad coalition of businesses, utilities, local governments, universities, and nonprofits working to assess and support programs, innovation, best practices and policies that advance energy efficiency in Virginia while providing a forum for stakeholder interaction.

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Moderator

David Steiner

President, D+R International

Board Chair, Virginia Energy Efficiency Council

David Steiner serves as Chair of the Virginia Energy Efficiency Council. He is President of D+R International, Ltd., which has been instrumental in the support of innovative program design for energy efficiency adoption over its 30-year history. The company focuses on high quality data that brings greater understanding of energy efficiency opportunities and ultimately capture of energy savings. David also serves on the Town of Vienna's Community Enhancement Commission.

D+R International

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Speakers

Jennifer Kefer

Vice President, David Gardiner & Associates
Executive Director, Alliance for Industrial Efficiency

Dalia El Tawy

Senior Marketing & Business Development Manager, Siemens

Charles Miller

Manager, Distributed Generation Asset Development, WGL Energy

Agenda

- ➔ Overview of CHP/WHP
  - ◆ Importance of the industrial sector
  - ◆ Benefits of CHP
  - ◆ Scale of the opportunity and state of the market
- ➔ Examples of CHP/WHP
- ➔ Virginia: programs and barriers
- ➔ Examples of CHP elsewhere
- ➔ What more needs to be done to get CHP/WHP in Virginia

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Jennifer Kefer

Executive Director

Alliance for Industrial Efficiency

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About the Alliance

The Alliance for Industrial Efficiency promotes state and federal policies to support U.S. manufacturing competitiveness through enhanced industrial efficiency. Our diverse coalition of businesses, labor groups, and non-profits work to improve energy efficiency in America's industrial sector. The Alliance is a project of David Gardiner & Associates.

Agenda

- ➔ Importance of the industrial sector
- ➔ Benefits of CHP
- ➔ Scale of the opportunity and state of the market

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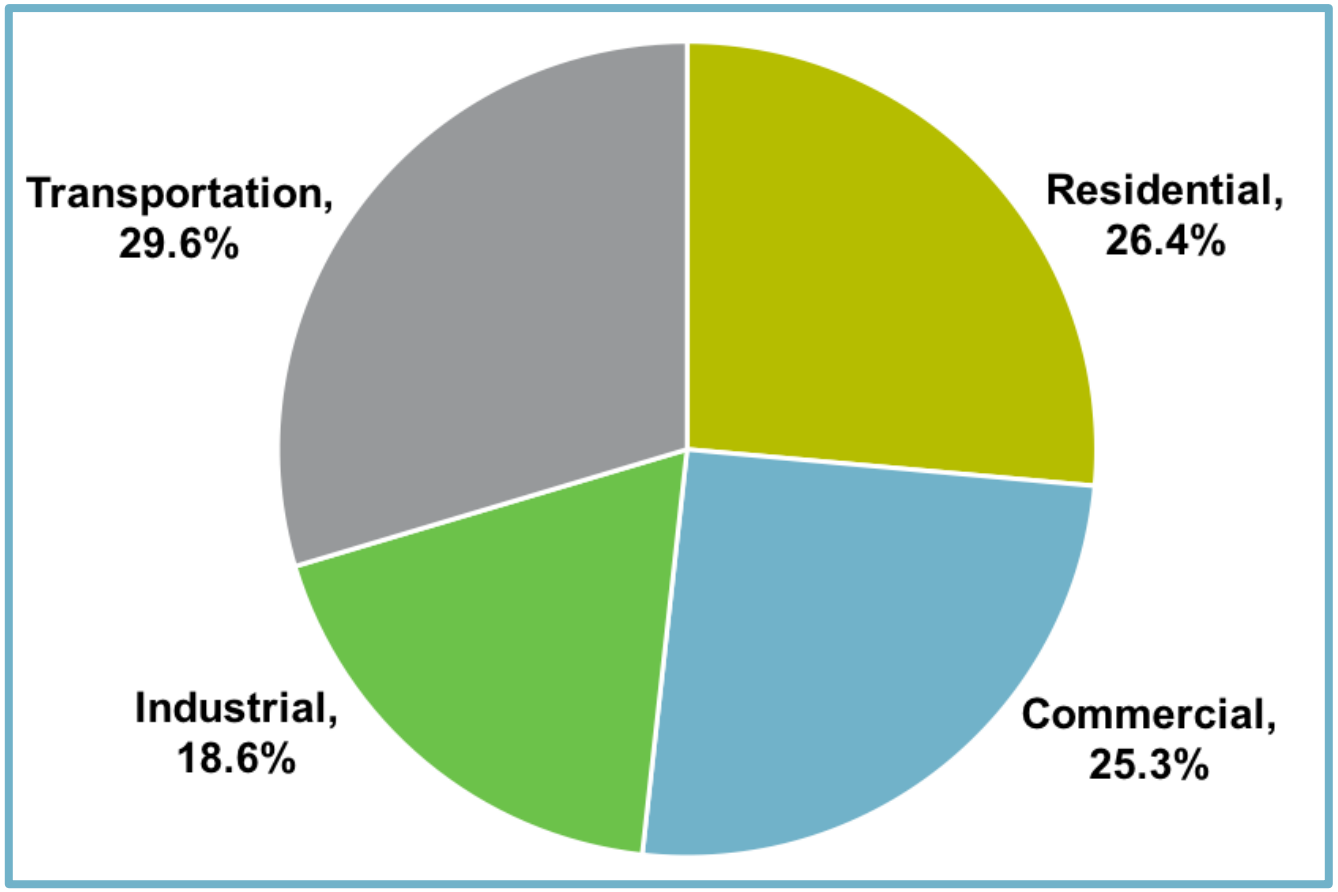
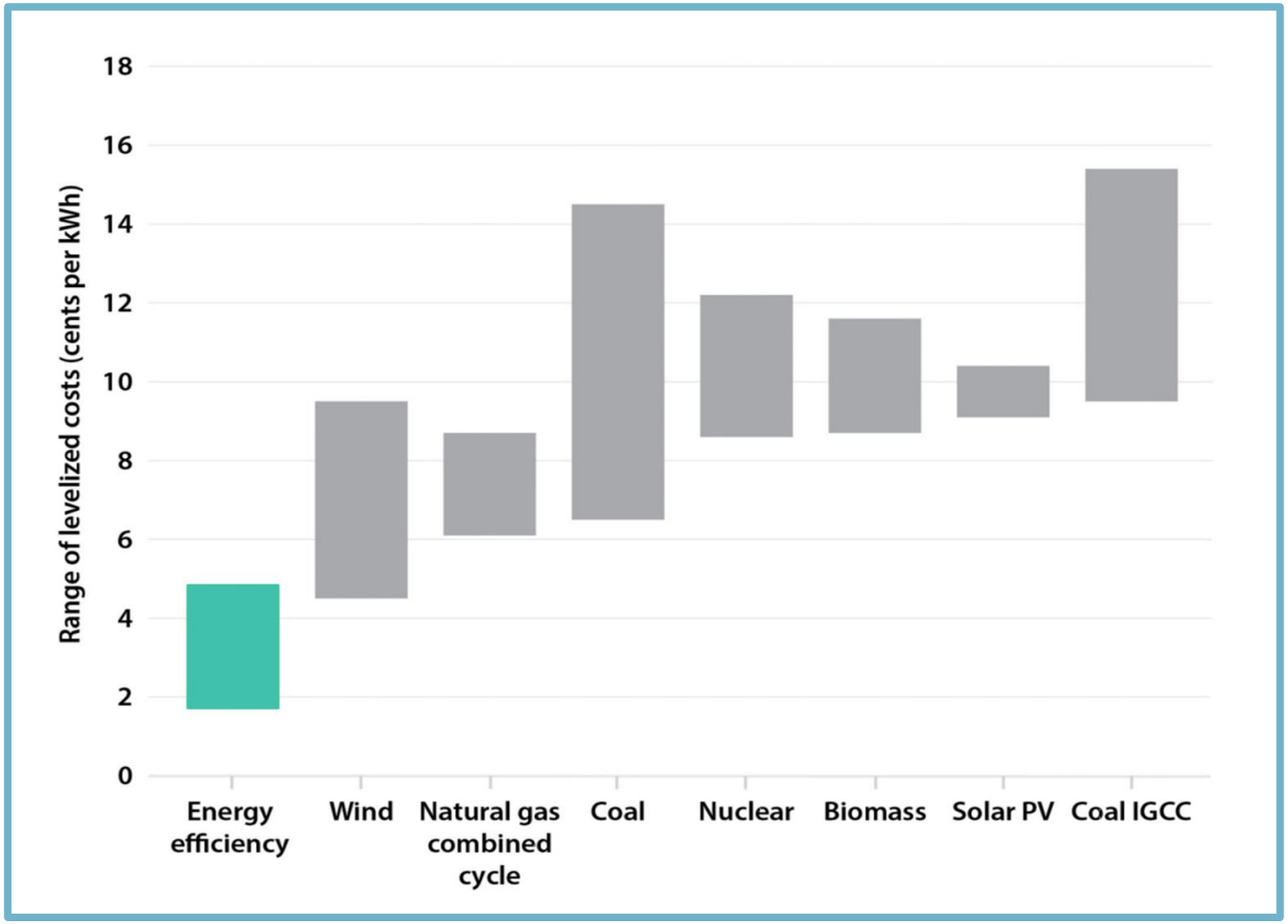
Virginia Energy Use by Sector



