

The background of the slide is a night-time photograph of a city skyline. In the foreground, the Esplanade - Theatres on the Bay is illuminated with blue and white lights. The sky is dark, and several skyscrapers in the background are lit up with various colors, including blue and white. The Siemens logo and tagline are overlaid on the top right of the image.

SIEMENS
Ingenuity for life

The Role of CHP in Securing Reliable & Efficient Power

2016 IDEA Conference

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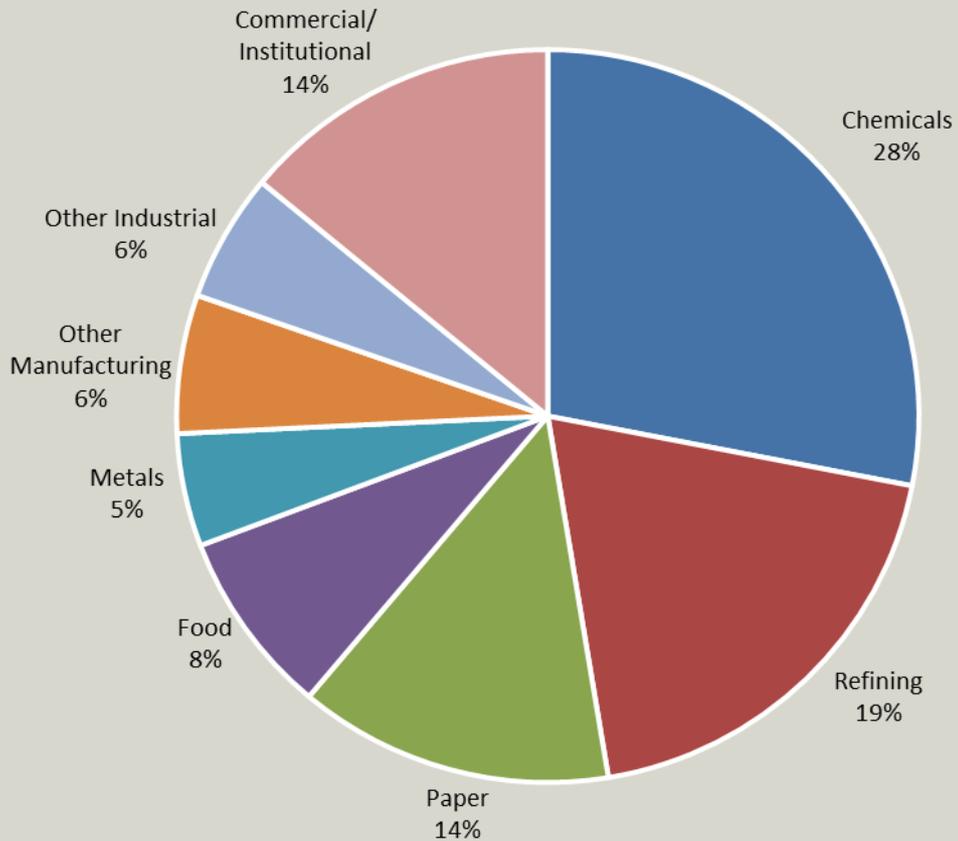
May 2016

- Combined Heat & Power
 - Background
 - Opportunities
- CHP Examples
 - Case studies – different technologies
- Siemens products & services for CHP applications
- Q & A

