

U.S. DEPARTMENT OF  
**ENERGY**

Office of  
ENERGY EFFICIENCY &  
RENEWABLE ENERGY

# Federal Utility Partnerships & Clean Production of Natural Gas

Karen Thomas, NREL | Jill Engel-Cox NREL

December 3, 2020



# Introductions



**Karen Thomas, NREL**  
202-641-7657  
[karen.thomas@nrel.gov](mailto:karen.thomas@nrel.gov)

Karen works for NREL, FEMP's lead laboratory for UESC support. She provides technical support, UESC workshop instruction, and project execution assistance to Federal acquisition teams.



**Jill Engel-Cox, NREL**  
303-275-3761  
[jill.engelcox@nrel.gov](mailto:jill.engelcox@nrel.gov)

Dr. Engel-Cox is Director of the Joint Institute for Strategic Energy Analysis (JISEA) at NREL. Over her 30-year career, she has been a researcher and strategic planner for a diverse suite of renewable energy, clean technology, and environmental programs in the United States, Asia, and Middle East.

# DOE Federal Energy Management Program

## Mission

The Federal Energy Management Program (FEMP) works with its stakeholders to:

- Enable federal agencies to meet energy-related goals
- Identify affordable solutions
- Facilitate public-private partnerships
- Provide energy leadership to the country by identifying and leveraging government best practices





# Training Agenda

- **Federal Utility Partnerships**
  - Background and benefits
  - Utility Energy Service Contract Overview
  - Case Studies
  - FEMP Support and Resources
- **Clean Production of Natural Gas**
  - Electric-Natural Gas Interface Study
  - Clean Power Technologies for Oil & Gas Industry Operations
  - Integration of Renewable & Carbon Capture Systems





# Utility Partnerships and UESCs

## Utility Energy Service Contracts (UESCs)

- Limited-source contracts between a federal agency and serving utility for energy management services, including:
  - Energy efficiency improvements
  - Water efficiency improvements
  - Demand reduction services
- Provide a streamlined contracting approach for the broad spectrum of energy management services offered by local utilities
  - Line extensions
  - Special facilities

42 U.S.C. § 8256(c)(4)

42 U.S.C. § 8256(c)(3)

# Why Do Federal Agencies Choose UESCs?

UESCs enable agencies to leverage financing to meet energy- and water-related goals and requirements, including:

- Statutory requirements and executive orders
- Agency-specific energy program priorities
- Site requirements and facility needs
- Opportunities identified by facility and energy audits



## Federal Energy Management Laws and Requirements

Visit the FEMP website for information: [www.energy.gov/eere/femp/federal-energy-management-laws-and-requirements](http://www.energy.gov/eere/femp/federal-energy-management-laws-and-requirements)

# Why do Utilities Offer UESCs?

- Increase incentive program impact and participation
- Meet Public Utility Commission requirements
- Demonstrate expertise and capabilities to help federal customers meet energy goals
- Establish a relationship with the federal government to partner for implementing energy projects and to assist with solving future energy challenges
- Leverage third-party financiers to execute UESCs

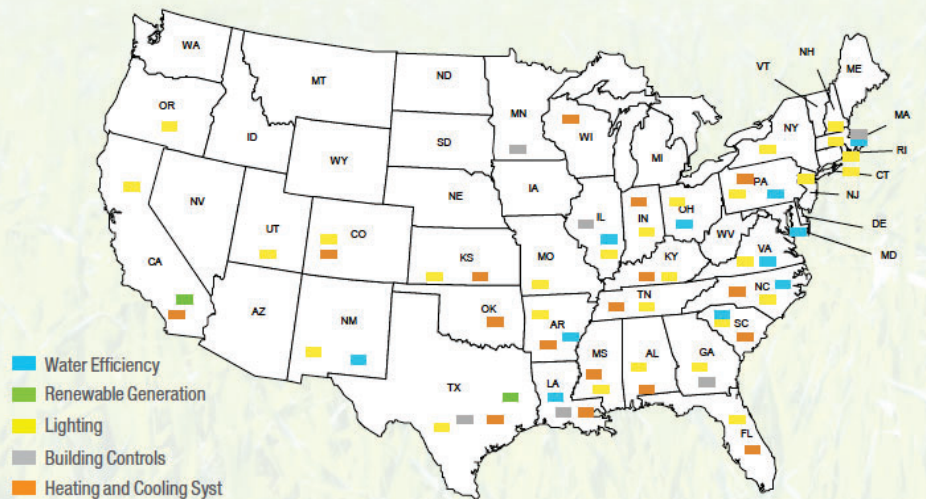




# Impacts of Utility Partnerships

- **Infrastructure:** \$14.2 billion in investment since 1998 addresses a portion of the backlog in federal buildings and maintenance needs
- **Jobs & Economic Impact:** created 113,500 jobs (job-years)