Source: EIA 2016

Energy Efficiency Keeps Bills Down



Source: ACEEE 2014

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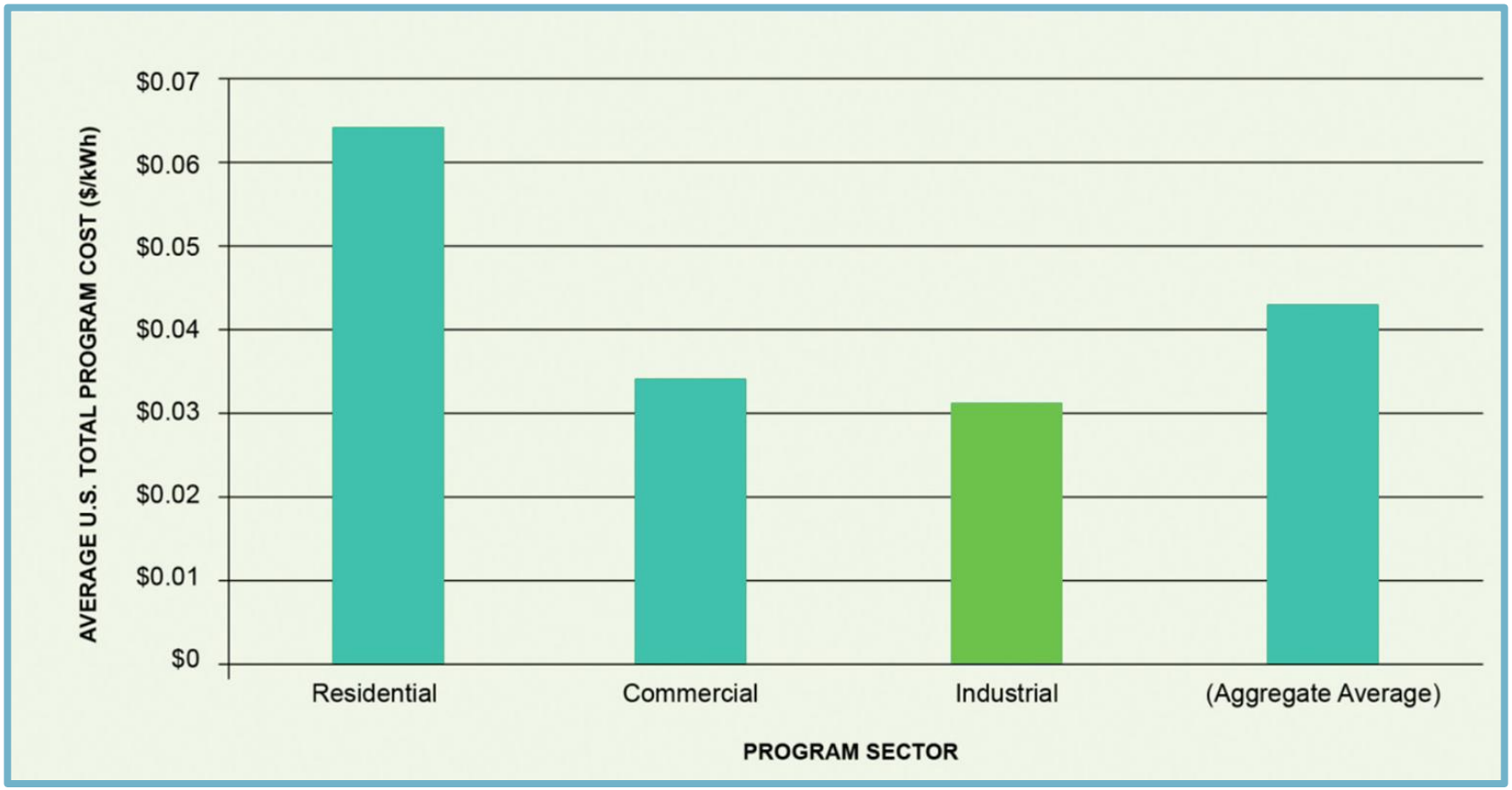
Industrial Efficiency Is the Cheapest Source of Efficiency



Source: Aden et al. 2013

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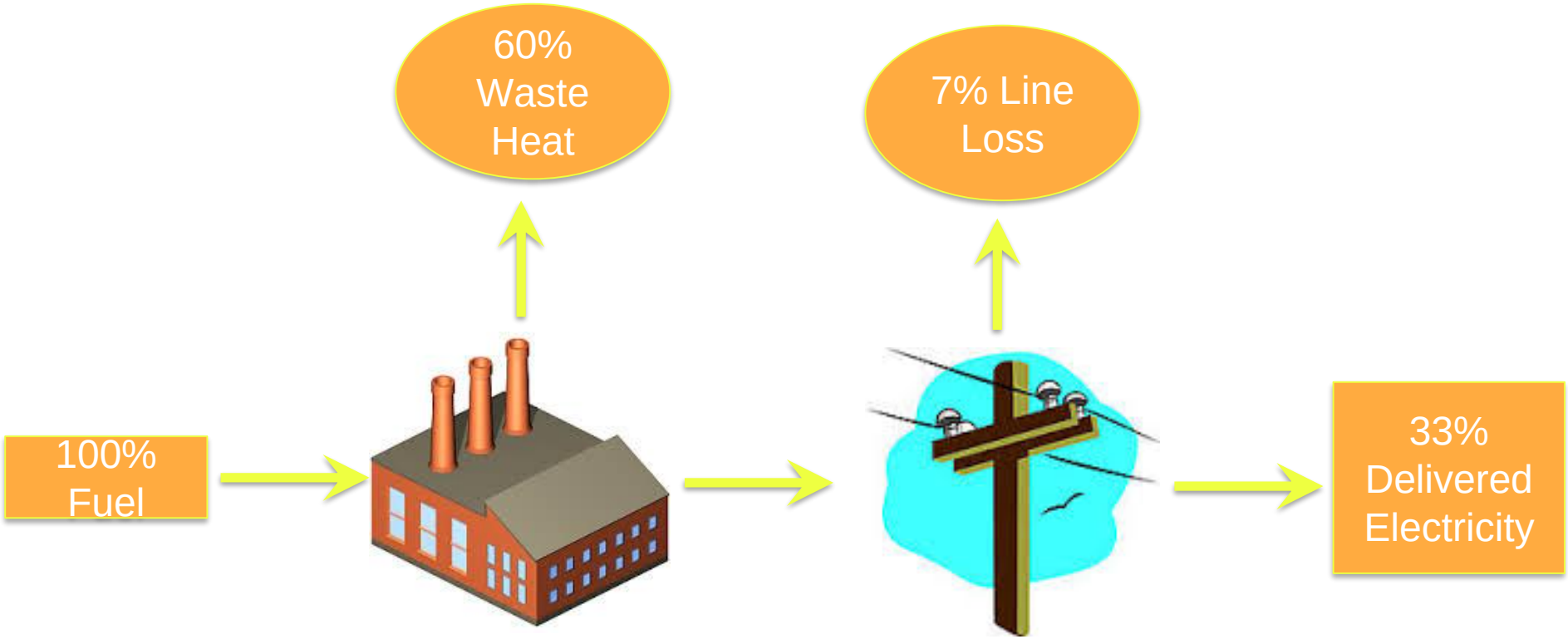
CHP Is an Efficient Way to Produce Power



CHP Benefits:

1. Manufacturers
2. The Public
3. Utilities

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Current CHP Projects

Source: DOE CHP Installation Database, March 2014

ArcelorMittal (Indiana)

- 90 MW energy recovery and reuse 504 boiler project
- $63.2 million total project cost
- $31.6 million DOE grant
- $20 million in annual energy savings
- Payback (with DOE grant): 1.58 years
- Provides 20% of energy needs

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Hood Dairy (Winchester, VA)

- 15-MW microgrid, including CHP
- 4 year payback period (ongoing)
- 30% emissions reduction
- Expanding to provide refrigeration

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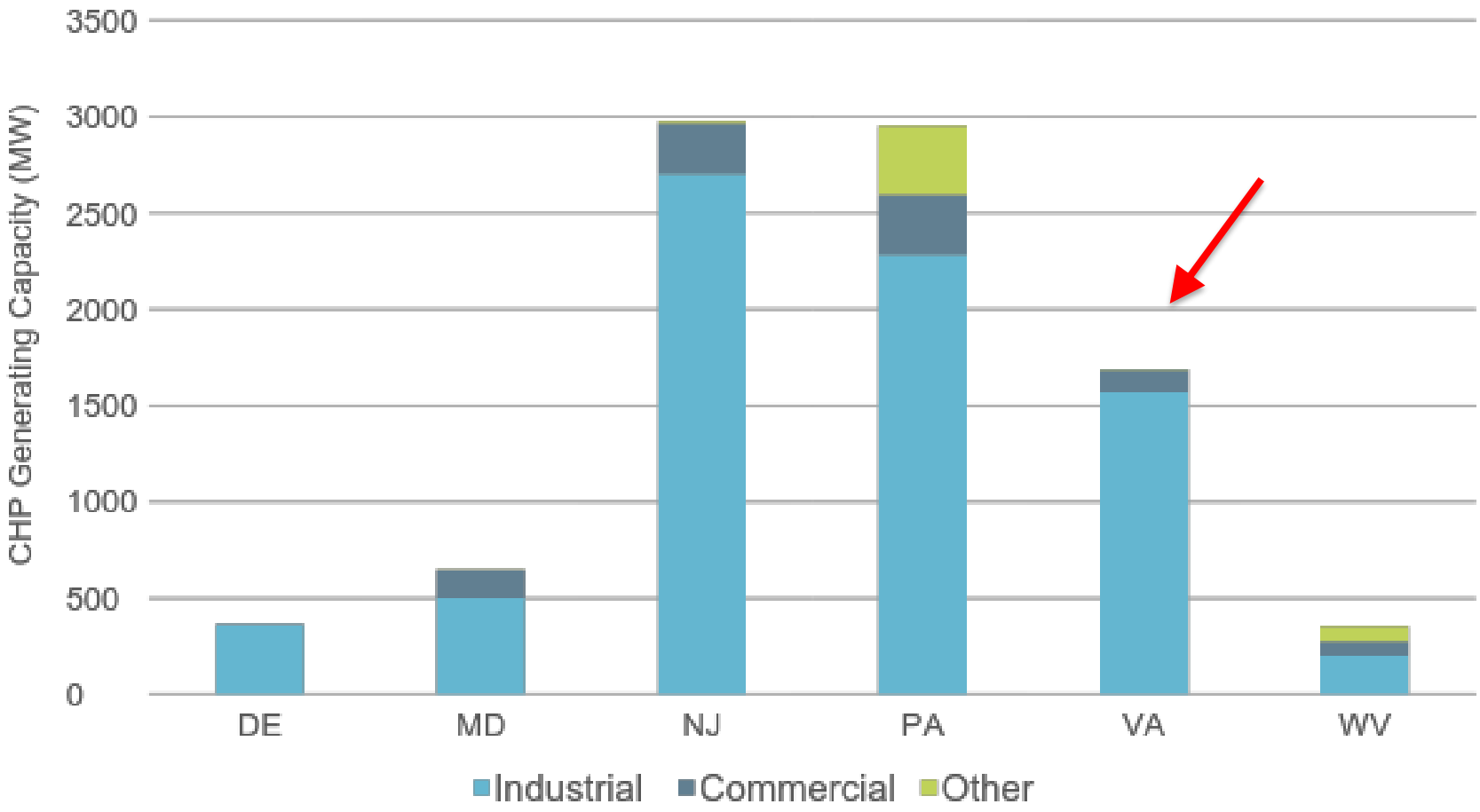
CHP Generating Capacity in the Mid-Atlantic



Source: DOE CHP Installation Database, December 2015

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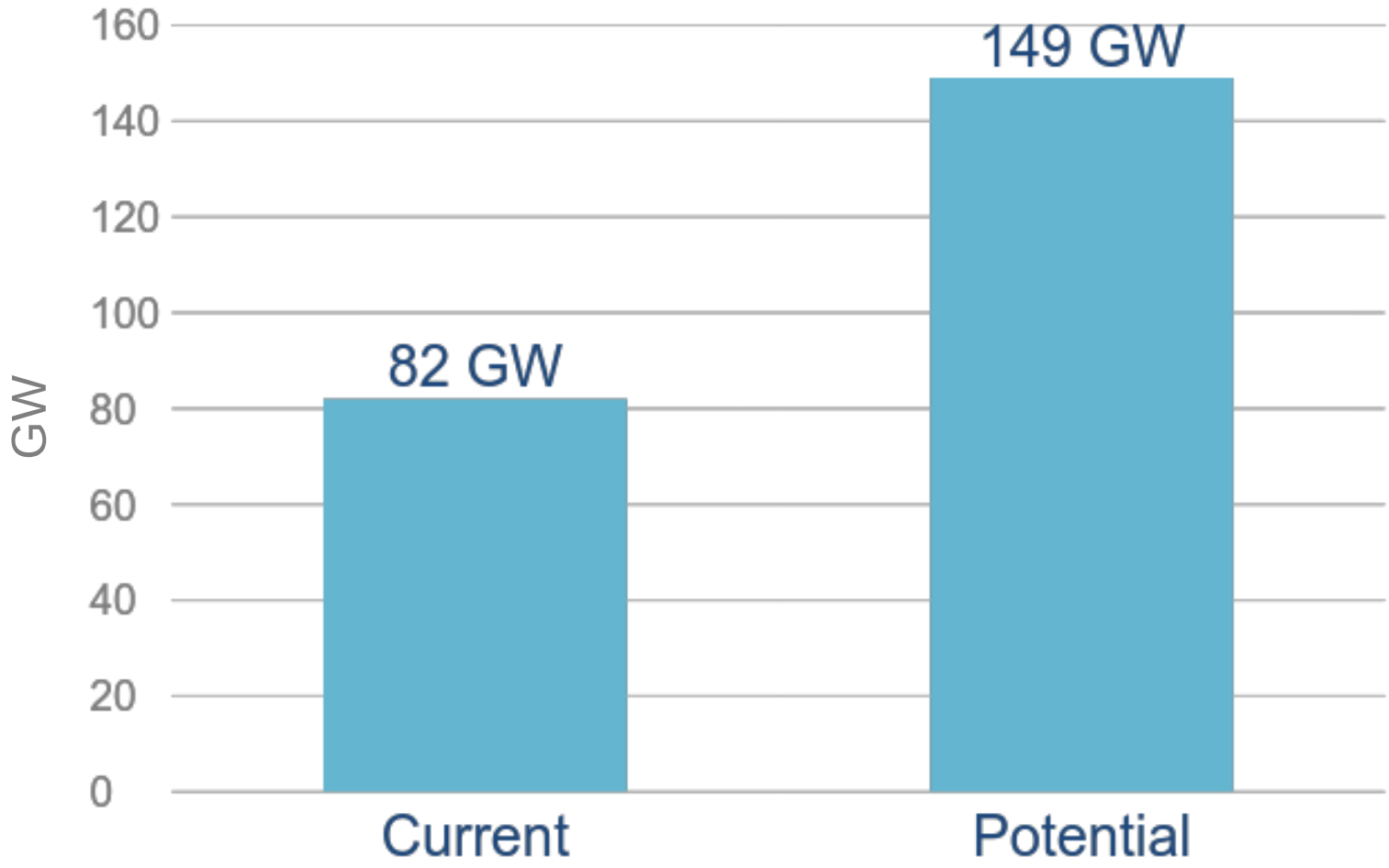
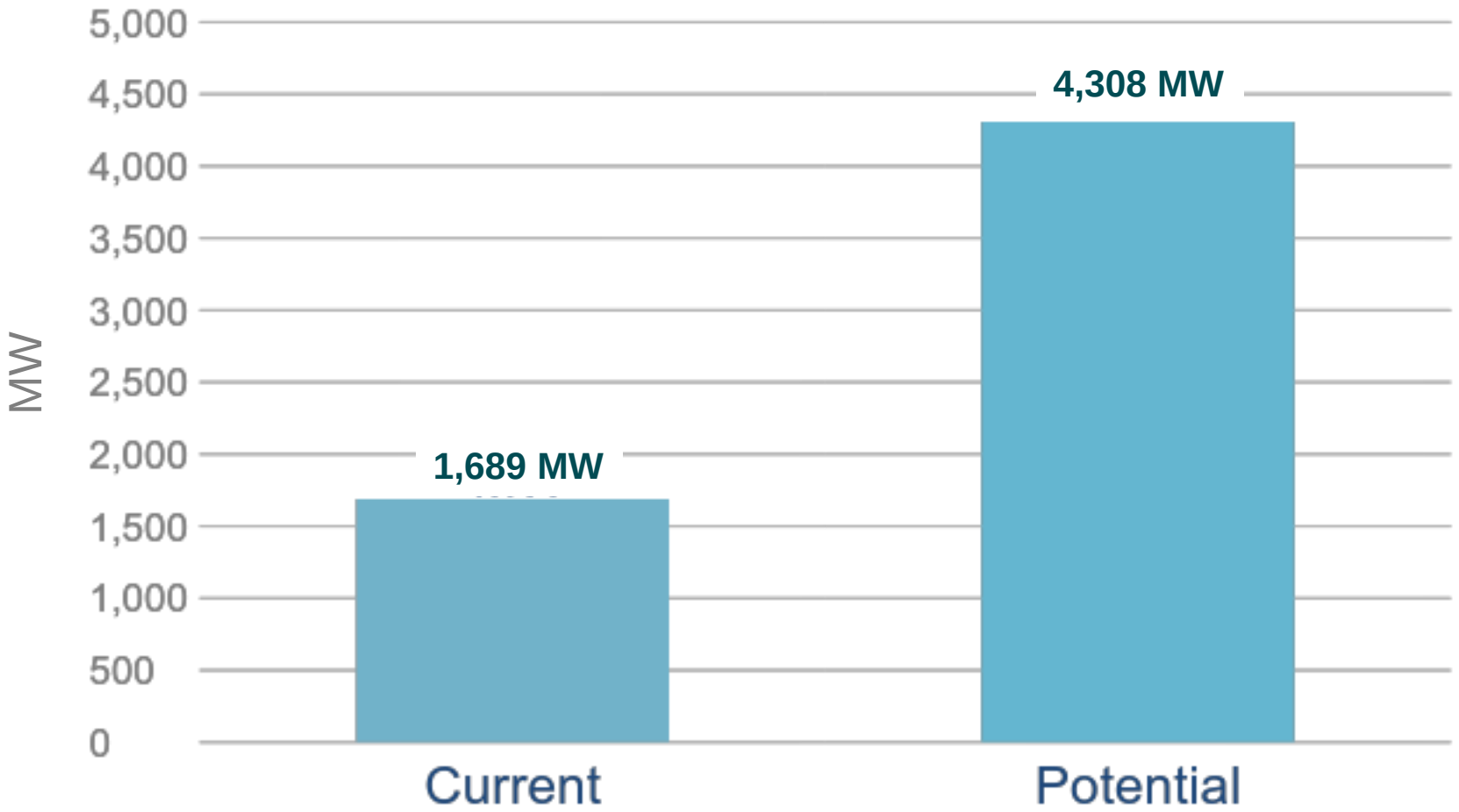
U.S CHP Technical Potential