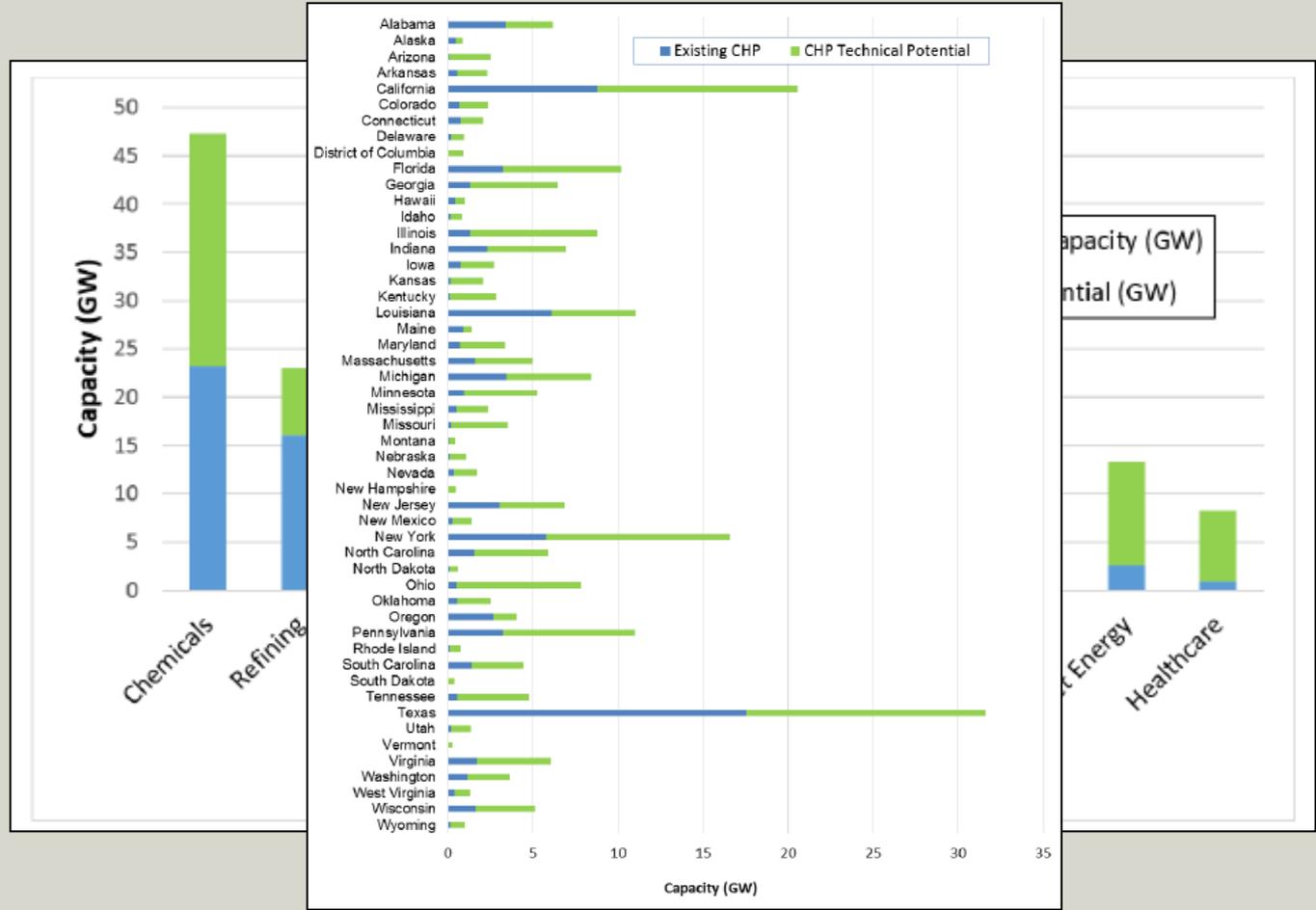
CHP – Background & Opportunity



Existing CHP Capacity (MW)



Source: DOE CHP Installation Database (U.S. installations as of December 31, 2014)



Source: DOE CHP Deployment Program, 2016

Examples & Case-studies
CHP Projects
Applications & Technologies

Siemens Provides Fuel Flexibility and Low Emissions from Landfill Gas-to-Energy Project



**University of
New Hampshire**

Challenge	Solution
Process landfill gas as optional cost-effective renewable fuel	SGT-300 turbine can use natural gas, liquids and landfill gas fuels
Reduced emissions at university power gen site and at landfill.	Fuel flexibility allows use of low emissions fuel options with landfill gas.
CHP project delivers more than electric power	Up to 12MW of heating and cooling

7.8MW
electrical power output

99.02%
average availability achieved

Small CHP Power System Saves Wesleyan University \$1,000 per Day



Challenge	Solution
Need for reliable source of power and heat	676 kW Guascor reciprocating engine
Lower power rates yet assure reliable source	CHP gas-fired solution integrated into a microgrid project saves \$1,000/day
CHP project maintenance a must	Siemens partner maintenance team access assured

676kW

reciprocating engine is CHP solution for athletic facility

95%

availability achieved

Algonquin College Benefits from Siemens Comprehensive Energy Services



Challenge	Solution
Water and energy reduction measures	\$3.2M in annual cost savings
Fuel management and optimization, energy supply planning, utility bill management	Siemens Advantage Navigator
CHP project development: cogen, solar PV, power storage, EV charging and microgrid energy management	\$52M in improvements

4MW

energy center
(cogeneration)