Manufacturing Facilities Supporting the Performance Contract Industry

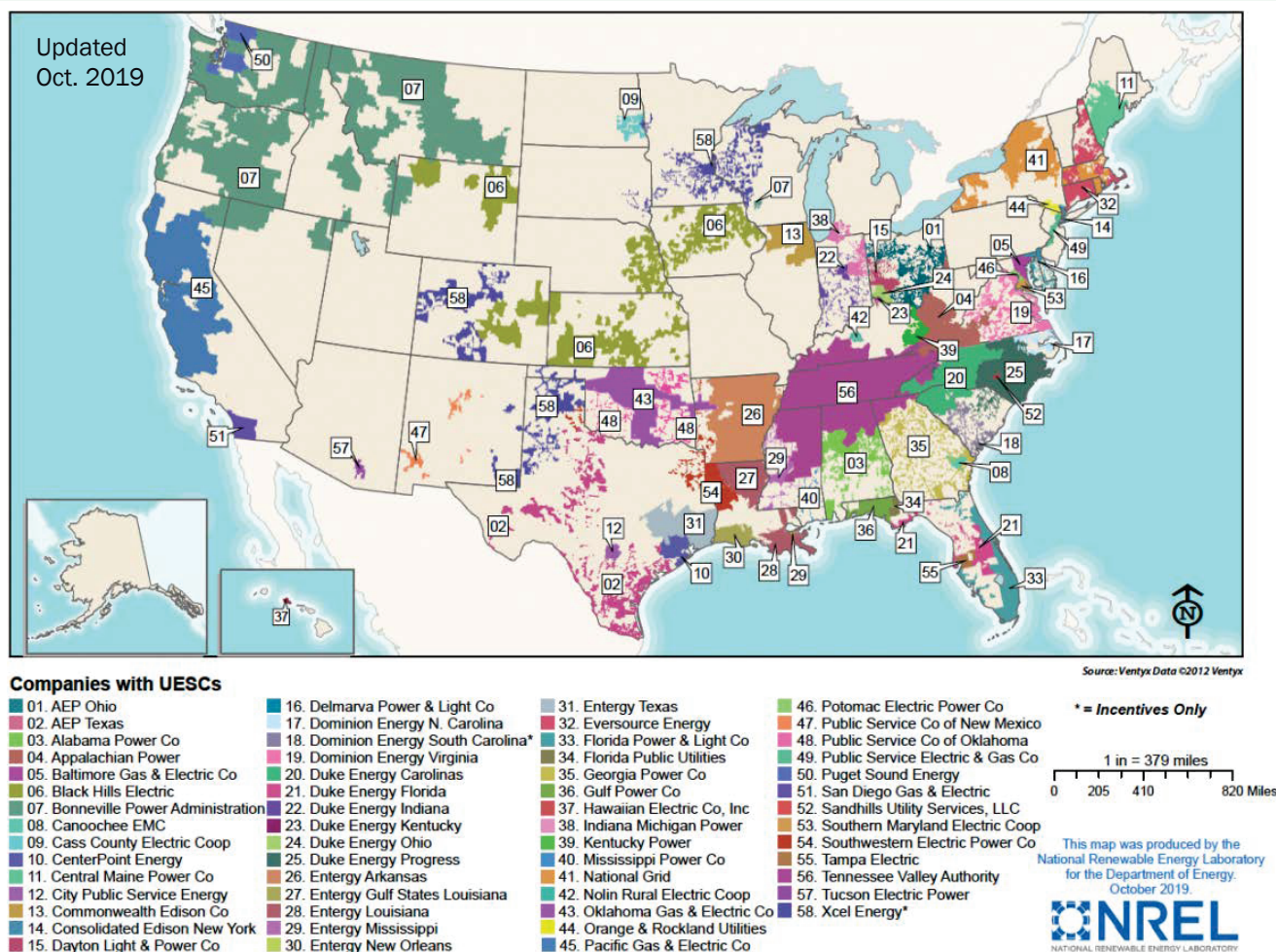


## Trades typically supported through UESC investment:

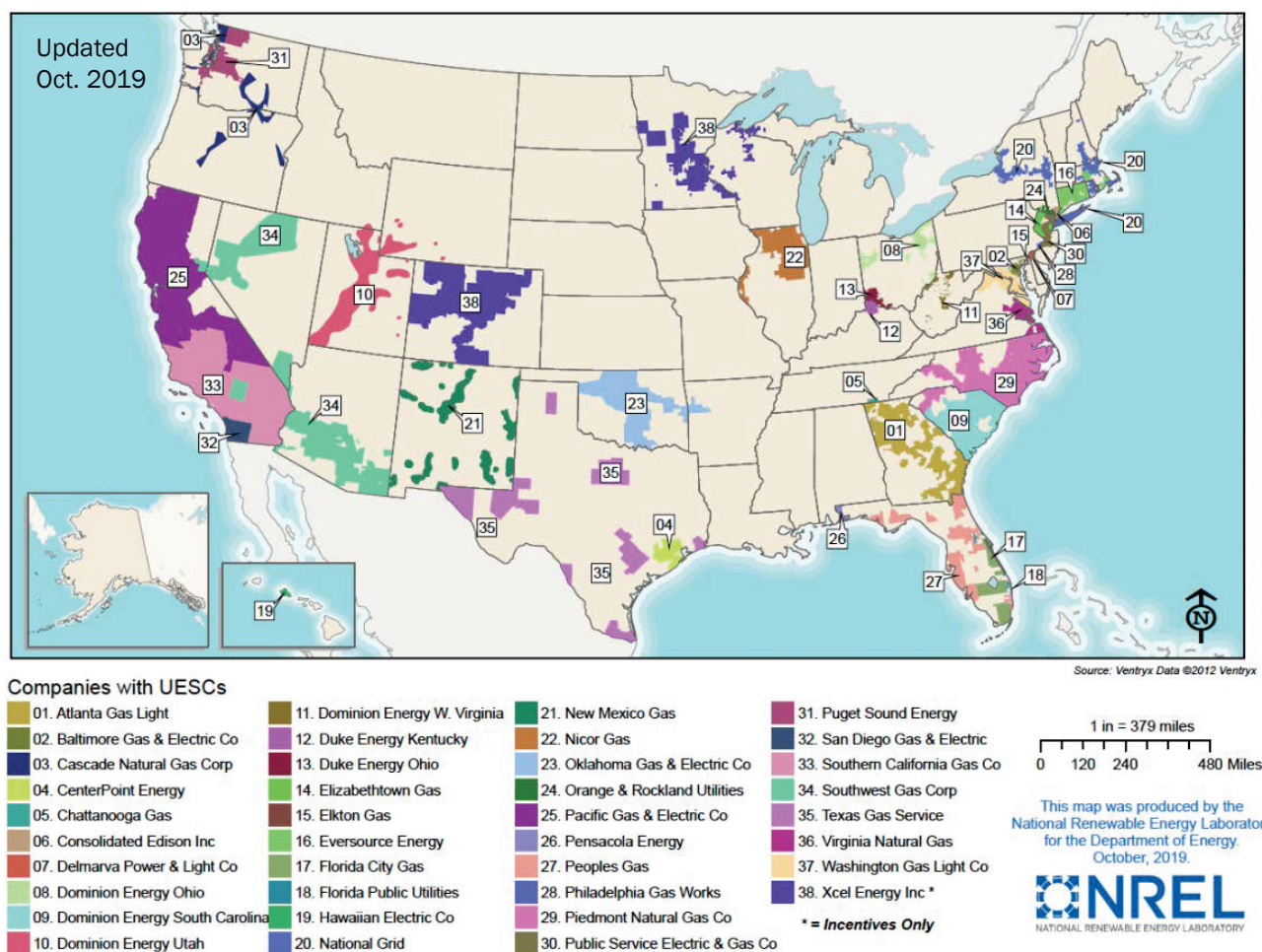
- HVAC technicians
- Electricians
- Plumbers
- Construction labor
- Construction management
- Manufacturing labor
- Engineers
- Project managers

Source: Nat'l Assoc. of Manufacturers, [Improving Federal Energy Savings Through Performance Contracting](#)

# Utilities Offering UESCs – Electric



# Utilities Offering UESCs – Natural Gas





# Utilities Offering UESCs

Visit the [FEMP Utility Program Partners](#) website for a list of utilities currently offering UESCs to their federal customers.

- If your utility is not listed on the website, reach out to FEMP for support in approaching your utility about offering a UESC program
- FEMP provides support to utilities interested in starting or re-starting their UESC programs

Companies with UESCs			
01. Atlanta Gas Light	11. Dominion Energy W. Virginia	21. New Mexico Gas	31. Puget Sound Energy
02. Baltimore Gas & Electric Co	12. Duke Energy Kentucky	22. Nicor Gas	32. San Diego Gas & Electric
03. Cascade Natural Gas Corp	13. Duke Energy Ohio	23. Oklahoma Gas & Electric Co	33. Southern California Gas Co
04. CenterPoint Energy	14. Elizabethtown Gas	24. Orange & Rockland Utilities	34. Southwest Gas Corp
05. Chattanooga Gas	15. Elkton Gas	25. Pacific Gas & Electric Co	35. Texas Gas Service
06. Consolidated Edison Inc	16. Eversource Energy	26. Pensacola Energy	36. Virginia Natural Gas
07. Delmarva Power & Light Co	17. Florida City Gas	27. Peoples Gas	37. Washington Gas Light Co
08. Dominion Energy Ohio	18. Florida Public Utilities	28. Philadelphia Gas Works	38. Xcel Energy Inc *
09. Dominion Energy South Carolina	19. Hawaiian Electric Co	29. Piedmont Natural Gas Co	
10. Dominion Energy Utah	20. National Grid	30. Public Service Electric & Gas Co	

\* = Incentives Only



## Contract Overview



# Authorizing Legislation

## Federal legislation authorizes and encourages agencies to:

- Participate in utility incentive programs
- Accept any financial incentive, goods, or services generally available
- Negotiate with utilities to design cost-effective programs to meet unique facility needs
- Pursue energy resilience projects in addition to energy conservation

### Legislation References

- 42 U.S.C. § 8256(c), Utility Incentive Programs
- 42 U.S.C. § 8253, Energy Management Requirements
- 10 U.S.C. § 2913 Energy Savings Contracts and Activities (DOD-specific)
- Federal Acquisition Regulations Part 41: Acquisition of Utility Services



# Features of a UESC

- 25-year maximum contract term
- Intended that savings exceed payments over the life of contract (including energy-related cost savings)
- Multiple sites served by the same utility can be included in a single contract
- Funded by any combination of agency funds and financing
- No project size restrictions



