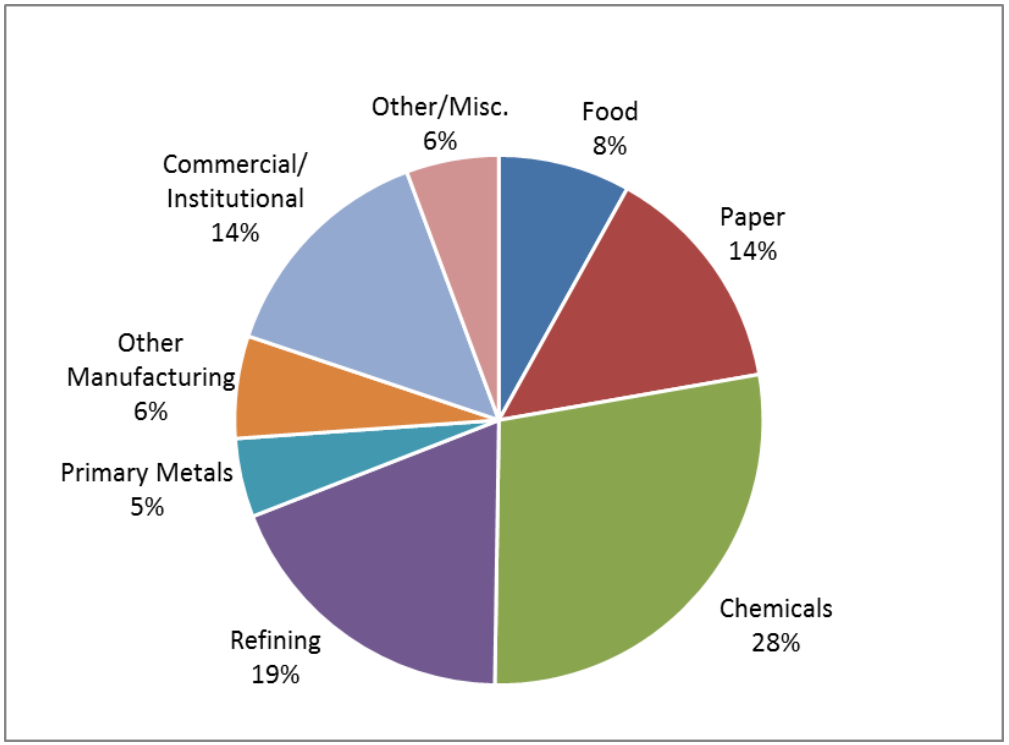
Better Plants
U.S. DEPARTMENT OF ENERGY

Advancing Commercial and Industrial Energy Efficiency Policies and Programs

5/28/15

U.S. DEPARTMENT OF ENERGY

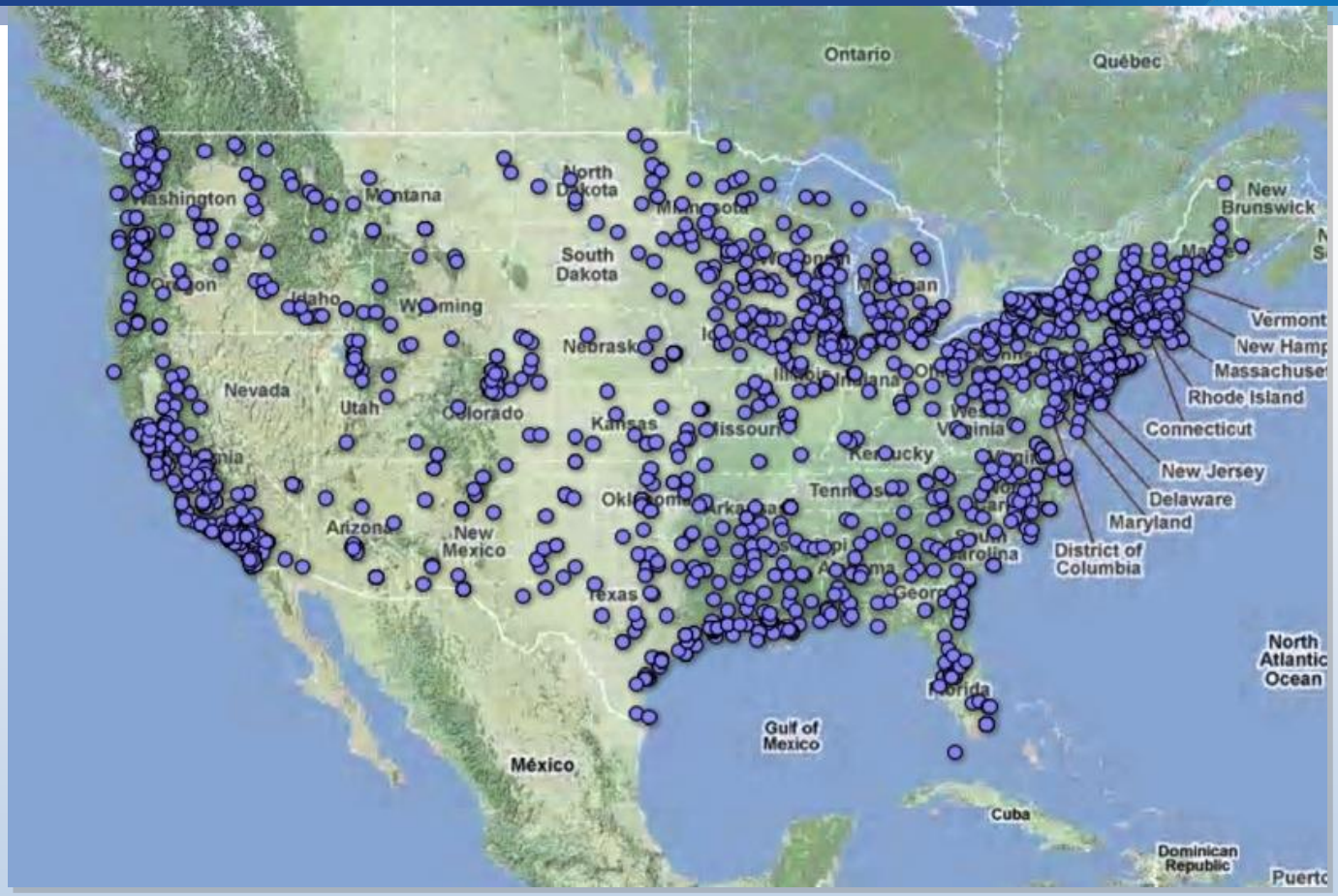
Where are We Now: U.S. CHP Installations



Sources: DOE/ICF CHP Installation Database (U.S. installations as of December 31, 2013); EIA

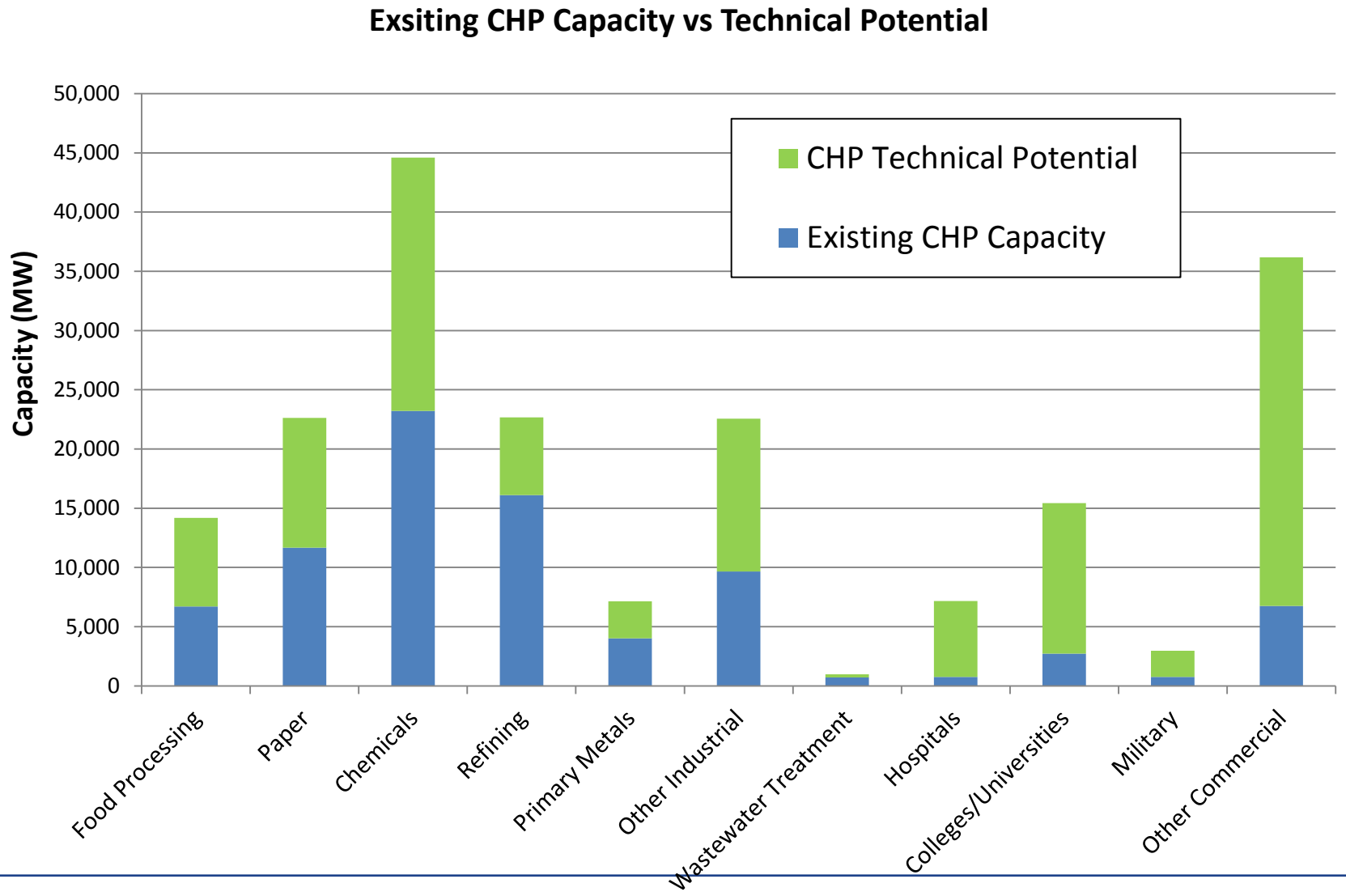
- **82.7 GW** of installed CHP over 4,300 industrial and commercial facilities
- 80% of capacity in industrial applications
- 70% of capacity is natural gas fired
- Avoids more than **1.8 quadrillion Btus** of fuel consumption annually
- Avoids **241 million metric tons of CO_2** compared to separate production