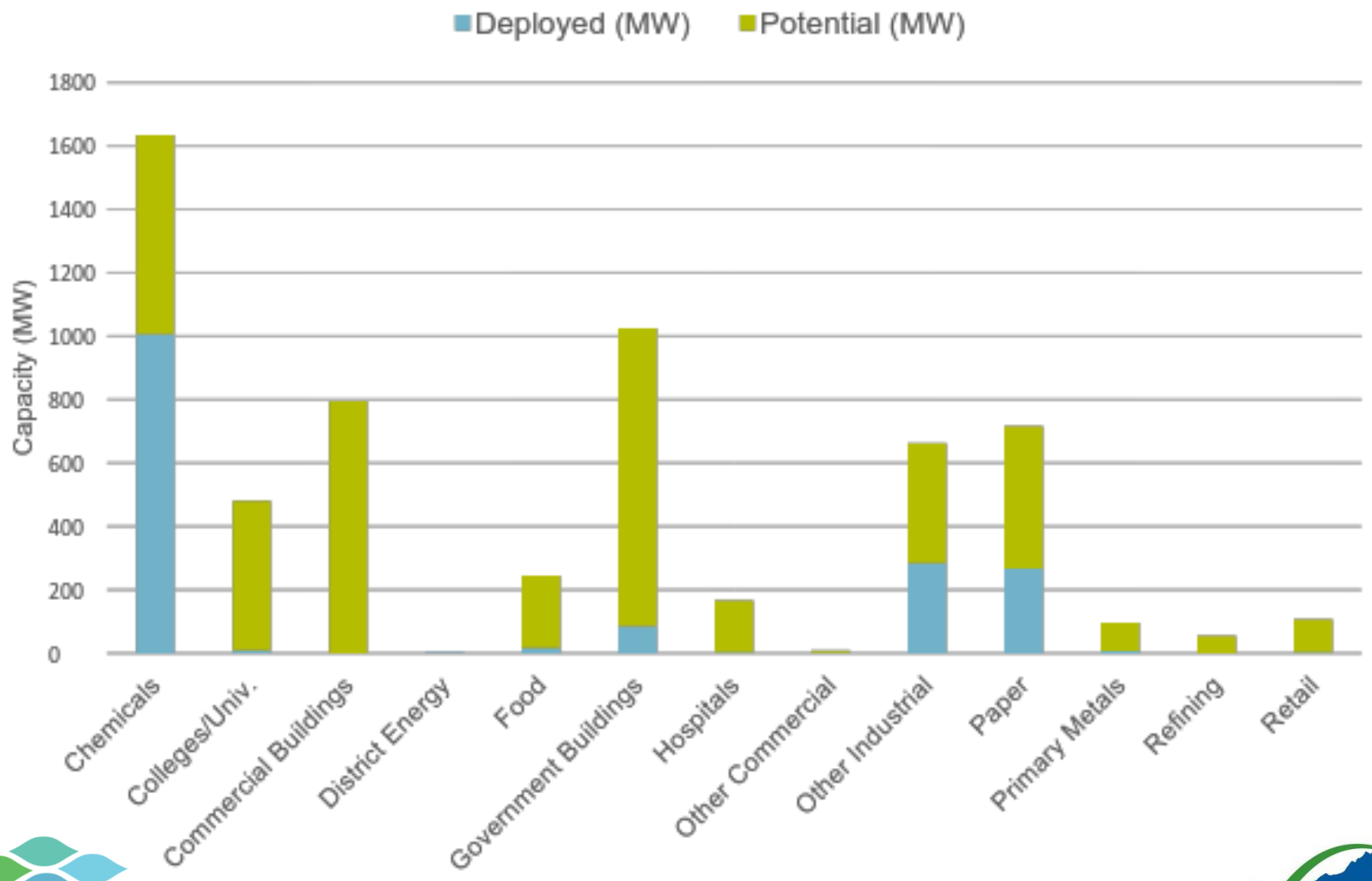
Source: DOE 2016

CHP Technical Potential (Virginia)



Source: DOE 2016

VA CHP Technical Potential vs. Deployment



Source: DOE 2016

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Investing in CHP and Industrial Efficiency Can…

- **Save Virginia businesses $4.1 billion** (2016-2030) in avoided electricity costs;
- **Save 6.6-million megawatt-hours** of electricity in 2030;
- **Reduce annual CO_2 emissions in the state by 2.6-million tons** in 2030; and
- **Achieve about 31% of Virginia's emission reductions** called for under EPA's Clean Power Plan (CPP).