48%

reduction in
annual energy
costs

\$350k

annual savings through
demand & supply side
services

City of Holland – CHP Plant

Michigan improves energy efficiency



Siemens Scope of Supply
(2) SGT-800 GTs, (1) SST-400 ST, 2 major LTP, T3000 DCS, 3-GSU, 1-UAT, Switchgear, and MCC

Challenge	Solution
Coal-fired plant no longer met city energy needs	Two SGT-800 and One SST-400 provide cost-efficient power
Underground snowmelt system could not meet energy demands	Waste heat from circulating water system provides heat for increased snowmelt system demands
Complex development process	Provide “bundle buy” solutions to facilitate supply process

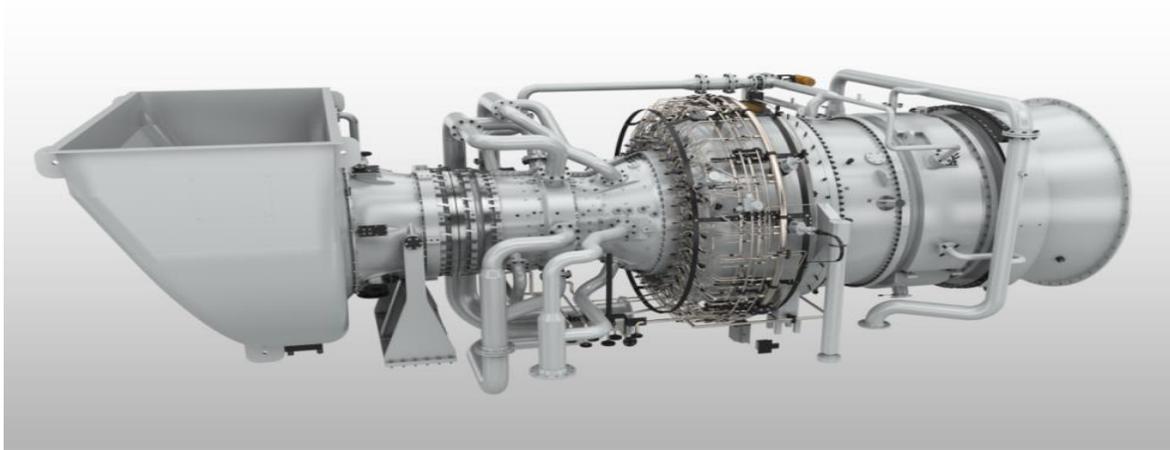
<h1>145MW</h1> <p>New power generated via CHP plant</p>	<h1>~50%</h1> <p>The CO2 emissions reduction rate from existing supplier</p>
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Leveraging portfolio breadth to facilitate project development goals

SGT-800 Industrial Gas Turbine

Reliable – Flexible - Efficient

SIEMENS



SGT-800 Gas Turbine

Power Generation:

Simple Cycle (ISO) 47.5 / 50.5 / 53.0 MW(e)

Combined Cycle 2x1 (ISO) 135.4 / 143.6 / 150.0 MW(e)

Proven CC and CHP efficiency and reliability

High steam raising capability for CHP applications

Single lift package for ease of installation

Largest installed fleet on its class - 276 turbines WW

Lowest emissions to meet stringent environmental requirements and minimize BOP costs