CHP is Everywhere



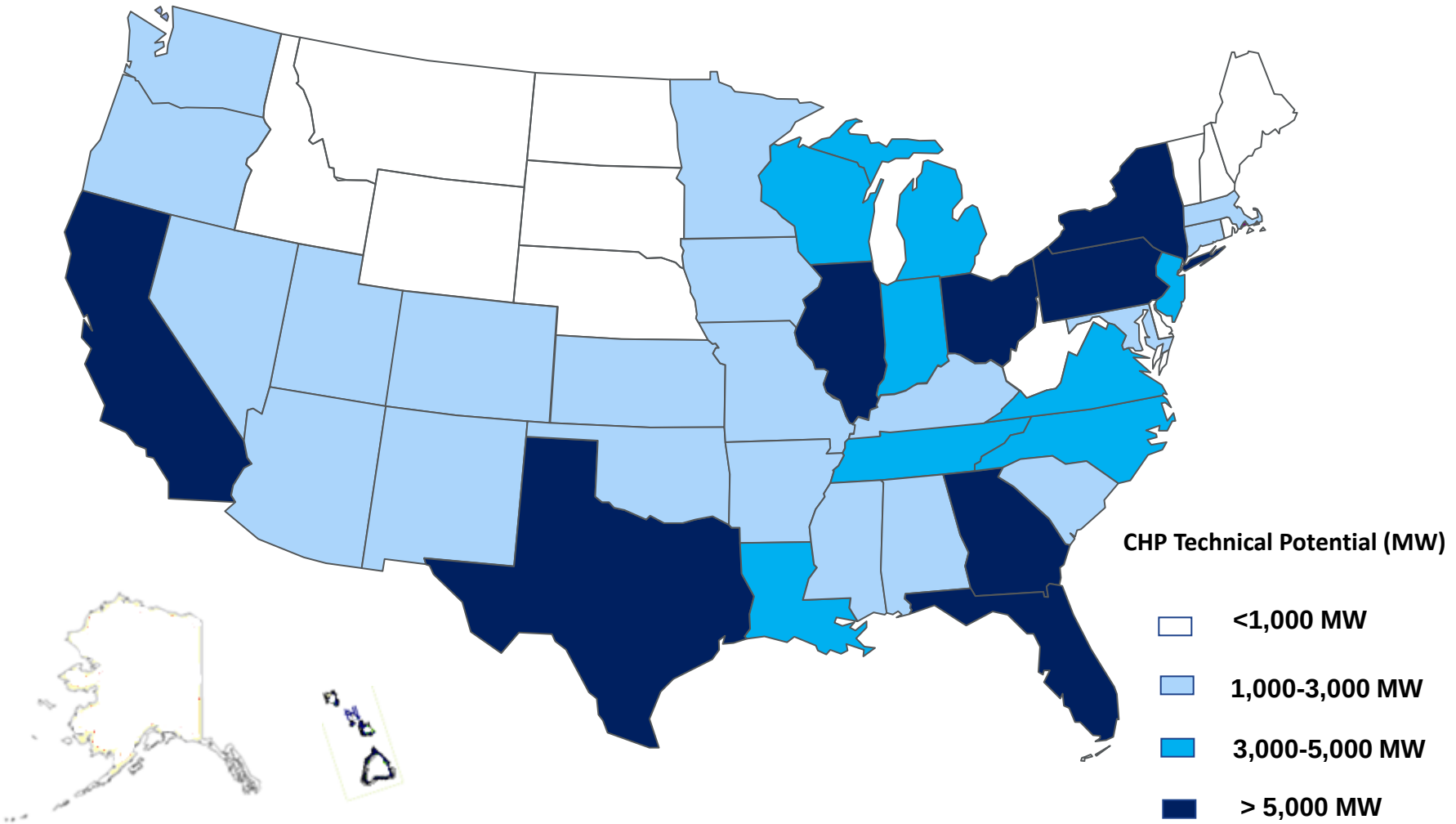
Source: DOE CHP Installation Database (U.S. installations as of Dec. 31, 2013)

Where is the Remaining Potential for CHP?



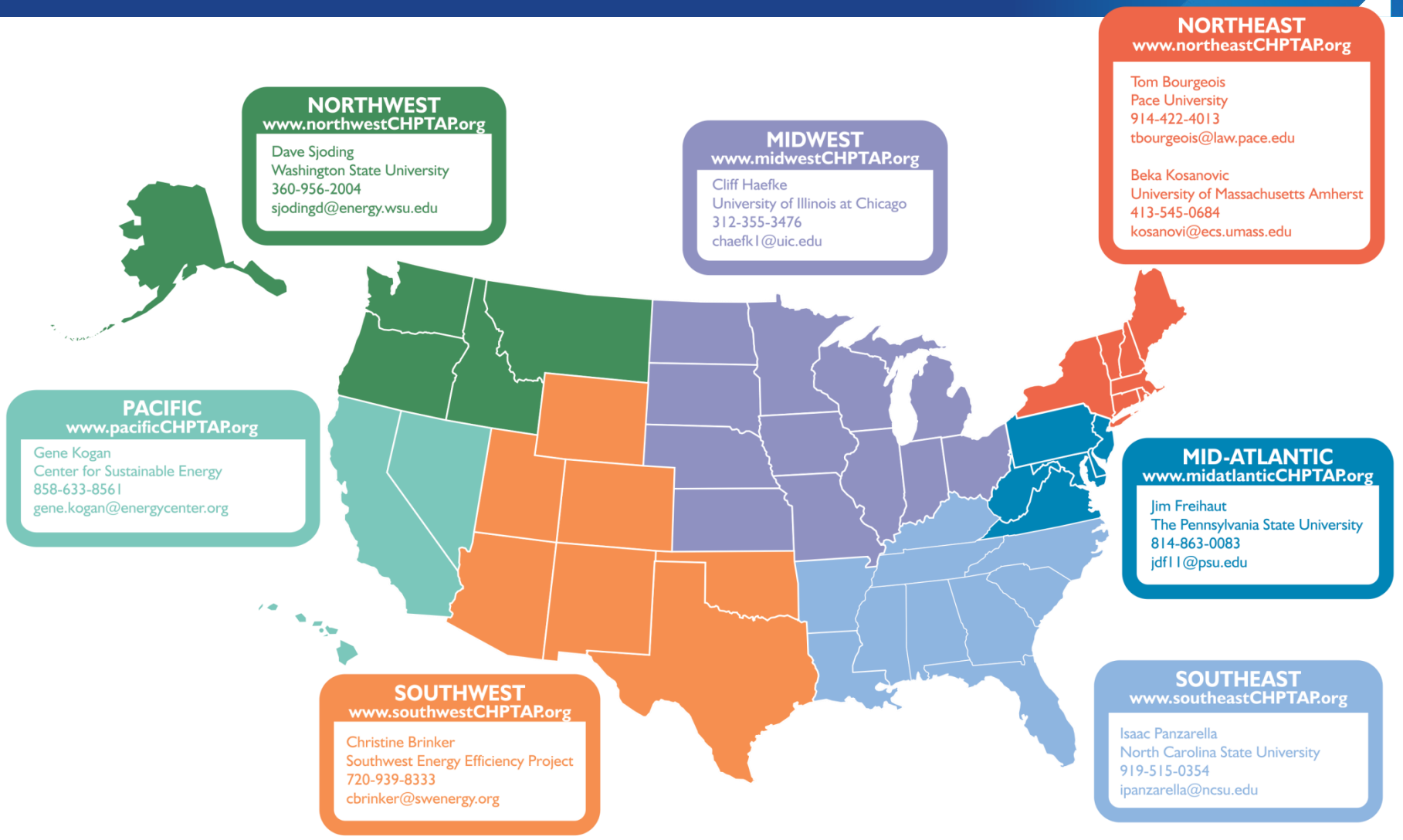
Source: ICF internal estimates (2014)

Where is the Remaining Potential for CHP?