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Dalia El Tawy

Senior Marketing & Business Development Manager

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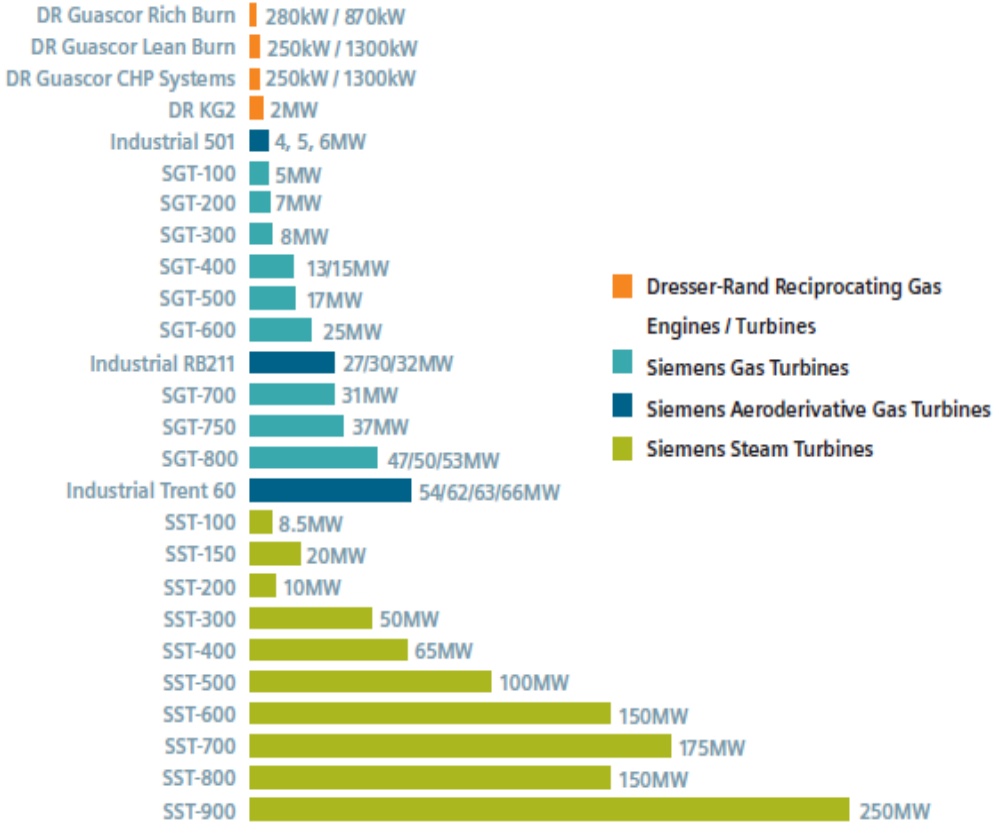
A Comprehensive Portfolio of Advanced Technologies for CHP Applications



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CHP Projects: Key Selection Criteria

- Meeting thermal and power load requirements
- Reducing energy costs
- Availability and reliability
- Lower emissions
- Fuel flexibility
- Enhanced control
- Financing solutions
- Life-cycle support

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Examples & case-studies

CHP projects: applications & technologies

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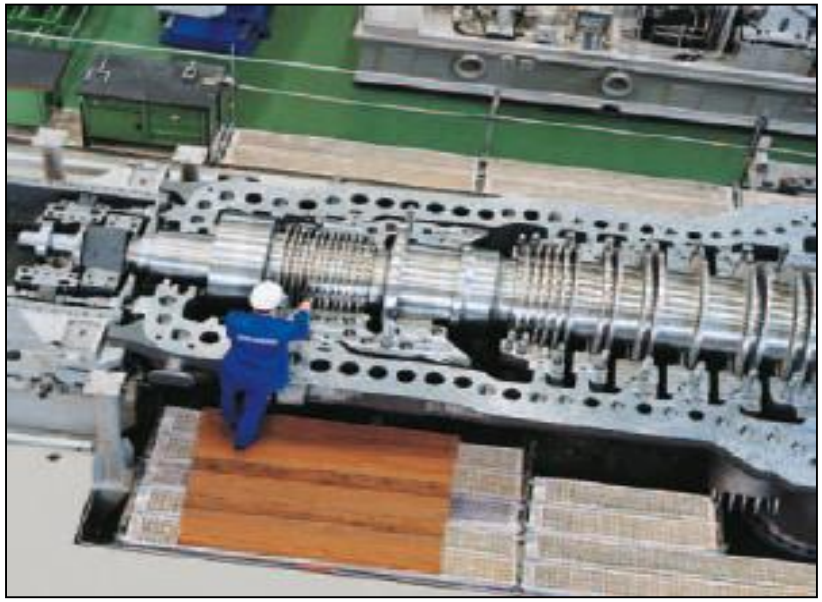
CHP projects in industrial applications
Pulp & paper - example 1



Wisaforest pulp & paper mill Pietarsaari, Finland CHP plant

- One of largest 100% biomass-fired power plants in the world
- Supplies electricity and process steam to the mill's operations
- Also, provides district heating to the surrounding town of Pietarsaari
- Prime mover: SST-800 steam turbine
- Power output: 143 MW

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CHP projects in industrial applications
Pulp & paper - example 2

Klabin pulp & paper factory Ortigueria, Brazil CHP Plant

- Two of the largest steam turbines used in the pulp and paper industry worldwide
- Highly specific steam turbines integrated into a customized process cycle
- Uniquely flexible plant due to 2 production lines and ability to produce 2 types of fiber simultaneously
- Prime mover: 2 SST-800 steam turbines
- Power output: 270 MW
- 150 MW fed into the national power grid

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CHP projects in industrial applications
Breweries and distilleries

CHP plant at a brewery in London, Canada

Industrial 501-KB7 Aeroderivative Gas Turbine

4.0 – 6.6 MW(e)

CHP plant installed in a distillery in Scotland, UK

SGT-100 Industrial Gas Turbine

5.1 - 5.4 MW (e)

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CHP projects in industrial applications
Chemicals and waste-water treatment

CHP project at a chemical plant in Infracor Marl, Germany

1 x SGT-800 Gas Turbine & 1 x SST-300 Steam Turbine 60 MW(e)

CHP project installed in a wastewater ttreatment facility in Psyttalia, Greece

SGT-400 Gas Turbine 12.9 MW(e)

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CHP in Virginia:
current status and
areas for improvement

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CHP in Virginia
Current status and areas for improvement

- CHP incentives
  - Need for additional state policies/programs that provide incentives for CHP deployment
- Energy savings from CHP
  - State policies designed to acquire energy savings from CHP, similar to other efficiency resources, could help in encouraging additional CHP installations
- Interconnection standards
  - Additional specifics with regards to fuels and technologies could enhance the standards and support CHP deployment

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Charles Miller

Manager, Distributed Generation Asset Development

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Examples of Where CHP Programs are Working

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Efforts in WGL Territory

In February 2016 WGL Petitioned for a rate case that would support deployment of CHP in the District of Columbia

Outcome of petition is expected in March or April

Allows Negotiated rates for firm and interruptible service

1. Floor of Firm = Tariff rate for interruptible
2. Interruptible Rate has no floor
3. Would not require commission approval of negotiated rates
4. Ultimately may lead to a published CHP tariff rate

WGL™ ENERGY ANSWERS. ASK US.

Washington Gas Requests Rate Increase in District of Columbia to Address Service Costs

WASHINGTON--(BUSINESS WIRE)-- Washington Gas, a WGL company (NYSE:WGL), has filed an application with the Public Service Commissior generating $17.4 million in additional annual revenue. The revenue increase includes $4.5 million associated with natural gas system upgrades prev surcharges.

The filing addresses rate relief necessary for Washington Gas to recover its costs and earn its allowed rate of return. The typical residential heating $7.94 per month. The filing also satisfies a settlement agreement approved by the DCPSC in 2015, which provides for the recovery through a surcha upgrade the Washington Gas distribution system and enhance safety. This settlement required the company to file a new rate proposal by August 1,

"For 167 years, Washington Gas has consistently delivered on its commitment to provide natural gas safely and reliably to customers in the District Holdings, Inc. and Washington Gas. "The proposed rates will allow us to continue meeting this commitment while upgrading the natural gas system.

Other elements of the application include the following requests:

- Revenue Normalization Adjustment -- Washington Gas has included a request to establish a revenue normalization adjustment (RNA) in its bills resulting from extreme weather patterns. Washington Gas operates with similar normalization adjustments in its Maryland and Virginia s
- Combined Heat and Power Rate Schedule - Washington Gas has proposed a commercial framework for the delivery of natural gas for Comb systems capture vented heat during the power generation process and use this heat for space heating and cooling. CHP systems are up to 8
- Multi-Family Development Incentives -- Washington Gas has proposed an incentive program for developers of multi-family housing projects including lower energy bills and reduced carbon emissions, to more residents in the District of Columbia.