# Eligible Utilities

---

**Eligible utilities are serving local distribution utilities.**

- Maintain the infrastructure (pipes, poles, and wires) for the distribution of electricity, natural gas and water in a specific geographic area.
- Are subject to regulatory oversight from a governing authority such as a public utility commission
- Provide service under federal, state or local regulated authority for all customers in the service area
- Includes investor-owned, municipal, federal and rural coops

# Energy Conservation Measures (ECMs)

## ECM Criteria

- Produce measurable energy or water reductions or demand reduction
- Be directly related to the use of energy or water, or demand reduction
- Preponderance of work (measured in dollars) must be for items one and two above, and
- Be a direct or indirect improvement to real property

## Example ECMs\*

- Boiler, chiller retrofits
- Construction of new cogeneration facilities
- Gas fired water heaters/gas fired unit heaters
- Energy management control systems upgrades
- Commissioning activities
- Lighting and lighting control improvements
- Renewable energy systems

*All energy-consuming systems, including water, should be considered regardless of fuel source.*

*\*Not an exhaustive list, all other measures that meet the ECM criteria are included.*



# UESC Funding

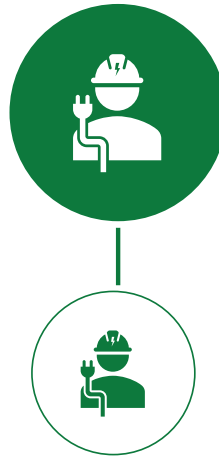
**42 U.S.C. § 8253(f)(10)(B)** specifically authorizes federal agencies to use “any combination” of appropriated funds and private financing.



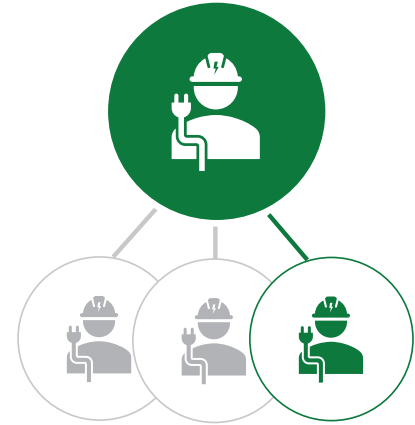
# UESC Implementation Models



**Utility  
Self-Performs**



**Utility with Single ESCO Partner**

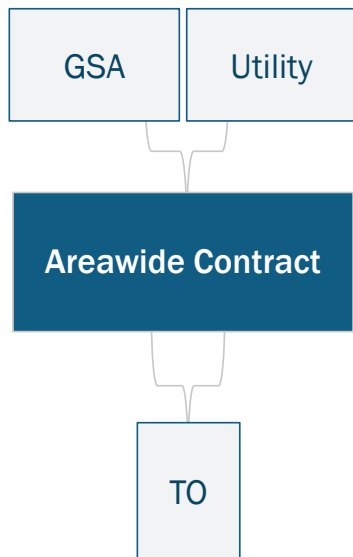


**Utility with Multiple ESCO Partners  
(one ESCO per project)**

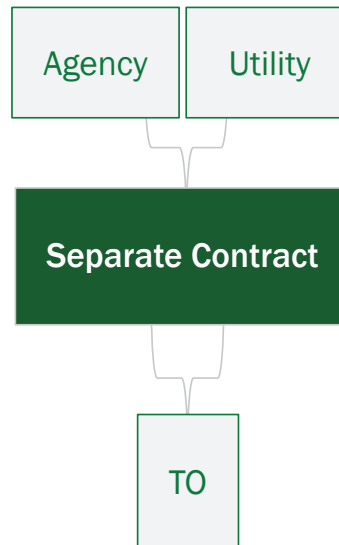
*Utility is always the prime contractor—even when an ESCO is involved.*

# Contracting Options

## Areawide Contract

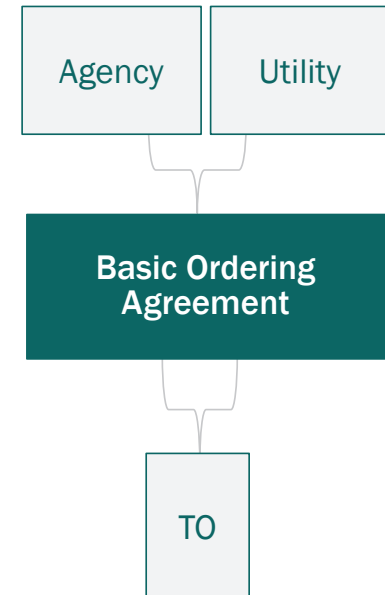


## Separate Contract



TO = Task Order

## Basic Ordering Agreement



# GSA Areawide Contract (AWC)

**FAR Part 41 authorizes GSA to establish AWCs to be used by federal agencies to procure utility service within the utility's franchised service territory:**

- AWC is bilaterally signed by GSA and utility
- Agencies place UESC Task Orders (contracts) under the AWC

## Authorization for Energy Management Services (EMSA)

Nature of Service:

- ☐ Preliminary Energy Audit
- ☐ Investment Grade Audit
- ☐ Engineering & Design Study
- ☐ Energy Conservation Project Installation
- ☐ Demand Side Management Project

Examples: Boiler Retrofits, Cogeneration Facilities, Recommissioning, HVAC

## Authorization for Natural Gas Service

Nature of Service:

- ☐ Connect
- ☐ Change
- ☐ Continue service
- ☐ Line Extension, Alteration, Relocation or Reinforcement
- ☐ Transportation
- ☐ Billing & Ancillary Services

Example: Installation of gas line



# UESCs and Resilience Planning

**Utilities can provide services via UESCs that support resilience initiatives for their federal customers.**

- Increase reliability
- Reduce system loads – all energy consuming systems
- Install interconnected power plant
- Install renewable energy system
- Incorporate microgrid/smart grid capabilities
- Energy storage
- Include demand response and island mode capabilities