Source: ICF Internal Estimates (2014)

DOE CHP Technical Assistance Partnerships (CHP TAPs)



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Better Plants
U.S. DEPARTMENT OF ENERGY

U.S. DEPARTMENT OF ENERGY

Come to the Better Plants Recognition Event!

Where: Main ballroom (Salons 1 and 2)
When: 5:15-6:00 PM, Thursday evening

- Light snacks and cash bar
- Network with industry peers and Advanced Manufacturing Office (AMO) technology experts
- View posters of ongoing AMO projects

Panelists

- **Jessica Burdette**, Minnesota Department of Commerce
- **Michael Leslie**, Maryland Energy Administration
- **Marty Stipe**, Oregon Department of Energy
- **Bill Edmonds**, NW Natural

Jessica Burdette
Minnesota Department of Commerce

U.S. DEPARTMENT OF ENERGY

Better Buildings Summit - 2015

Combined Heat and Power: Minnesota Update

Jessica Burdette
Conservation Improvement Program (CIP) Supervisor

Minnesota: Statewide Energy Policy Objectives

Conservation Improvement Program (CIP)

- MN Statute 216B.241
- Utility Energy Efficiency and Conservation Goals
  - 1.5% = Electric
  - 1% = Natural Gas
- CHP/WHR Eligibility included in 2013

Renewable Energy Standard (RES)

- MN Statute 216C.05, Subd. 2
- Portfolio standard = 25% by 2025
- Biomass CHP Eligible for inclusion in the RES

Greenhouse Gas Emissions Goals (GHG)

- MN Statute 216H.02
- 15% by 2015
- 30% by 2025
- 80% by 2050
- CHP is a potential tool to achieve increased GHG emissions reductions

Minnesota's Past CHP Work

- Energy Savings Goal Study (2013-14)
- Conservation Applied Research & Development CHP Studies (2013-14)
- Department of Energy CHP Grant (2014-15)

Energy Savings Goal Study (ESG)

Legislation

H.F. 729, 4th Engrossment, Article 12, Section 8 established the Energy Savings Goal Study (ESG)

- The Department of Commerce was charged with completing this work

Stakeholder Process

Commerce conducted stakeholder meetings on various topics in late 2013:

- Industrial energy efficiency
- Combined heat and power

Report

Report and ESG findings presented to the Minnesota Legislature in 2014:

- Recommendations were made for continued evaluation of CHP

Energy Savings Goal Study CHP Key Findings

1. The policy objective for greater CHP implementation and eligibility in CIP needs to be better defined

2. Stand-by rates identified as a barrier to increased CHP implementation

3. More detailed data on CHP potential in Minnesota is needed

4. Any CHP program or standard should reduce risk to customers and utilities, and have long-term achievement objectives focusing on system reliability and utility/operator relationships

5. Questions remain regarding CHP system ownership structures from customer and utility perspectives

CHP Studies – Conservation Applied Research and Development (CARD)

- ***CHP Standby Rates and Net Metering***
  - Conducted by Energy Resources Center (University of Illinois)
  - Published April 2014

- ***Minnesota CHP Policies and Potential***
  - Conducted by FVB Energy/ICF International
  - Published September 2014

CHP Standby Rate Study Key Recommendations

1. Standby rates should be transparent, concise and easily understandable

2. Standby energy usage fee should reflect both demand and time-of-use cost drivers

3. Forced Outage Rate should be used in the calculation of a customer's reservation charge

4. Standby demand usage fees should only apply during on-peak hours and be charged on a daily basis

5. Grace periods exempting demand usage fees should be removed where they exist

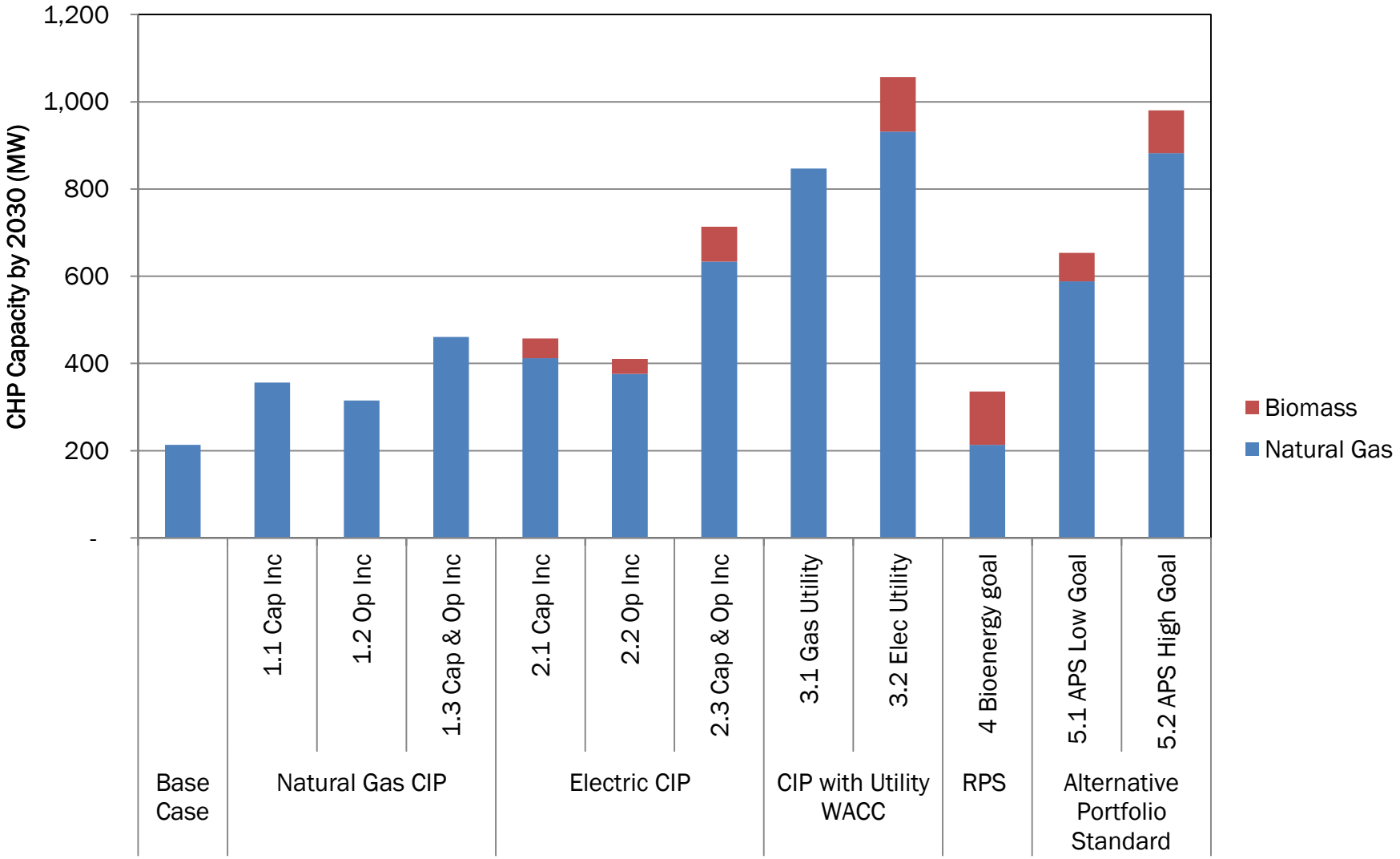
CHP Potential Study
Key Findings

1. **Existing CHP:** 961.5 MW of CHP capacity located at 52 sites in Minnesota. 83% resides in systems > 20 MW

2. **Technical Potential:** 3,049 MW of new technical potential.