The company anticipates that the new rates will become effective in February 2017.

Washington Gas' last rate increase in the District of Columbia was approved by the DCPSC in May 2013. About 157,000 of the company's 1.1 millio

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Efforts in WGL Territory

Maryland has published rate and policy for gas fired generation stations but this is more directed to commercial generation

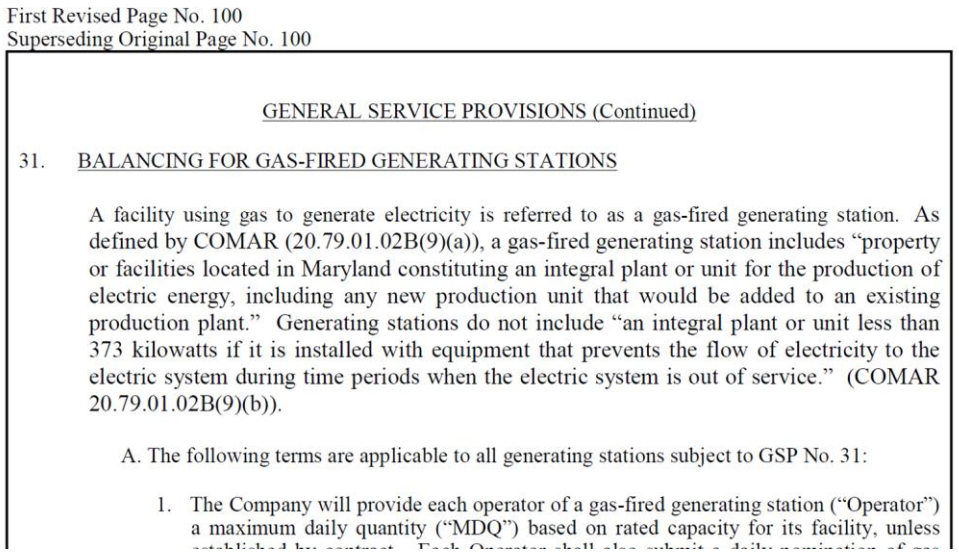
Restriction is greater than 373KW in size and does not include grid protection

This effectively limits application to “In Front of the Meter” applications

BGE has petitioned to incorporate “Micro-grid Solutions” into a rate base.

Concerns with this approach may limit effective competition for the rate base

1) Third Party Ownership and PPA
2) Public Micro-grid innovation
3) Technology evolution



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GENERAL SERVICE PROVISIONS (Continued)

31. BALANCING FOR GAS-FIRED GENERATING STATIONS

A facility using gas to generate electricity is referred to as a gas-fired generating station. As defined by COMAR (20.79.01.02B(9)(a)), a gas-fired generating station includes “property or facilities located in Maryland constituting an integral plant or unit for the production of electric energy, including any new production unit that would be added to an existing production plant.” Generating stations do not include “an integral plant or unit less than 373 kilowatts if it is installed with equipment that prevents the flow of electricity to the electric system during time periods when the electric system is out of service.” (COMAR 20.79.01.02B(9)(b)).

A. The following terms are applicable to all generating stations subject to GSP No. 31:

1. The Company will provide each operator of a gas-fired generating station (“Operator”) a maximum daily quantity (“MDQ”) based on rated capacity for its facility, unless

Efforts in WGL Territory

Virginia currently enjoys extremely competitive pricing for both gas and electric

Electric service is exceptionally low comparative to surrounding states

Creates significant challenges for CHP deployment

Will most likely require state programs that affect the “Public Good” such as the NYSERDA program in NY

- Based on already reduced costs, Gas utilities may have difficulty differentiating between Large Commercial applications and CHP installations

Current WGL Tariff rates in VA can theoretically support CHP applications however project is extremely sensitive to commodity fluctuations

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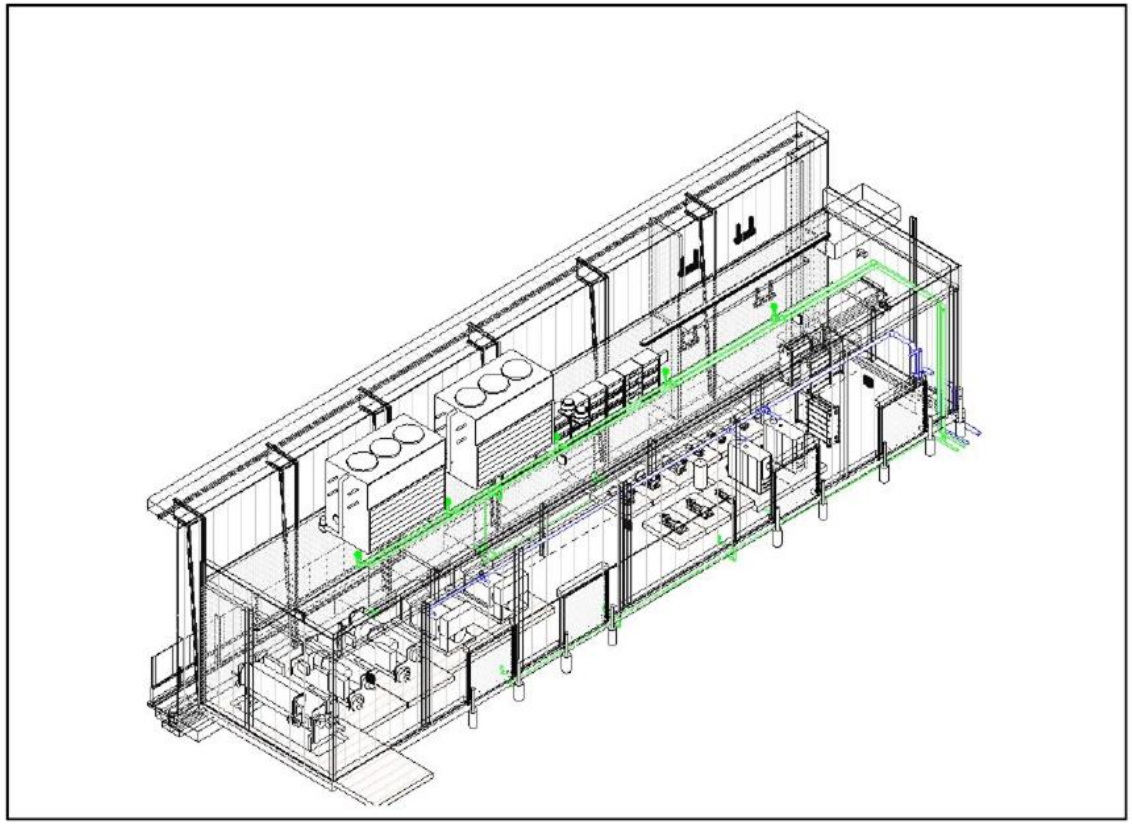
VA Modular CHP System



System benefits reminder

System ensures facility resiliency through black start capability and redundant heating and cooling systems

Overall reduction in carbon footprint by nearly 50% fro grid electric

Reduced life cycle cost of operations with significant efficiency improvement over DX

Ability to predict operations cost and incorporate strategies to mitigate any fuel risk

Allows for secure operations during system outages – Designate as place of refuge

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Representative Project: Commodity Comparison

Projected Commodity DX	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449
Equipment Charge	$440	$893	$920	$947	$976	$1,005
Gas Charge	$427	$431	$435	$439	$444	$448
Scenario 1	$867	$1,324	$1,355	$1,386	$1,420	$1,453
Equipment Charge	$594	$1,206	$1,242	$1,312	$1,357	$1,398
Gas Charge	$427	$431	$435	$439	$444	$448
Scenario 2	$1,021	$1,637	$1,677	$1,751	$1,801	$1,846
Equipment Charge	$776	$1,576	$1,623	$1,672	$1,773	$1,827
Gas Charge	$427	$431	$435	$439	$444	$448
Scenario 3	$1,203	$2,007	$2,058	$2,111	$2,217	$2,275

DX Commodity Cost escalated at 3% per year
WGL Commodity Operations cost escalated at 3% per year
WGL CHP Commodity gas escalated at 1% per year
All electric escalated at 3% per year