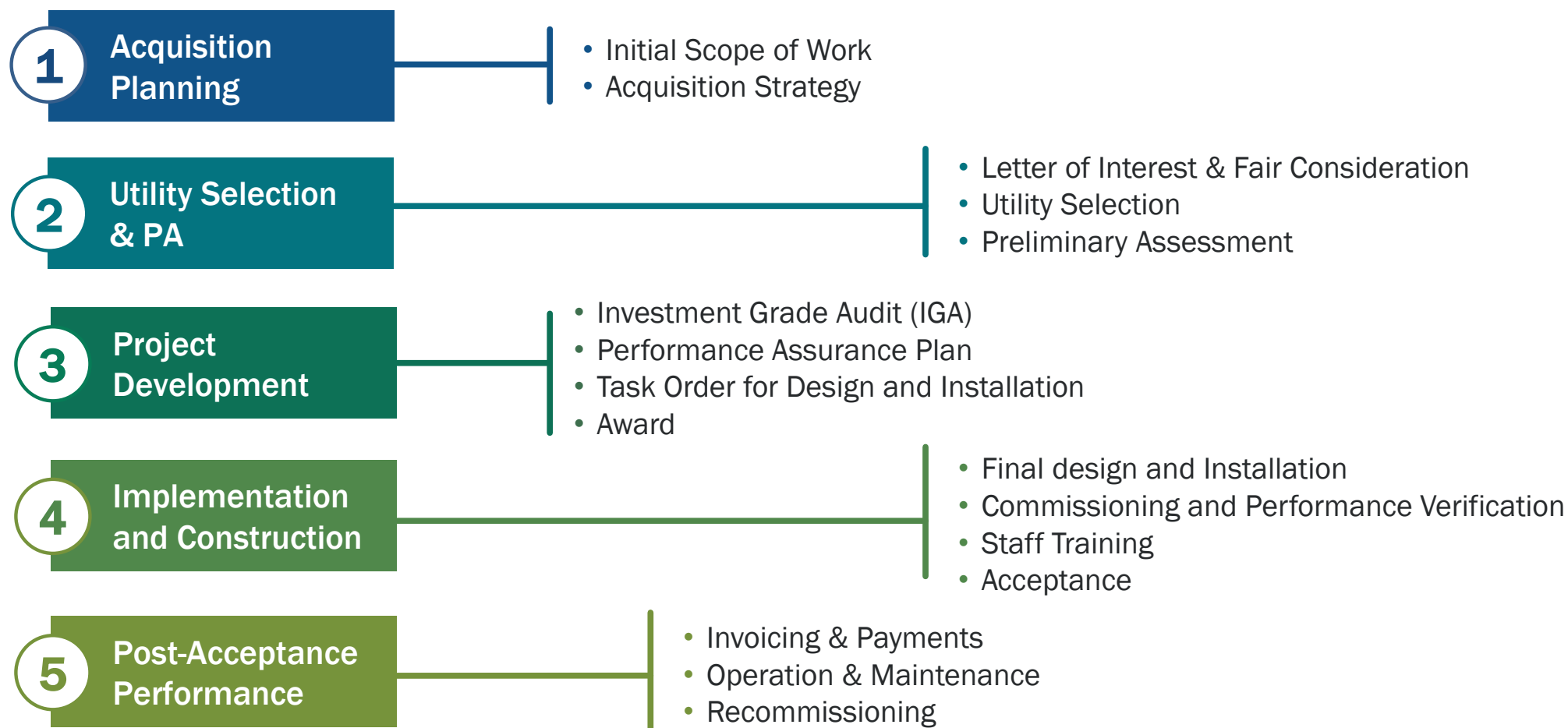
# Resilience is a Top Priority for Agencies

Energy and water resilience is a key component of federal facility infrastructure operations

*Resilience* is accomplished when operational and procedural elements are able to withstand, adapt to, respond to, and recover from disruption

AP/David Philip

# UESC Project Implementation Process



# Case Studies: Coast Guard Academy

## UESC Quick Facts:

- Investment Value: \$72.6 million
- Location: U.S. Coast Guard Academy, New London, Connecticut
- Utility Partner: Eversource
- Contract Term: 20 years
- Avoided Cost: Estimated 80% energy cost reduction, or \$2 million/year

## Energy Conservation Measures:

- Combined heat & power (CHP) – 1 MW
- Boiler system improvements
- Steam and hot water system improvements
- Chiller plant expansion and optimization
- Lighting improvements
- Rooftop solar PV arrays
- Retrocommissioning
- Campus-wide DDC controls
- Water conservation



*The CHP plant, transformer upgrades, and electricity distribution improvements all **enhance energy resilience** at the Academy. When awarded in September 2017, this UESC was the **largest in DHS history**.*



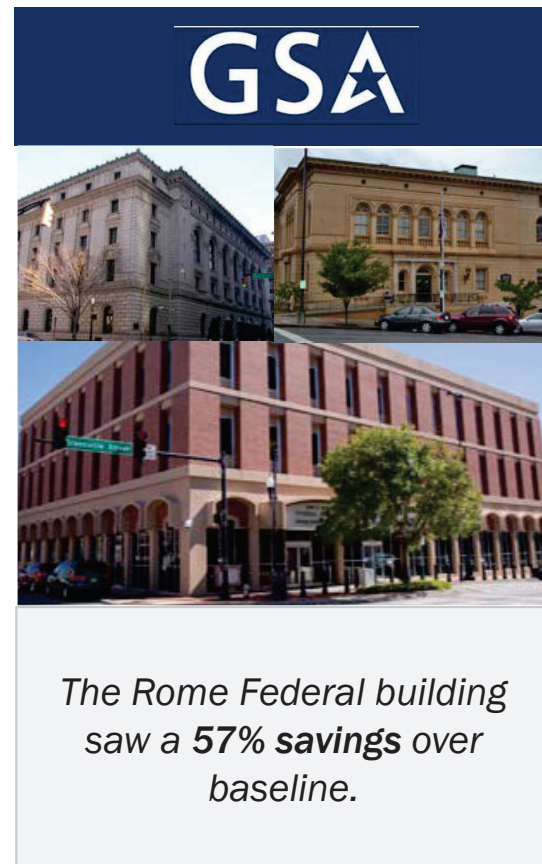
# Case Studies: GSA Atlanta Central

## UESC Quick Facts:

- **Investment Value:** \$11M project with \$7M buydown
- **Utility Partner:** Atlanta Gas Light (Southern Company Gas)
- **Location:** Tuttle Court of Appeals, Morgan Federal Building and Post Office and Rome Federal Building are GSA Federal Courthouses, Administration and Post Office Buildings in Atlanta, Newnan and Rome, Georgia
- **Contract Term:** 15 years

## Energy Conservation Measures:

- New chillers and pumps
- Heating system upgrade
- Recommissioning
- Controls system upgrade and optimization
- Lighting retrofits and controls
- Water conservation



# Case Studies: MCB Camp Lejeune

## UESC Quick Facts:

- Investment Value: \$27.5 million
- Location: U.S. Marine Corps Base Camp Lejeune, Jacksonville, NC
- Utility Partner: Piedmont Natural Gas (now Duke Energy)
- Contract Term: 15 years
- Avoided Cost: \$37 million in savings, or nearly \$2.5 million per year

## Energy Conservation Measures:

- Steam decentralization (shut down coal burning plants)
- 37 High efficiency boilers
- Hot water heating systems
- HVAC upgrades
- Water treatment equipment



*Awarded in March 2015, the project required no upfront capital. Upgrades allowed the site to shut down three less-efficient central steam plants, two of them coal-burning.*



## Next Steps: Start the Conversation with FEMP





# FEMP Support for Utilities

- Tailored training and utility program consultation
  - Guidance around establishing a UESC program
  - Competitively selecting ESCO contractors
  - Understanding legislative requirements
  - Connecting with federal customers
  - Executing projects
- Technical assistance provided by NREL and other DOE National Labs (by request and as available)



**Learn more on the FEMP Website**

[www.energy.gov/eere/femp/utility-energy-service-contracts-federal-agencies](http://www.energy.gov/eere/femp/utility-energy-service-contracts-federal-agencies)



# Federal Utility Partnership Working Group

Effort led by FEMP to cultivate lasting partnerships between federal agencies and utilities for improved energy and water management.

- Seminars and networking opportunities
- Training and industry updates
- Knowledge sharing around new technologies, best practices, and approaches to achieving energy goals



**Learn more about FUPWG on the FEMP website!**

**<https://www.energy.gov/eere/femp/federal-and-utility-collaboration>**

# Strategic Partnership Meetings

**Engage your federal customers by hosting a strategic partnership meeting with FEMP.**

- Objective is to inform federal agencies about incentive programs and energy services provided by the utility
- Co-hosted by FEMP Utility Team and utility personnel
- Agenda tailored to emphasize utility's priorities
  - Typically includes brief UESC training
- Scheduled upon request and at no cost to the utility (as available)



**Contact us to learn more!**

**Tracy Niro, DOE / FEMP | 202-431-7601 | [tracy.niro@ee.doe.gov](mailto:tracy.niro@ee.doe.gov)**

# Energy Incentive Program Resources

- How well do your federal customers understand your incentive programs?
- Leverage FEMP's resources to engage with your customers and communicate incentive options and opportunities.