3. **Economic Potential:** 984 MW has economic potential with a payback < 10 years

CHP Regulatory Study
Key Findings: Impacts of Policy Options

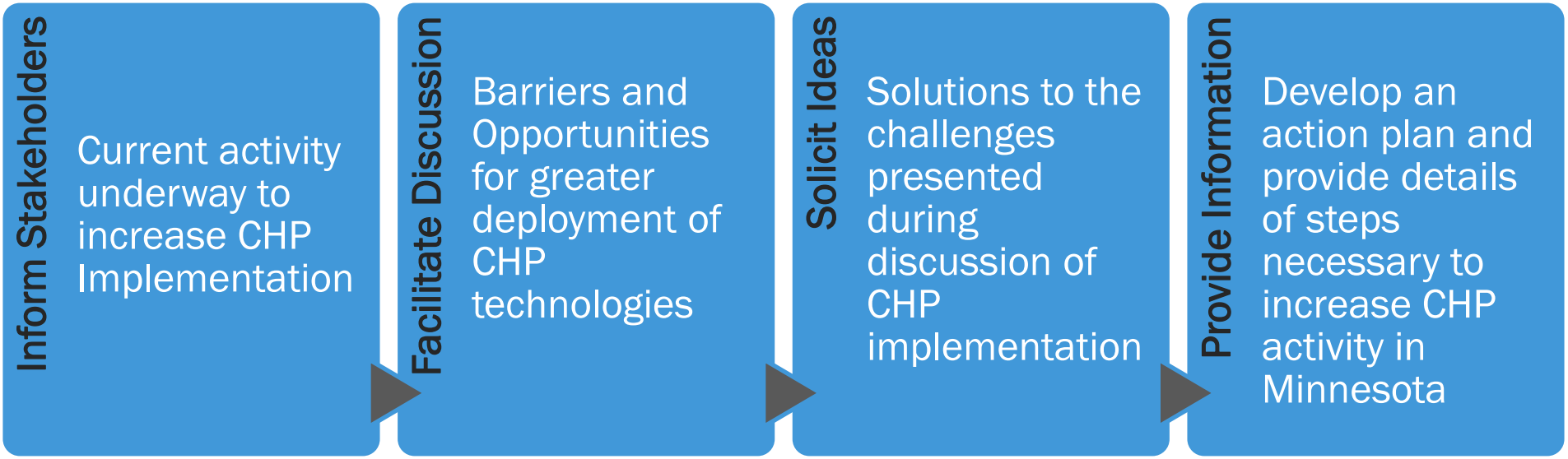


CHP Regulatory Study Key Findings (continued)

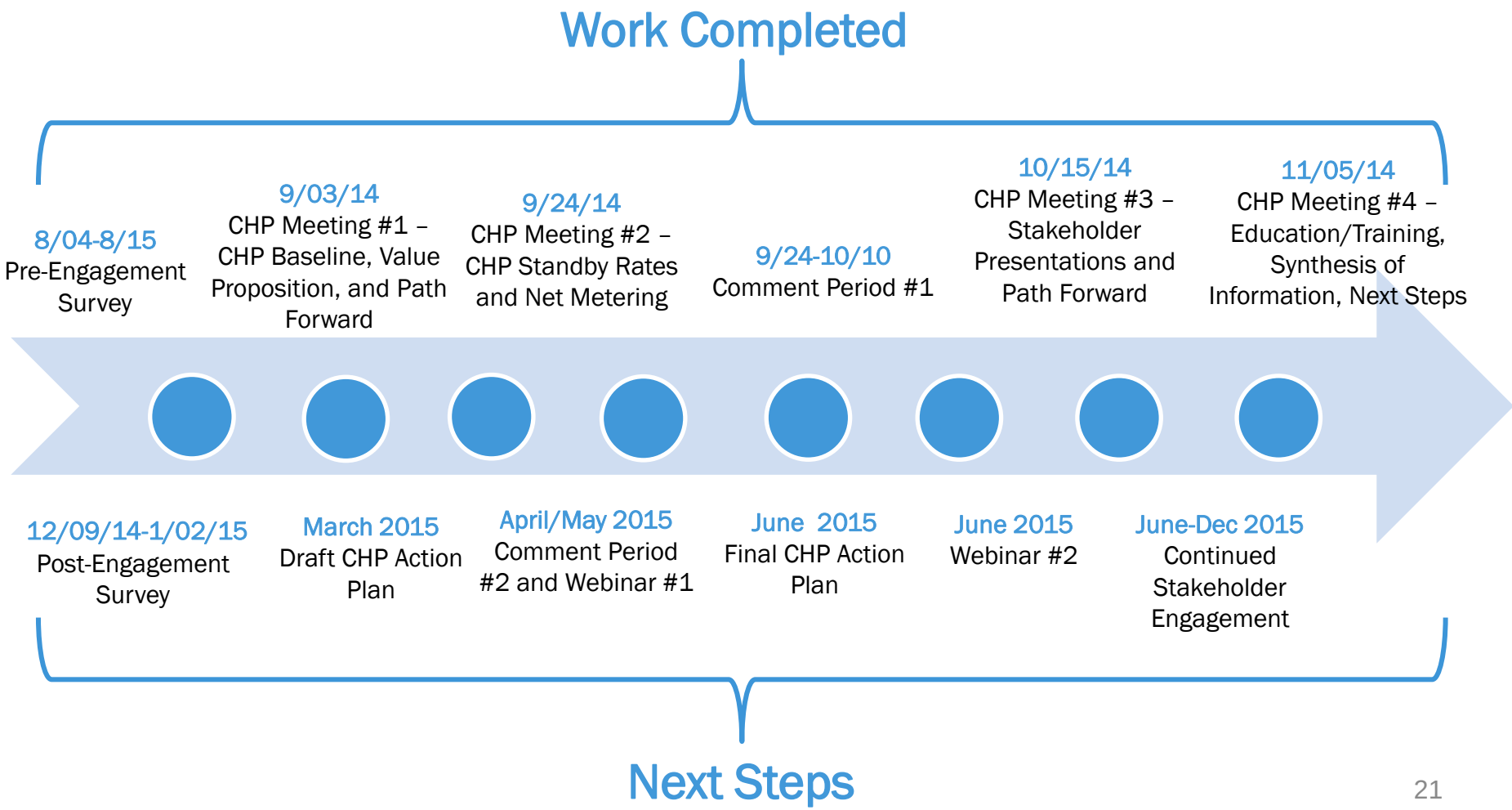
- Significant increases in implementation of CHP will require investment by utilities in CHP
- CHP within the EERS has a significant advantage
- Must examine issues relating to utility investment in CHP
- Integrated Resource Planning (IRP) is a tool that should be used to evaluate CHP.

U.S. Department of Energy CHP Project

Commerce was awarded a DOE grant in 2014 to conduct stakeholder engagement in Minnesota regarding CHP



DOE CHP Grant Stakeholder Engagement Process



DOE CHP Grant Stakeholder Meeting Themes

1. CHP Evaluation Criteria
2. Mapping CHP Opportunities
3. CHP Ownership Problems and Solutions
4. Adapting CIP for Supply-Side Investments
5. Education and Training Needs

Questions?

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Michael Leslie
Maryland Energy Administration

U.S. DEPARTMENT OF ENERGY

"Clean, Affordable and Reliable Energy for all Marylanders"

CHP and Commercial & Industrial Energy Efficiency Policies and Programs Presentation

DOE Better Buildings Summit - 2015

Michael Leslie, MSc,
Clean Energy CHP And C&I Program Manager

Maryland Energy Administration

Powering Maryland's Future

May 28, 2015

MEA Overview

The mission of the Maryland Energy Administration (MEA) is to promote affordable, reliable, clean energy. MEA's programs and policies help lower energy bills, fuel the creation of jobs, drive economic development, and promoting energy independence.

MEA Strategic Goals

The strategic goals of the Maryland Energy Administration are:

- Make the State of Maryland a leader in energy efficiency;
- Reduce energy costs for our citizens;
- Reduce greenhouse gas emissions from energy;
- Increase the use of renewable energy;
- Leverage public/private partnerships in order to improve the competitive position of Maryland industry; and
- Lower the operating expenses of State and local governments while contributing to the improvement of air and water quality in Maryland.

CHP Benefits and Policy Attributes

Energy Efficiency

- EmPOWER Maryland initiative, the State has a goal of reducing energy consumption by 15 percent by 2015

Economic Development

- The use of CHP systems creates LOCAL jobs in manufacturing, engineering, installation, ongoing operation and maintenance, and many other areas.

Grid and Facility Resiliency

- Complies with Executive Order demand to identify how to improve the resiliency and reliability of the Maryland electric distribution system

Greenhouse Gas Reduction

- Supports the Greenhouse Gas Reduction Plan (the Plan) that will reduce greenhouse gases 25 percent by the year 2020.