The leading Medium Gas Turbine for CC and CHP applications

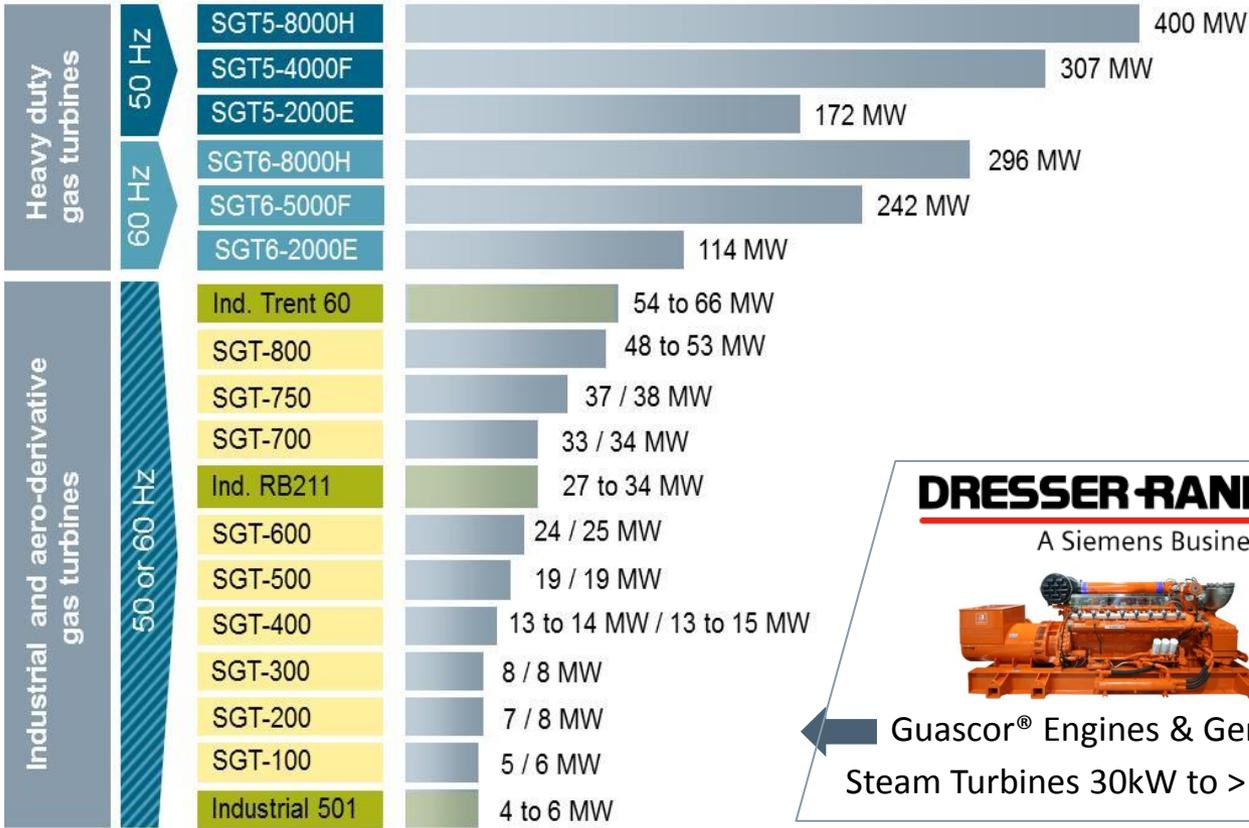
Siemens Offerings for CHP Projects

Products & Solutions

Siemens Continues to Expand its Portfolio to Align with Growth Markets and Provide Flexibility to Customers



Gas Turbine Portfolio



DRESSER-RAND
A Siemens Business

Guascor® Engines & Gensets:
Steam Turbines 30kW to > 150MW

Industrial Aero-derivative Heavy duty 60 Hz Heavy duty 50 Hz

Steam Turbine Portfolio

Type	Power Output (MW _e)														
	0,5	1	2	3	5	7	10	15	20	30	50	75	100	150	250
SST-900															250
SST-800															250
SST-700															175
SST-600															150
SST-500															100
SST-400															65
SST-300															50
SST-200															10
SST-150															20
SST-111															12
SST-110															7
SST-100															8.5
SST-060															6
SST-050															0.75
SST-040															0.3

The most comprehensive portfolio of products and solutions

Siemens Adjacent Portfolios and Capabilities

Going Beyond Core Products – Flexibility in Scope & Options



Distributed Energy Systems

- Cogeneration / Combined Heat & Power
- Small Thermal Power
- Microgrids
- Energy Storage



Siemens Product Portfolio

Automation		Grid automation Smart grid Microgrid	VPP
Energy efficiency solutions		Energy efficiency Power management	Financ. (Perf. Contr.)
Storage solutions		Battery storage Electrolyzer	Substation
Fossil / Biomass generation		Small GT Small ST	Substation Engines
Wind Onshore		Onshore WP Wind equipment Co-location storage	Substation
PV electrical equipment		PV elect. equipment	Substation

Capabilities	SIEMENS
Equipment	✓
Financing	✓
Own/Operate (PPA)	✓ Opportunity
Service (O&M)	✓ Opportunity
EPC, Turnkey Services	✓
Feasibility Assessment	✓
Customize Solutions	✓
National Sales Force	✓

- ✓ In-House Capability
- ✓ Partial Solution / Third-Party Provided

Summary

- Combined Heat & Power offers a significant opportunity for different applications based on proven technologies
- CHP is the anchor of microgrids and serves a critical role in integrating with renewables & providing a clean energy solution
- Siemens wide portfolio of products and services offers CHP solutions for different applications with flexibility in scope and options

Questions?



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