## Incentives Resources

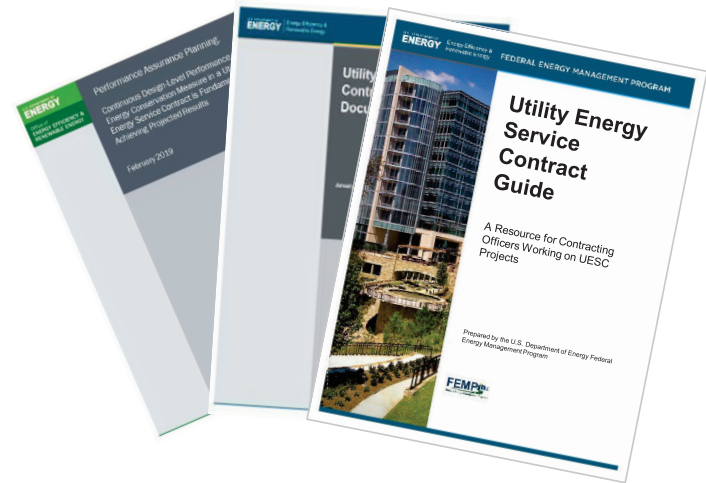
[Database of State Incentives for Renewables & Efficiency \(DSIRE\)](#)

[FEMP Demand Response and Time-Variable Pricing Programs website](#)

**FEMP Contact:** Phil Coleman | [PEColeman@lbl.gov](mailto:PEColeman@lbl.gov) | 610-604-0170

# FEMP UESC Resources

- [Enabling Documents](#)
- [UESC Contract Guide](#)
- [Performance Planning for UESCs](#)
- [UESC Report Template](#)
- [On-Demand Webinars Series](#)



**View all resources on the FEMP website!**

<https://www.energy.gov/eere/femp/resources-implementing-utility-energy-service-contracts>



# FEMP Utility Team Contact Information



**Tracy Niro**

DOE / FEMP

202-431-7601

[tracy.niro@ee.doe.gov](mailto:tracy.niro@ee.doe.gov)



**Karen Thomas**

NREL

202-641-7657

[karen.thomas@nrel.gov](mailto:karen.thomas@nrel.gov)



**Deb Vásquez**

NREL

303-384-7548

[deb.vasquez@nrel.gov](mailto:deb.vasquez@nrel.gov)



**Don't hesitate to contact FEMP with questions!**

Technical Assistance • Training • UESC Program Support



## Overview of NREL and Clean Production of Natural Gas

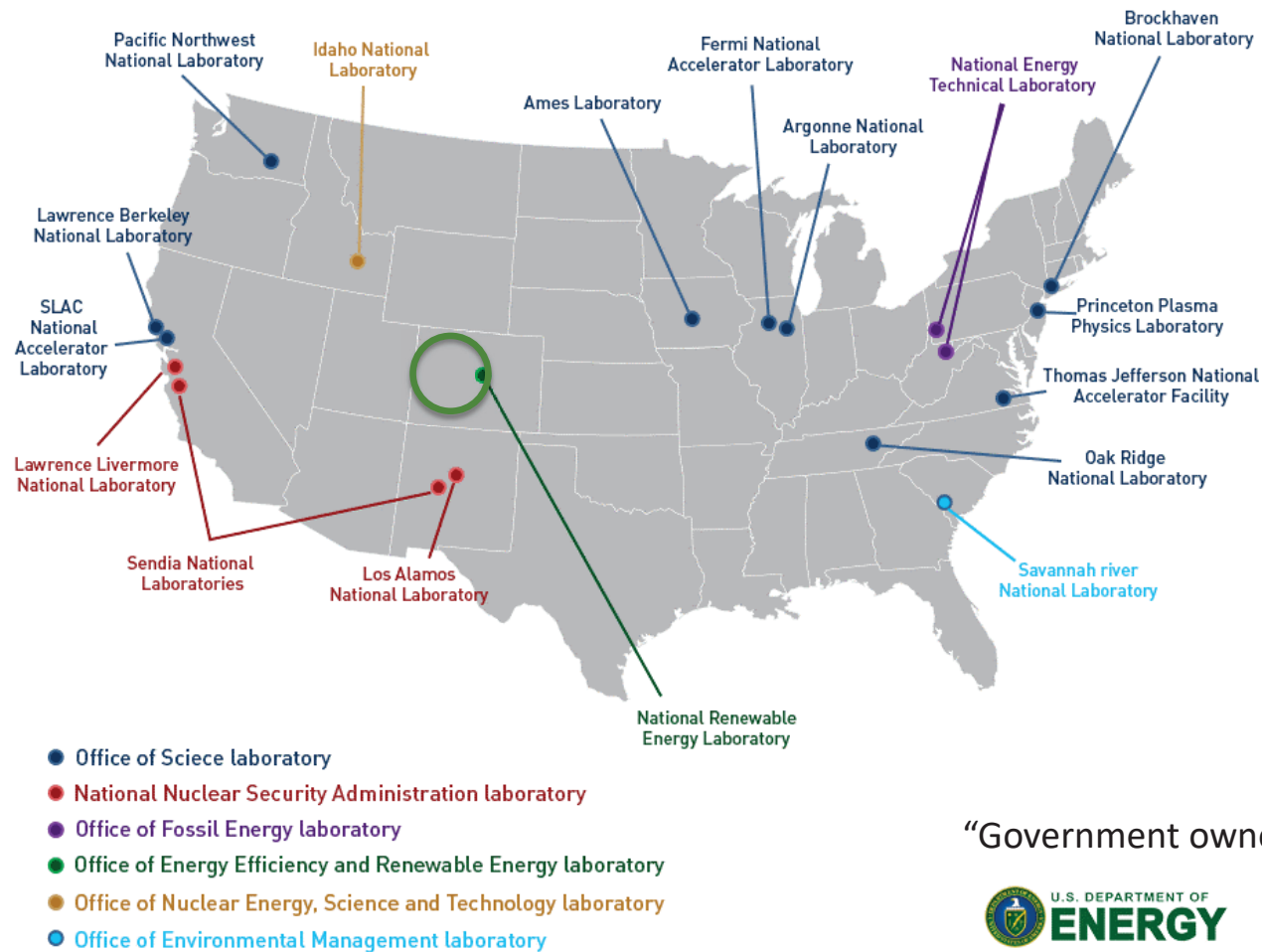
ESC-AGA Webinar: Federal Utility Partnerships and Clean Production of Natural Gas

3 December 2020

Jill Engel-Cox, Director, Joint Institute for Strategic Energy Analysis | [jill.engelcox@nrel.gov](mailto:jill.engelcox@nrel.gov)



# 17 U.S. Department of Energy National Laboratories



“Government owned, contractor operated”





**Mission:** NREL advances the science and engineering of energy efficiency, sustainable transportation, and renewable power technologies and provides the knowledge to integrate and optimize energy systems.