Current CHP Policy Attributes (continued)

Job Creation

- Job Creation Tax Credit (JCTC) managed by the Maryland Department of Business & Economic Development

Maryland Clean Energy Production Tax Credit

- CHP systems powered by renewable fuels such as biomass can potentially claim a credit equal to 0.85 cents per kilowatt-hour ($0.0085/kWh) against the state income tax, for a five-year period, for electricity generated by eligible resources. Scheduled to end on 12/31/2016

Maryland Renewable Energy Portfolio Standard

- Maryland legislature passed legislation (S.B. 690) expanding the portfolio standard's Tier I definition to include waste-to-energy systems.

CHP's Higher Efficiency Results in Energy and Emissions Savings

Suggested revisions and updated footnote

Category	10 MW CHP	10 MW PV	10 MW Wind	10 MW NGCC
Annual Capacity Factor	85%	22%	34%	70%
Annual Electricity	74,446 MWh	19,272 MWh	29,784 MWh	61,320 MWh
Annual Useful Heat Provided	114,544 MWh_t	None	None	None
Footprint Required	6,000 sq ft	1,740,000 sq ft	76,000 sq ft	N/A
Capital Cost	$19.8 million	$35.6 million	$22.1 million	$9.2 million
Annual Energy Savings, MMBtu	318,221	196,462	303,623	154,649
Annual CO_2 Savings, Tons	43,343	17,887	27,644	28,172
Annual NOx Savings	61.9	16.1	24.9	46.2

Original Source: Combined Heat and Power A Clean Energy Solution: August 2012: DOE and EPA

- *10 MW Gas Turbine CHP - 27% electric efficiency, 69% total CHP efficiency, 15 ppm NOx, $1,976/kW Capital Cost – Source: DOE/EPA Catalog of CHP Technologies, March 2015*
- *Capacity factors and capital costs for PV, Wind and Natural Gas Combined Cycle system based on utility systems in DOE's Advanced Energy Outlook 2015 – Source: Electricity Market Module Assumptions, 2014*
- *Efficiency (7,050 Btu/kWh) for Natural Gas Combined Cycle system based on Advanced Energy Outlook 2015 (620 MW system proportioned to 10 MW of output) – Source: Electricity Market Module Assumptions, 2014; 2.5 PPM NOx emissions assumed for NGCC*
- *CHP, PV, Wind and NGCC electricity displaces National All Fossil Average Generation resources: Based on eGRID 2012 – (2009 data) - 9,572 Btu/kWh, 1,743 lbs CO2/MWh, 1.5708 lbs NOx/MWh, 7% T&D losses;*
- *CHP thermal output displaces 80% efficient on-site natural gas boiler with NOx emissions of 0.1 lb/MMBtu*

Maryland's Installed CHP Base

Prime Mover	Sites	Capacity (kW)
Total	29	717,277
Boiler/Steam Turbine	8	585,200
Combined Cycle	2	25,500
Combustion Turbine	5	89,100
Fuel Cell	0	0
Microturbine	1	65
Other	0	0
Reciprocating Engine	8	15,060
Waste Heat to Power	1	902

ICF International http://www.eea-inc.com/chpdata/States/MD.html

Current Utility led CHP Program

Eligibility (BGE, PHI, and PE)

- Minimum requirement of 65% efficiency (Higher Heating Value)
- All qualifying systems must not export electricity to the grid
- Projects must be pre-approved

Incentive (BGE, PHI, and PE)

- $**2.5 million** per project incentive cap ($1.25m capacity and $1.25 production)
- Capacity Incentive Payment: Design incentive ($75/kW):
- Capacity Incentive Payment: Installation incentive ($**275/kW**) for projects under 250 kW and ($175/kW) for projects greater than 250 kW
- Production incentive: ($0.07/kWh for 18 months): Three payments subsequent to review of metering data at the end of the 6th, 12th and 18th months

SMECO

Currently, SMECO does not offer standalone CHP rebates and, instead, provide rebates under the Custom programs

How is the MEA positioned to help?

- Collaboration
- Lawton Loan Program
- Maryland Clean Energy Center (MCEC) Financing Program
- MEA EmPowerMdCHP Program

FY15 MEA EmPOWER Maryland CHP Program

Eligible Entities (Please see the MEA EmPowerMdCHP website for more details)

- Healthcare facilities (e.g. hospital, assisted living, nursing home, and surgical center)
- Publicly Owned Wastewater Treatment facilities

Minimum Project Requirements

- Located in the State of Maryland
- Ground breaking will take place and materials will be onsite by January 1, 2016
- Operational no later than January 1, 2017
- Minimum system efficiency of 60% Higher Heating Value

FY15 MEA EmPowerMdCHP Incentive

***MEA EmPowerMdCHP* Capacity Grant Incentive**	
System Size	Capacity Payment per kW
Equal to or less than 75kW	Up to $575
Between 76kW and 150kW	Up to $550
Between 151kW and 300kW	Up to $525
Between 301kW and 500kW	Up to $500
Between 501kW and 750kW	Up to $475
Between 751kW and 1MW	Up to $450
1MW and greater	Up to $425

Sample Incentive Calculations:
A 75kW CHP system is eligible to receive up to a $43,125 grant award.
75kWx$575/kW=$43,125

A 1MW CHP system is eligible for up to a $450,000 award.
1MWx$450/kW=$450,000

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FY15 MEA EmPowerMdCHP Results

Results

- Received 10 applications within the grant deadline totaling over 13 MW of new CHP capacity
- Approved 7 applications to receive grant funds
- 6 out of 7 are healthcare facilities
- No biomass or biofuel projects had been submitted
- Projects range in size from 130 – 2,000 kW
- Grant recipients are eligible to receive between $71,500 - $464,700
- Assuming all eligible grantees comply with the grant conditions the 7 projects will provide over 9 MW of new CHP capacity

Helpful Links

- **MEA EmPowerMdCHP Program**
- Jane E. Lawton Conservation Loan Program (Managed by MEA)
- Maryland Clean Energy Center (MCEC) Financing Program
- BGE Smart Energy Savers Program® Combined Heat and Power (CHP)
- Pepco Combined Heat & Power (CHP) program
- Delmarva Power Combined Heat & Power (CHP) program
- Potomac Edison Combined Heat and Power Incentives Program
- Maryland utility territory map

Next Generation Energy Efficiency Gains Program (NGEEG)

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REGIONAL MANUFACTURING INSTITUTE OF MARYLAND

The NGEEG program funds training and consulting efforts that help Maryland manufacturers in the BGE service territory implement energy conservation measures (ECMs).

- The Regional Manufacturing Institute of Maryland (RMI) is the Program developer and administrator.
- MEA disburses the funds and provides financial, consultation, outreach support, and oversight

NGEEG Program Benefits

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REGIONAL MANUFACTURING INSTITUTE OF MARYLAND

Participating Manufactures can receive up to $30,000 worth of business services to include:

- No-cost comprehensive energy audit
- Compressed air leak detection service
- Energy monitoring system equipment and installation, including monthly benchmarking and engineering analysis
- Strategic operational and equipment improvement planning report
- Energy efficiency training
- Green Team Employee engagement program
- Review and process utility and State rebate and financial resources
- Share best practices through monthly leadership engagement

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Examples of Manufactures Benefiting from NGEEG

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NGEEG
Case Study #1 C-Care

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REGIONAL MANUFACTURING INSTITUTE OF MARYLAND

- C-Care 135,000 sq ft; spending $700,00 annually on energy (78% on electricity)
- The program identified significant HVAC, retro-commissioning, controls, and lighting ECMs
- RMI and C-Care predicts $1.5 million project will reduce 1 million kWh cut energy costs by at least $160,000 annually
- Awarded $434,473 MEA grant to help offset the costs of implementing the ECMs

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NGEEG
Case Study #2 Tenax

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REGIONAL MANUFACTURING INSTITUTE OF MARYLAND

- Baltimore City fencing manufacturer; 160,000 sq ft factory and office space
- Spent $460,000 last year on energy; no previous energy audit or utility rebates
- The program identified multiple ECMs to include lighting upgrades, controlling exhaust, and HVAC upgrades providing up to a 600,000 kWh annual reduction
- Applied for MEA Lawton Loan, which provides a cash positive opportunity to implement ECMs, thereby, saving Tenax approximately $100,000 in annual energy costs

TENAX®

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Powering Maryland's Future

NGEEG Results

ENERGY SOLUTIONS CENTER
REGIONAL MANUFACTURING INSTITUTE OF MARYLAND

- As of January, 17 companies have graduated from the NGEEG program
  - Completed 2,704,173 kWh reductions with another 7,647,133 kWh reduction in process, thereby, surpassing the companies 6,800,000 kWh goal for the group
  - Collectively saving $1,098,900 annually
- 21 remaining companies projected to reduce more than 8.4 million kWh once they graduate in the next 6 months