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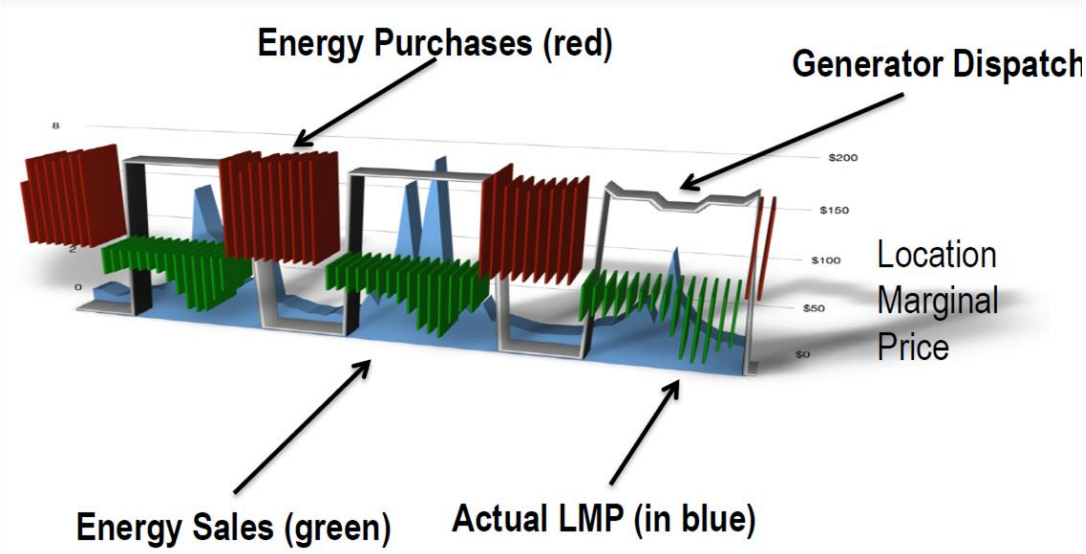
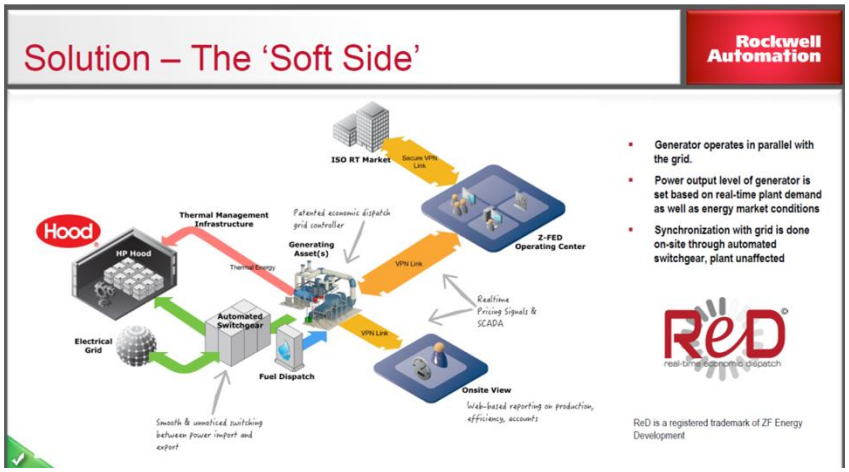
Other Ways to Work the System

Hood Dairy represents an alternative approach that overcomes the traditional limitations of CHP deployment by focusing on "Value Stacking" out side of only thermal and electric costs/savings.

By incorporating market dynamics into the overall value equation for either a direct owner or for a third party ownership model, additional value can be obtained and monetized to overcome the low commodity savings challenge in the region

ZF Energy and Rockwell Automation have teamed together for the Hood Dairy Project to validate the value stacking approach





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Questions & Answers

Type your questions by clicking the "Ask a Question" button located on the top left-hand side of the screen

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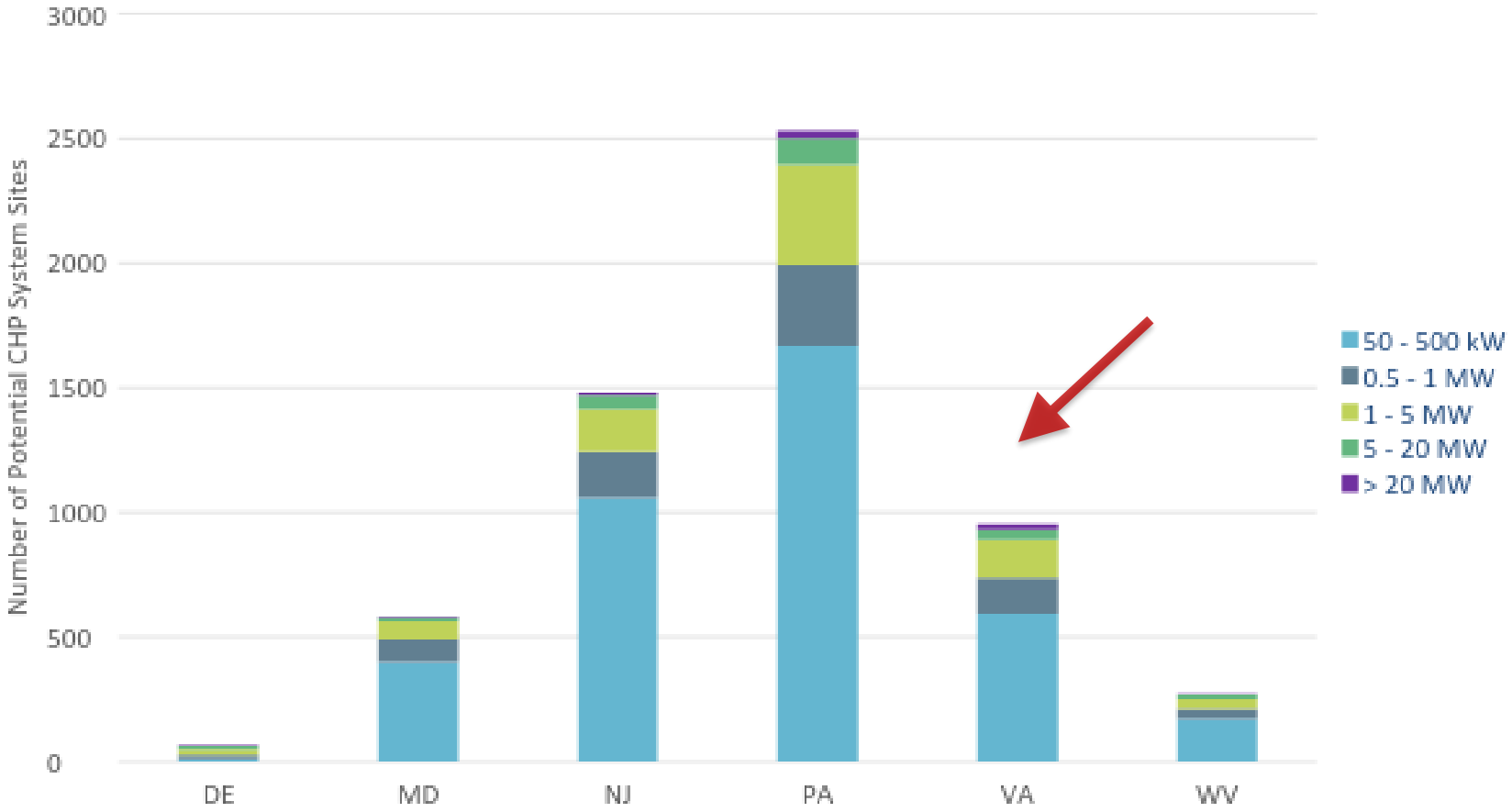
ADDITIONAL SLIDES

Mid-Atlantic Industrial CHP Technical Potential

(8,348 MW @ 5,943 sites)