**Example Technology Areas:**

[www.nrel.gov/about](http://www.nrel.gov/about)



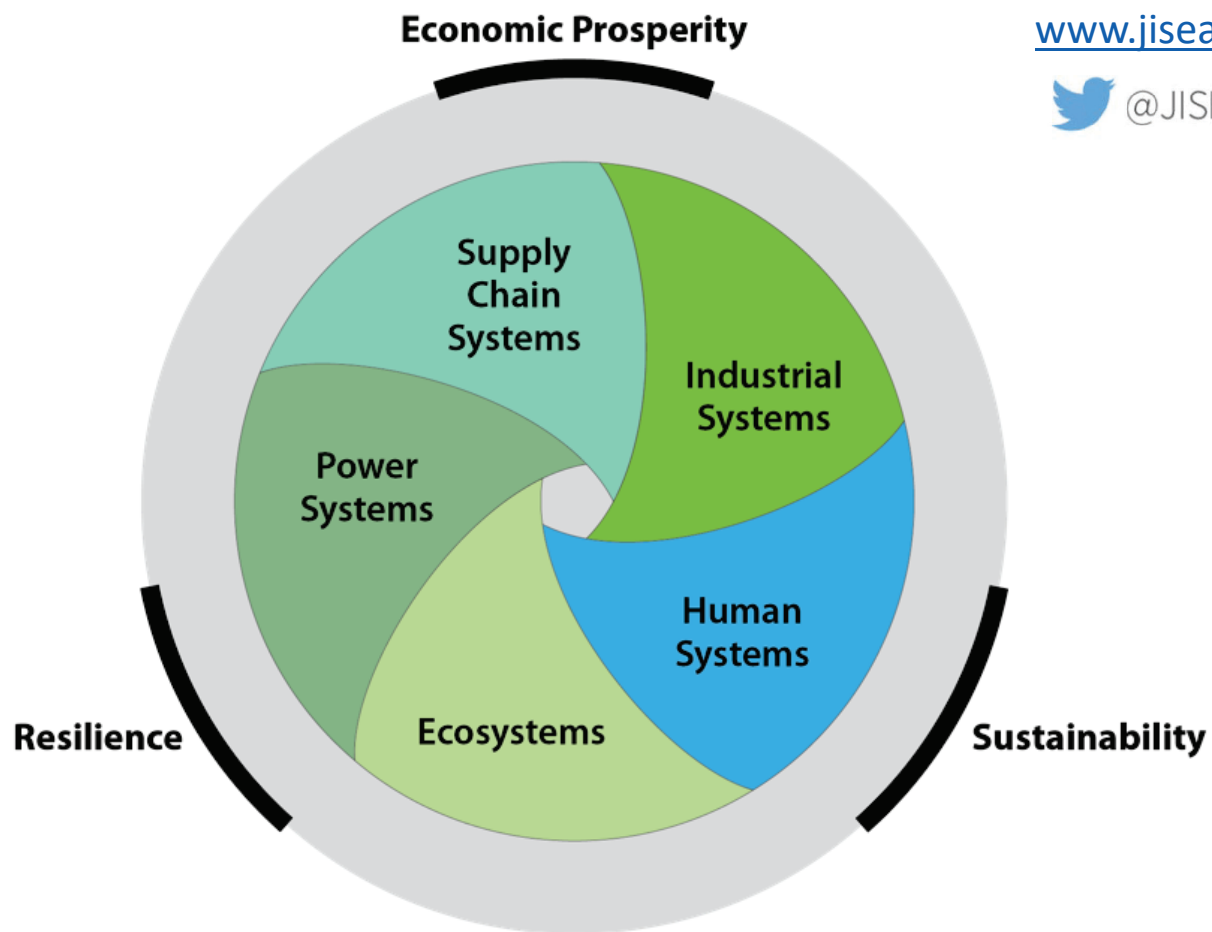
- 2,900 employees and postdoctoral researchers, interns, and visiting professionals
- 327-acre main campus in Golden & 305-acre Flatirons Campus with National Wind Technology Center 13 miles north
- 69 R&D 100 awards. More than 1,000 scientific and technical materials published annually

# JISEA

Joint Institute for  
Strategic Energy Analysis

*Connecting  
technologies, economic  
sectors, and continents  
to catalyze the transition  
to the 21<sup>st</sup> century  
energy economy.*

## Founding Partners:



[www.jisea.org](http://www.jisea.org)

 @JISEA1



# Electric-Natural Gas Interface Study

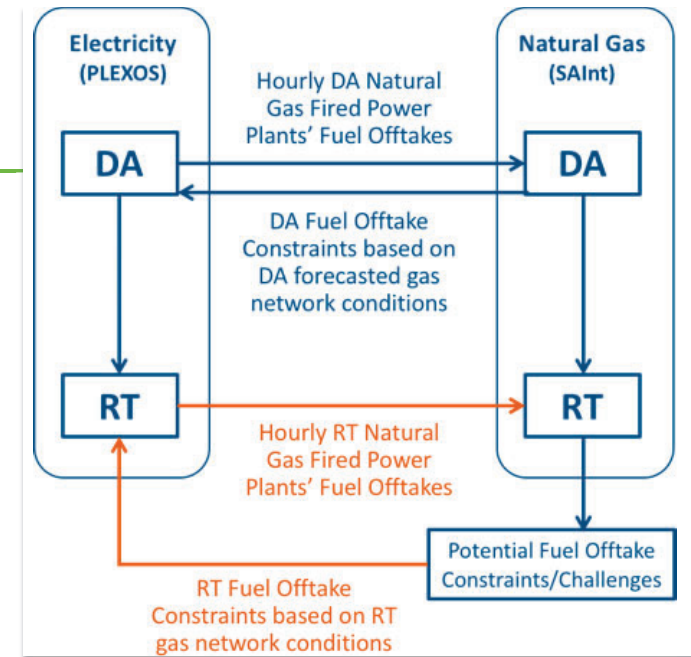
**Electricity & Gas** networks are **interconnected** energy infrastructures whose operation and reliability depend on one another. As the percent of gas and variable renewable power plants increase, the connection between these networks becomes increasingly important.

**Goal of project** is to:

Co-simulate power and natural gas network operations.

Define an interconnected power and natural gas test system

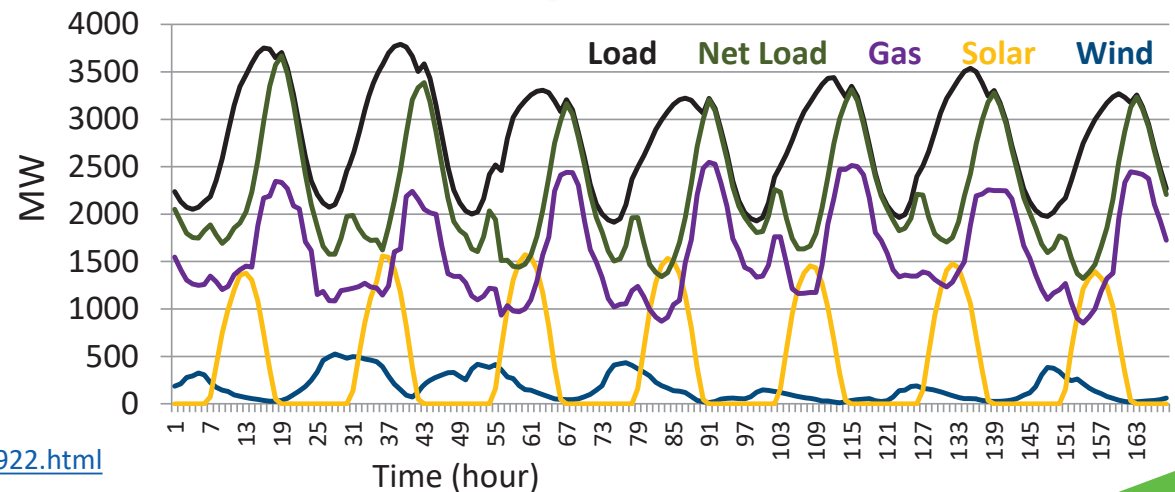
Determine value of coordination of day-ahead operations