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FY15

EmPOWER MARYLAND CHALLENGE

Commercial-Industrial Grant Program

- Implement upgrades that achieve deep electricity savings of 20% or more
- Incentivize projects that incorporate multiple efficiency upgrades in a whole building approach
- Showcase best practices

FY15 C&I Grant Program in Brief

- Competitive grants to implement and showcase upgrades to commercial and industrial buildings that reduce electricity usage by 20 percent or more
- Grants cover up to 50% of project costs *after* other incentives
- Awards can range from $20,000 to $500,000
- No limit on maximum project size

FY15 C&I Grant Eligibility

- Any commercial or non-profit enterprise
  - Examples: senior living facilities, hotels, supermarkets, office buildings, retail facilities, office areas associated with industrial plants, and restaurants
- Buildings must be located in Maryland
- Projects must improve whole building or dedicated space
  - An area/space that has its own meter
  - An area/space with a purpose distinct from the surrounding space
- Eligible electricity efficiency measures
  - Technology upgrades
  - Operational changes (when combined with technology upgrades)

FY15 C&I Grant Eligible Efficiency Measures

Technology upgrades

- Building insulation and envelope
- Lighting
- Controls
- Motors and variable frequency drives
- Heating, ventilation and air conditioning (HVAC)
- Refrigeration
- Other electric-only projects

Operational changes

- Staff training and credentialing
- Re- or retro-commissioning
- Energy data analytics
- Strategic energy management or ISO 150001 implementation

Must be combined with technology upgrades and result in *measureable* energy savings

FY14 C&I Grant Results

- 21 Projects Funded
  - 7 Deep Retrofit Projects (5 Measures)
  - 14 Multi-measure Retrofit Projects
  - 27 % avg kWh savings (exceeds 20% program goal by 7%)
- Awards range from $$20,000 to $400,000
- Estimated savings of more than 20 million kWh annually

Fy15 C&I Grant Support

- Resources available at program website: http://energy.maryland.gov/Business/
- Contact ci.mea@maryland.gov for all programmatic questions

MEA CHP Presentation

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Maryland Energy ADMINISTRATION

Powering Maryland's Future

Marty Stipe, Oregon Department of Energy
Bill Edmonds, Northwest Natural

U.S. DEPARTMENT OF ENERGY

Combined Heat and Power in Oregon

Marty Stipe, Oregon Department of Energy

May 28, 2015

OREGON DEPARTMENT OF ENERGY

CHP History in Oregon

- Paper and Wood Products + Food Processing
- Challenging economics
- Support from state government

OREGON DEPARTMENT OF ENERGY

CHP History in Oregon

- Policy and Incentives
  - Supporting CHP since 1980
  - Business Energy Tax Credits (BETC)
    - 17 projects supported
    - $24,458,788 in tax credits

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CHP Program Expansion

- Keep tax credits, added outreach
- Framework of current efforts
  - Opportunity Assessment
  - Economics
  - Partnerships
  - Support from the US DOE
  - Legislation

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Doing the Homework

- Opportunity Assessment
  - Washington State University / ICF International report
  - CHP Technical Assistance Partnership

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Where Is The Opportunity?

CHP Technical Potential by Electric Utility Territory (MW Capacity)						
Electric Utility	**50-500 kW**	**500-1 MW**	**1-5 MW**	**5-20 MW**	**>20 MW**	**Total**
Portland General Electric	163	105	182	76	87	**614**
Pacific Power & Light	97	76	99	102	98	**471**
Eugene Water & Electric Board	21	12	51	0	0	**84**
Other Electric Companies	57	51	94	16	71	**289**
Total	**338**	**244**	**425**	**195**	**255**	**1,457**

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Analysis Is Important

- Economics
  - Realistic opportunities
  - Industry and large investments
  - Multiple incentives
  - Analysis

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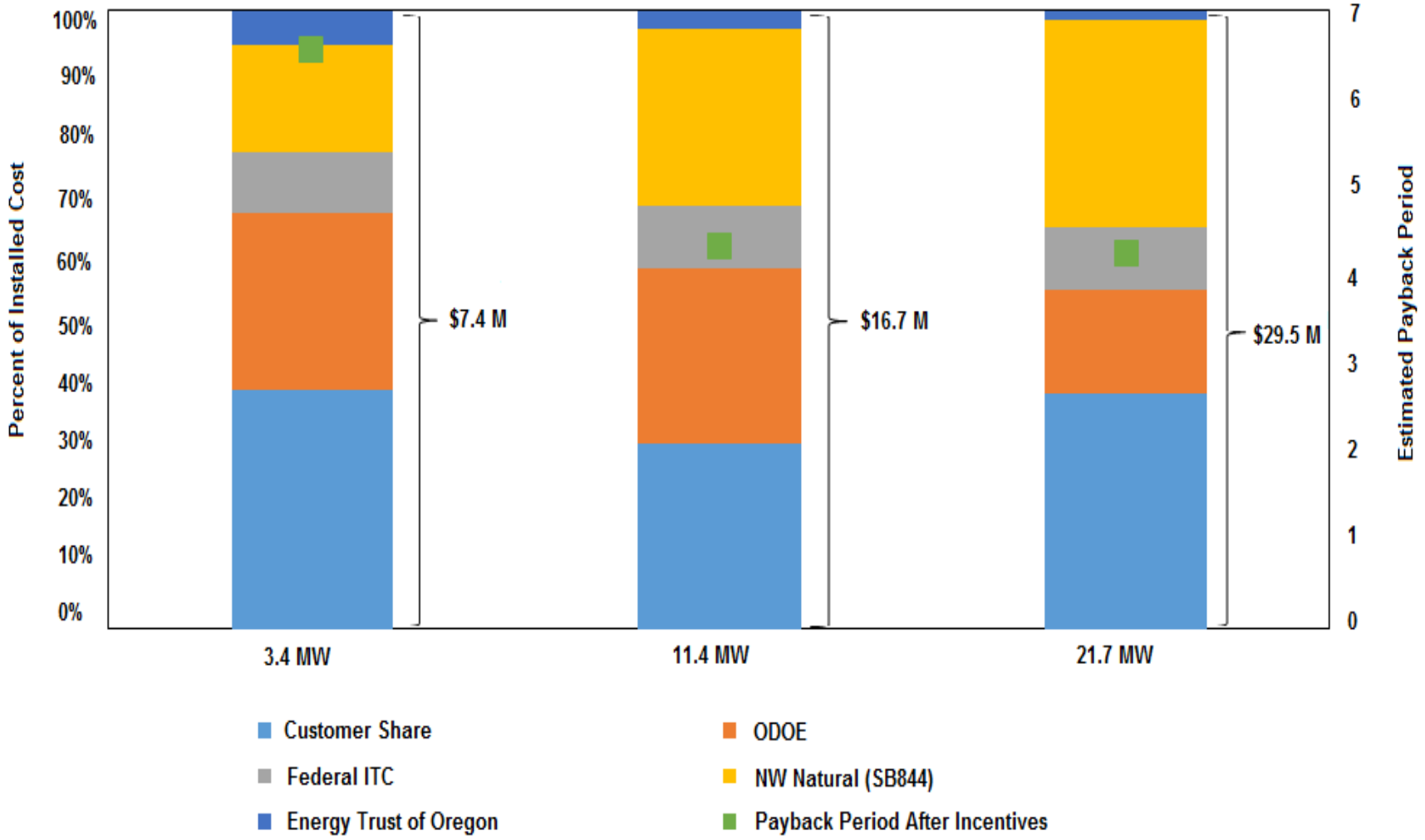
Stacked Incentives To Reach the Target



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The Value of Teamwork

- Partnerships
  - Acknowledge multiple goals
  - Aim for long-term outcomes
  - Support during stakeholder engagement
  - Anchor on common metrics and values

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Increased Focus and Support

- Support from the US DOE
  - National support
  - New perspectives and programs
- Legislation
  - Game changing
  - Allows long-term program commitment

OREGON DEPARTMENT OF ENERGY

Thank you!