Source: DOE March 2016

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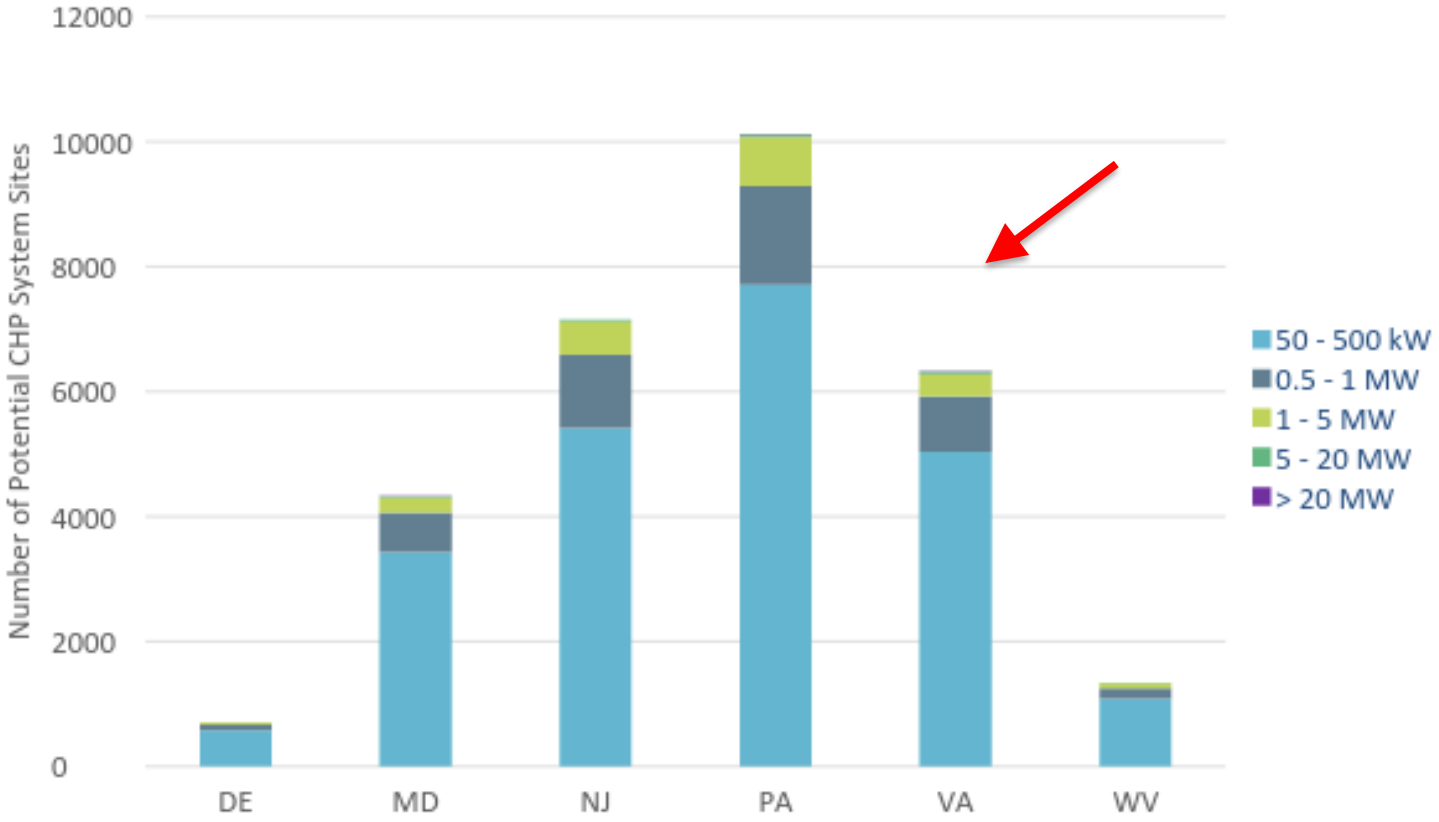
Mid-Atlantic Commercial CHP Technical Potential (9,884 MW @ 22,868 sites)



Source: DOE March 2016

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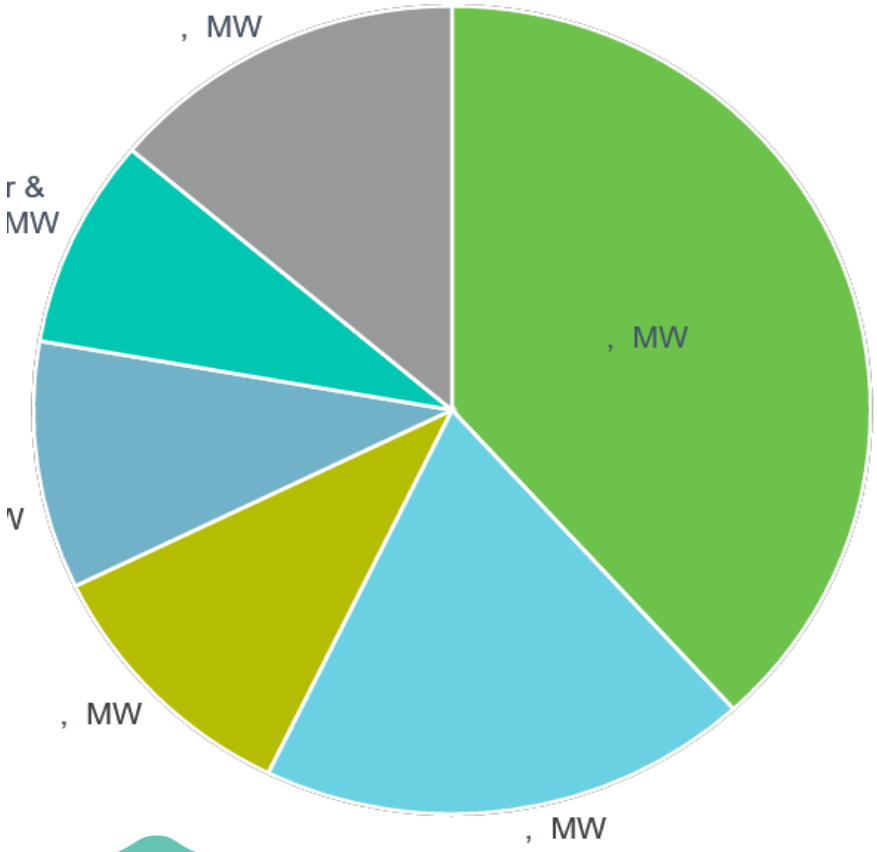
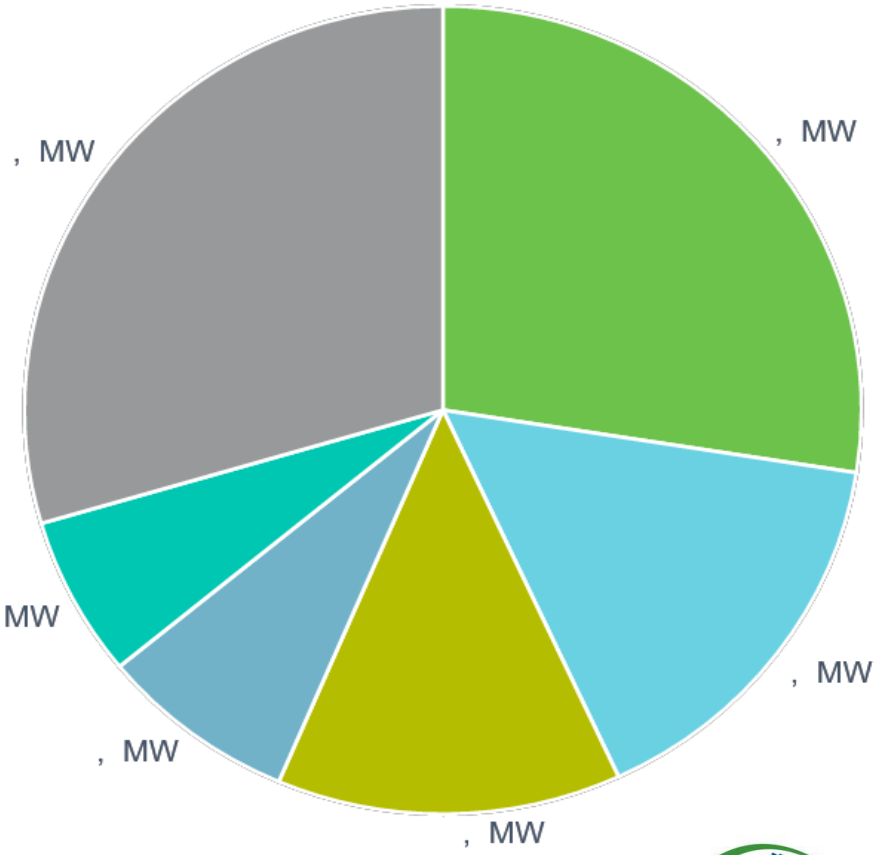
Commercial & Industrial CHP Potential (Virginia)

Industrial On-Site Technical Potential



Commercial On-Site Technical Potential



Source: DOE 2016