## Funded through JISEA sponsorship by:

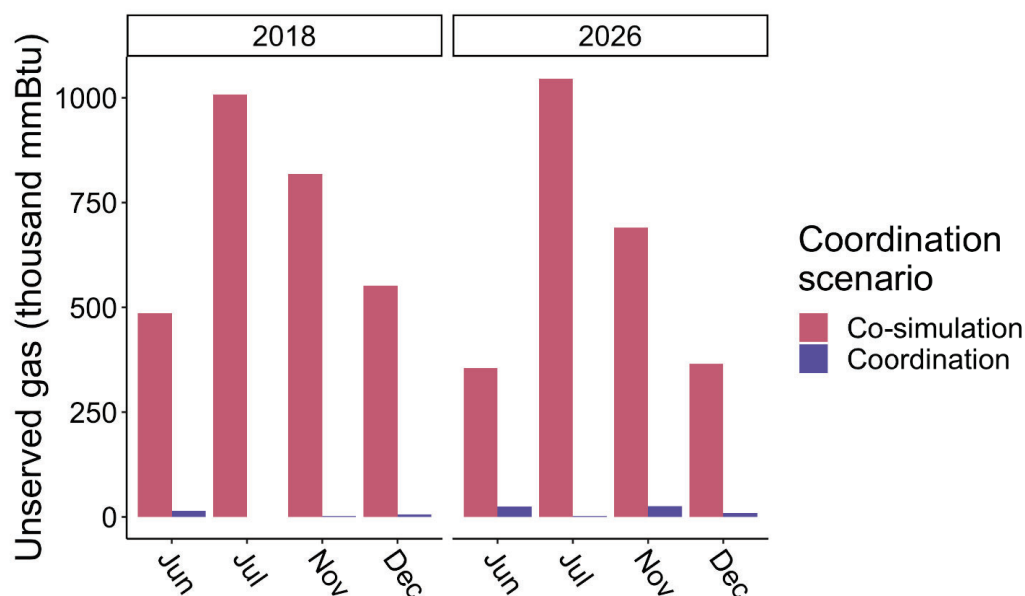
- American Electric Power
- Environmental Defense Fund
- Hewlett Foundation
- Kinder Morgan
- American Gas Association
- Midcontinent Independent System Operator

Source: See reports and summary at: <https://www.jisea.org/20200922.html>



# Electric-Natural Gas Interface Study – Results

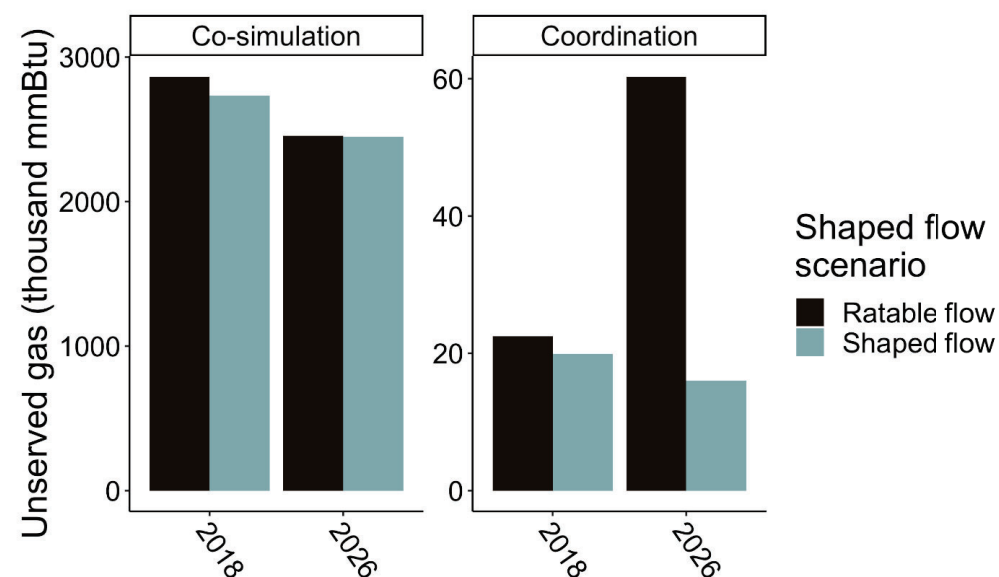
**Total unserved natural gas by week for the co-simulation and coordination scenarios (based on ratable flows)**



Redispatch of the power sector based on constraints from the gas model (i.e. coordination) serves to reduce unserved gas by upwards of 97% relative to co-simulation.

Source: See reports and summary at: <https://www.jisea.org/20200922.html>

**Total unserved natural gas using constant flows at the day ahead and intra-day market levels (ratable) and using hourly gas offtakes from generators (shaped flow)**



Shape flow gas nominations reduce curtailed gas offtakes when compared with ratable gas nominations

# Clean Power Technologies for Oil & Gas Industry Operations

**Value Proposition:** Demonstrate highly reliable, affordable, clean power for oil & gas operations.

Reduce risk to operations | Access to unique, world class capabilities |  
Collaboratively identify 'best practices' to reduce cost | Leverage research/testing dollars

## Program Results:

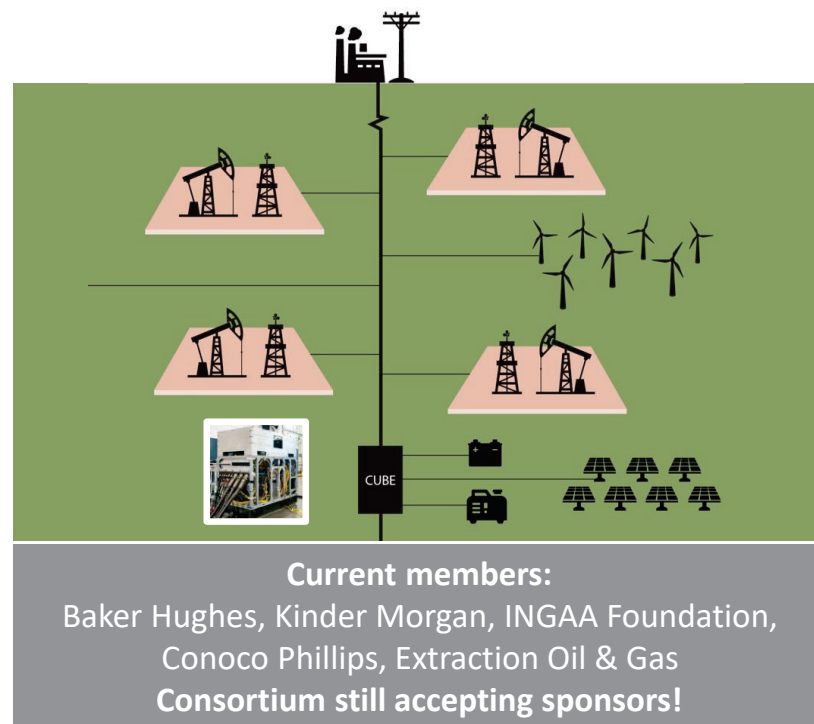
- Operational, financial, and environmental improvements within oil & gas operations (upstream, midstream, refineries)

## Governance:

- Consortium of industry partners to leverage resources for benefit of those involved, supported/managed by JISEA

## Program Targets:

- Support the identification, development, and adaptation of **highly reliable, cost-effective clean energy solutions** for oil and gas operations
- Perform **techno-economic analysis and site-specific optimization** of combinations of renewable and conventional generation, storage, and energy conservation
- With industry partners, **demonstrate the most promising technologies** for validation of performance in a variety of field environments, while analyzing optimization scenarios.



# Example: Hypothetical Grid-Connected Upstream Site

The recommended system and cost of grid-connected emissions reductions is significantly impacted by accounting method.

**With net emissions accounting:**

- Large PV systems that export excess generation to the grid provide the most cost-effective route to achieving emissions reductions targets.