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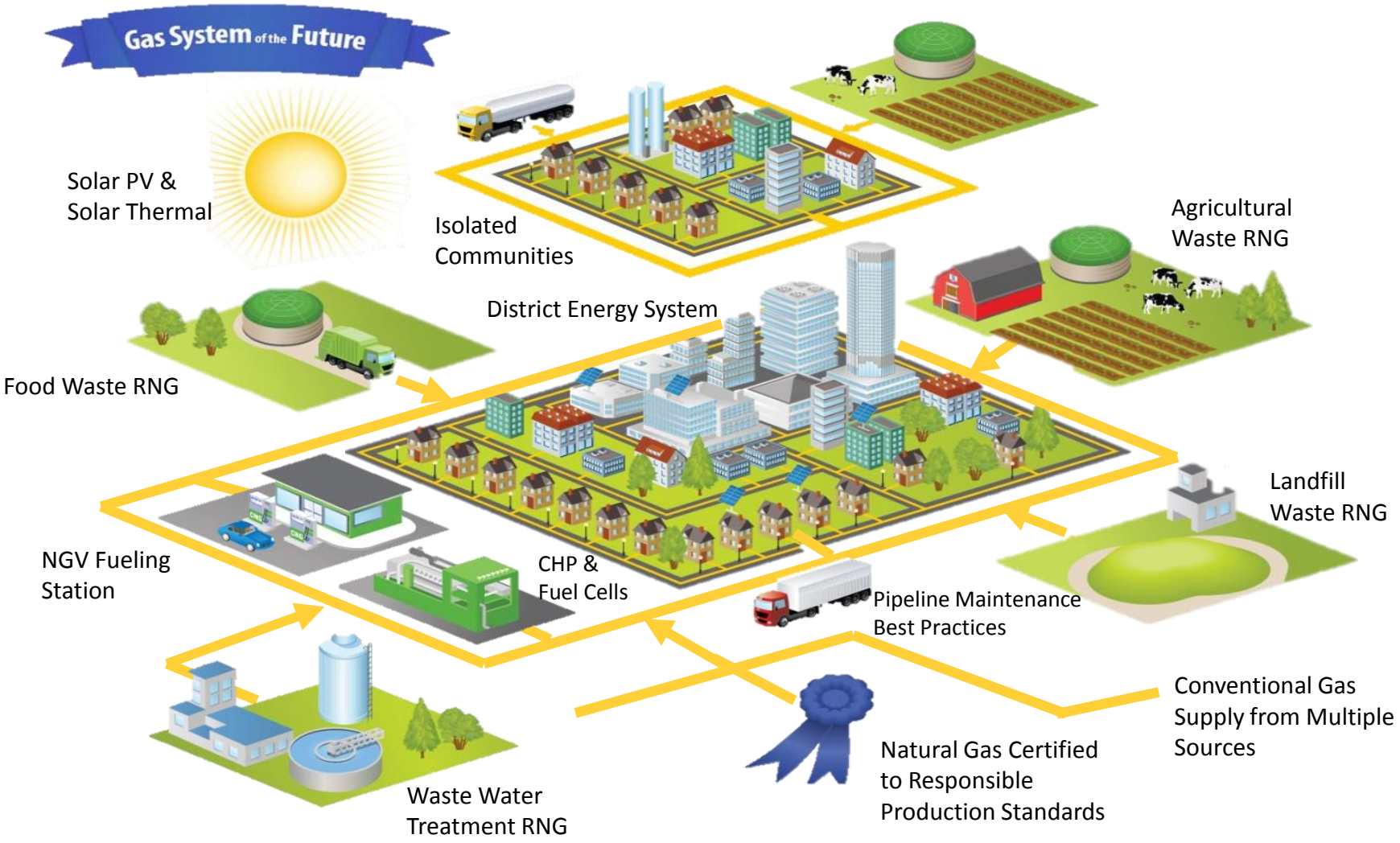
OREGON DEPARTMENT OF ENERGY

NW Natural's CHP Program: A Team Approach to Meeting State & National CHP Goals

US Department of Energy Better Buildings Summit
May 27-29, 2015 Washington DC


Gas System of the Future
Solar PV &
Solar Thermal
Isolated
Communities
Agricultural
Waste RNG
District Energy System
Food Waste RNG
Landfill
Waste RNG
NGV Fueling
Station
CHP &
Fuel Cells
Pipeline Maintenance
Best Practices
Conventional Gas
Supply from Multiple
Sources
Natural Gas Certified
to Responsible
Production Standards
Waste Water
Treatment RNG

Oregon SB 844 Overview

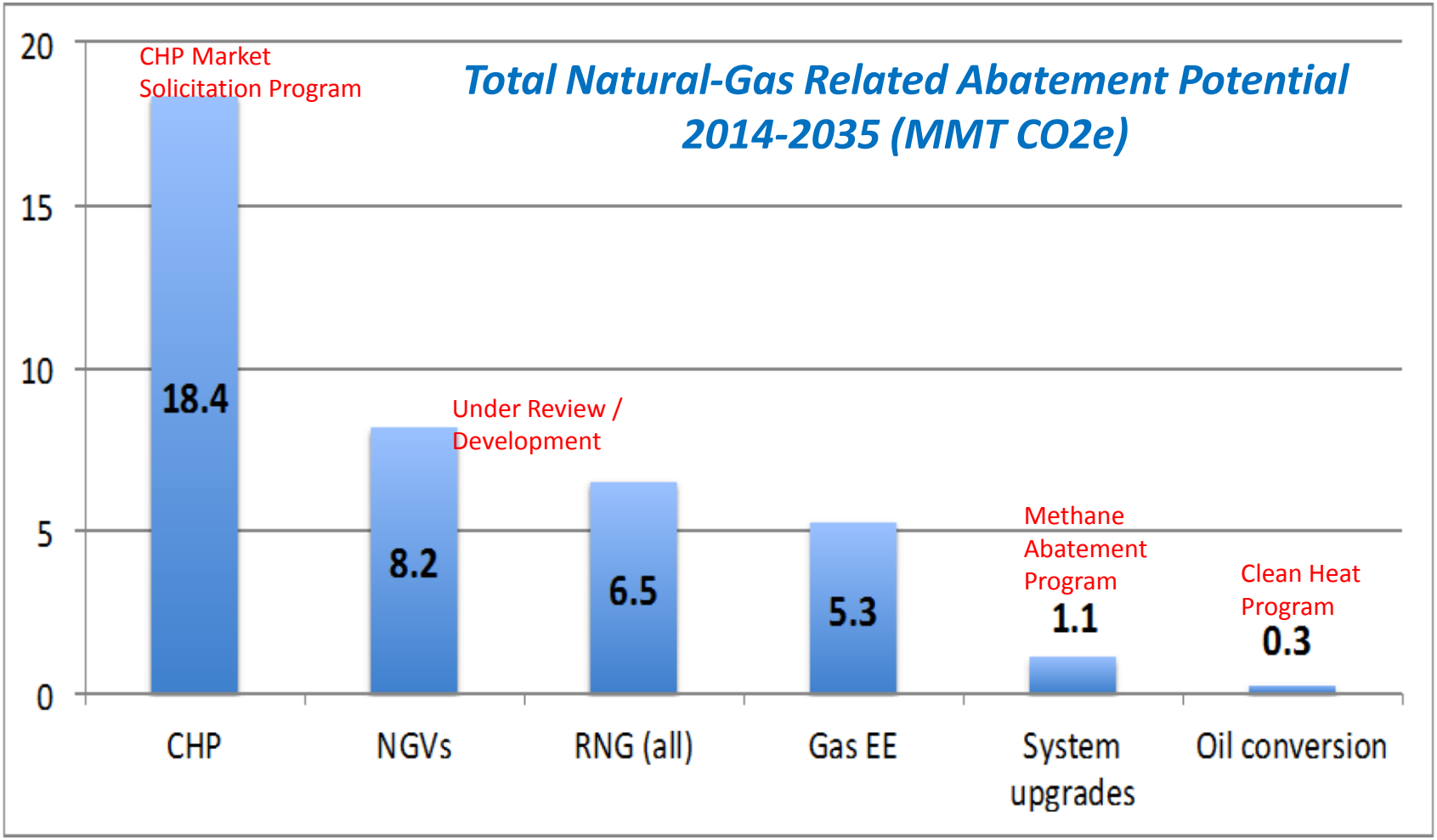
Oregon SB 844 (passed in the 2013 session) allows Oregon natural gas utilities to voluntarily develop greenhouse gas reduction projects.

Projects must:

- Reduce net GHG emissions
- Go beyond business as usual
- Result in customer benefits

Utility can receive an incentive for these projects

State Carbon Reduction Potential



Based on findings from the Oregon Department of Energy and Center for Climate Solutions, Energy Trust of Oregon and The Climate Trust.

Policy Context

Obama Administration (Exec Order, August 30, 2012) – Goal of deploying 40 gigawatts of new CHP in US by 2020.

Existing incentives and isolated efforts not moving market.

In the State of Oregon currently only two known CHP installations (excluding bio-mass), with total of 24 MWs.

ICF International, under contract to ODOE, identified 1,457 MWs of technical potential and 319 MWs of economic potential in Oregon.

Program Designed to Leverage Multiple Efforts and to Stack Incentives

NW Natural

- NW Natural Incentives for Carbon Reduction
- Federal Incentives for Business Investment
- US EPA CHP Partnership and US DOE Technical Assistance Program (Washington State University)
- State Incentives for Investments in Energy Efficiency
- Utility incentives for Electric Generation Efficiency and/or Thermal Efficiency (Administered through the Energy Trust of Oregon)

NW Natural Program

- **Enabled by SB844 & motivated by potential to reduce carbon emissions**
- **Designed to set common eligibility criteria and a coordinated approach (project evaluation, monitoring and verification).**

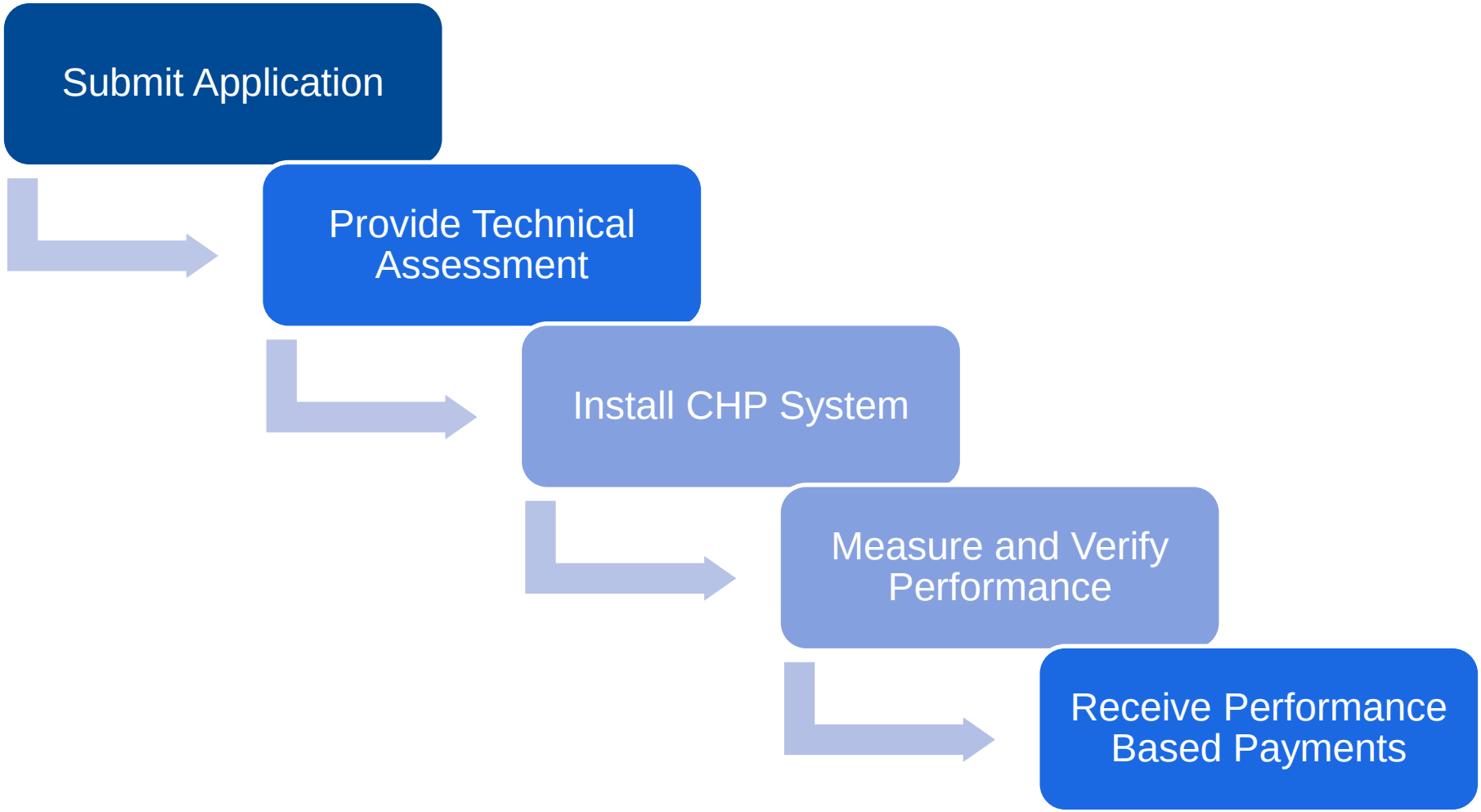
Designed to:

- **Promote customer-sponsored CHP projects that are more efficient than grid supplied electricity generation**
- **Promote carbon savings on regional basis**
- **Keep customers motivated over time to continue achieving energy efficiency and carbon savings**

Consistency with Existing Programs

	Federal	Oregon Department of Energy EIP	NW Natural	Energy Trust of Oregon
Efficiency Requirement	Effectively 10% more efficient than CCGT at 50% efficiency (60% efficient, produce at least 20% of its useful energy as electricity and at least 20% as useful thermal energy)	10% more efficient than CCGT Heat Rate	10% more efficient than CCGT Heat Rate	10% more efficient than CCGT Heat Rate
Basis for Incentive	Capital Investment on Projects up to 50 MW	Capital Investment	Carbon Reduction	Energy Efficiency
Incentive	10% Investment Tax Credit on first 15 MW Accelerated Depreciation	35% of project cost over 5 years (28.5% NPV) (WSU modeled $5 Million maximum per project)	$30/Mte CO2 up to $4.5 Million per year	$0.08 per annual kWh up to 50 % of eligible project cost up to $500K
M&V Requirement	Not Required	Not Required	Common reporting to the ETO & NW Natural- M& V basis for payment of incentive for up to 40 operating quarters	Common reporting to the ETO & NW Natural- Short term M&V at time of project completion

NW Natural Program Process



Project Payback Modeling

NW Natural®

	$10/Tonne Incentive			$20/Tonne Incentive			$30/Tonne Incentive			$40/Tonne Incentive			$50/Tonne Incentive		
Description	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds
Hospital - 800,000 sf with Two 800 kW Recip Engines ●	$ 52,297	5.8	3.0	$ 102,043	5.0	2.6	$ 153,064	4.5	2.3	$ 204,086	4.0	2.1	$ 255,107	3.7	1.9
Hotel - 60 Unit with Indoor Pool & Laundry, 20 kW Microturbine	$ 662	8.3	4.6	$ 1,293	7.6	4.1	$ 1,939	6.9	3.8	$ 2,585	6.3	3.5	$ 3,231	5.9	3.2

Low End

	$10/Tonne Incentive			$20/Tonne Incentive			$30/Tonne Incentive			$40/Tonne Incentive			$50/Tonne Incentive		
Description	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds	844 Incentive	Payback - No EIP Funds	Payback - At Maximum EIP Funds
Gas Turbine - 11.4 MW	$ 396,044	6.8	4.4	$ 772,769	5.7	3.8	$1,188,132	5.0	3.2	$1,545,538	4.4	2.9	$1,931,922	3.9	2.6
Gas Turbine - 21.7 MW	$ 811,430	6.0	4.9	$1,622,860	5.0	4.1	$2,434,290	4.4	3.6	$3,245,720	3.9	3.2	$4,057,150	3.5	2.8
Gas Turbine - 30 MW	$1,103,386	6.3	5.5	$2,261,942	5.3	4.7	$3,392,913	4.6	4.0	$4,523,883	4.1	3.6	$5,654,854	3.7	3.2
Gas Turbine - 45 MW	$1,669,416	5.5	5.0	$3,422,302	4.7	4.3	$5,133,453	4.1	3.7	$6,844,604	3.6	3.3	$8,555,755	3.2	2.9
Gas Turbine - 50 MW	$1,906,587	5.0	4.6	$3,813,173	4.3	3.9	$5,719,760	3.8	3.5	$7,626,346	3.4	3.1	$9,532,933	3.0	2.8

High End

															2.4
											4.4	$ 180,800	6.6	3.9	
								5.0	$ 415,120	7.4	4.4	$ 518,900	6.6	3.9	
						4.9	$ 450,659	7.1	4.2	$ 600,879	6.3	3.7	$ 751,098	5.6	3.3
			4.4	$ 772,769	5.7	3.8	$1,188,132	5.0	3.2	$1,545,538	4.4	2.9	$1,931,922	3.9	2.6
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NW Natural Program

Potential Size of NWN Opportunity

- **Technical potential: 1,457 MWs (from ICF Study)**
- **Economic potential: 319 MW (although decreasing due to changes in forest products)**
- **Program target: approx. 110 MW by 2020**
- **Carbon benefit: approx 260,000 tons CO2e/year at full build out**

Broader Application

- **National challenge to "crack the nut" on CHP**
- **Purposefully built using national tools (US DOE modeling, eGRID emissions, etc.)**
- **Most powerful to have national program that allows multi-state industrial customers access to CHP**

Questions & Opportunities

Bill Edmonds
Director, Environmental Management & Sustainability
NW Natural