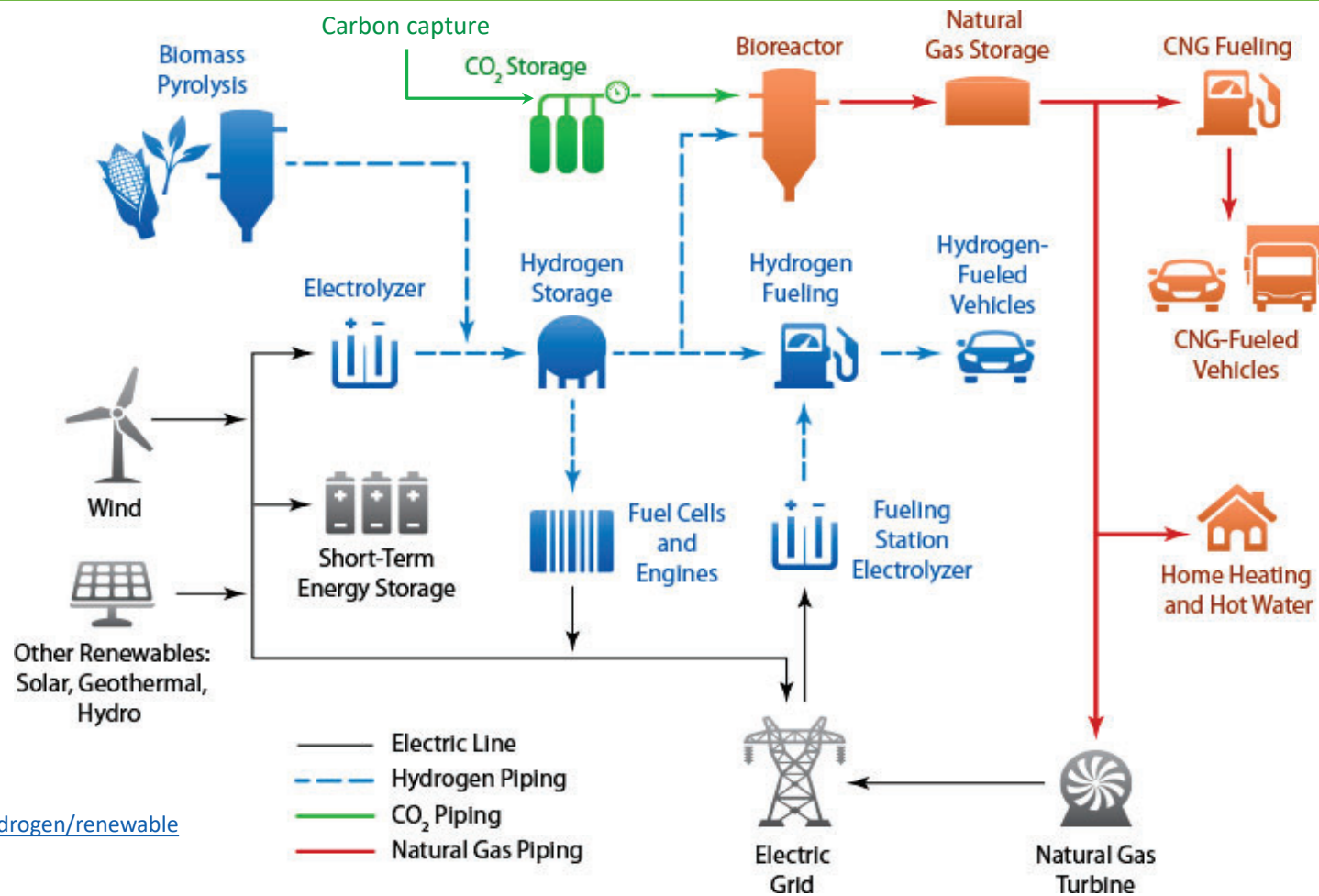
**Without net emissions accounting:**

- Beyond 20% emissions reductions, battery storage and wind turbines are required because this accounting methodology requires the renewable generation to be consumed directly onsite.
- As annual emissions reductions approach 100%, the marginal cost per tCO<sub>2</sub>e becomes increasingly expensive due to the high capital costs of battery storage and wind turbines.

	Base case	Cost optimal	Annual % Emissions Reduction - With Net Emissions Accounting					Annual % Emissions Reduction - Without Net Emissions Accounting				
			20%	40%	60%	80%	100%	20%	40%	60%	80%	100%
PV capacity [MW-DC]	-	7.4	10.0	19.9	29.9	39.9	49.9	10.5	13.7	21.8	35.7	63.4
Wind capacity [MW-AC]	-	-	-	-	-	-	-	-	6.0	9.1	10.3	30.5
Battery energy capacity [MWh]	-	-	-	-	-	-	-	-	-	25.5	69.3	282.3
Battery inverter capacity [MW]	-	-	-	-	-	-	-	-	-	3.8	8.5	7.3
Total lifecycle costs [\$M]	52.5	52.4	52.7	57.9	65.0	72.7	80.8	52.9	65.4	82.9	107.2	254.4
Net present value [\$M]	-	0.1	(0.2)	(5.5)	(12.5)	(20.2)	(28.4)	(0.4)	(12.9)	(30.4)	(54.7)	(201.9)
Annualized cost of emissions reductions [\$/tCO <sub>2</sub> e]	-	(2.1)	4.1	50.8	77.6	94.0	105.8	7.2	120.2	189.3	255.3	753.3

Source: Krah et al. 2020, <https://syscon2020-virtual.com/presentation/paper/opportunities-clean-energy-natural-gas-well-operations/>

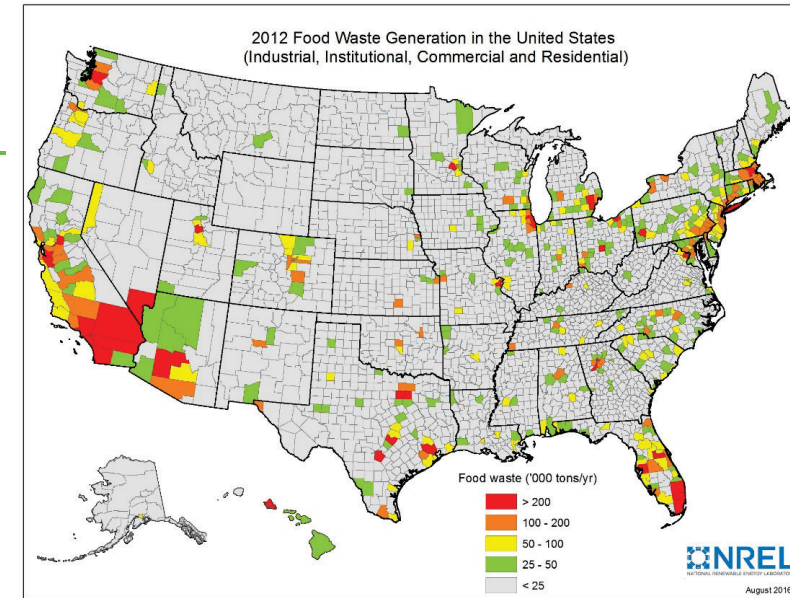
# Integration of Renewable & Carbon Capture Systems



Source:  
<https://www.nrel.gov/hydrogen/renewable-electrolysis.html>

# Renewable Natural Gas

- Resource assessment (resource quantity, prices, geographic distribution)
- Cost-benefit analysis (compares various pathways for resource utilization)
- Market analysis (e.g. resource potential, current uses and competition)
- Potential for integration with current natural gas infrastructure



## Example U.S. Resource Map and Supply Curves

More info at:

<https://www.nrel.gov/bioenergy/biogas-upgrading.html>

Sources: Milbrandt, A., et al. Wet waste-to-energy resources in the United States. Resources, Conservation and Recycling 137, 2018. <https://www.sciencedirect.com/science/article/pii/S0921344918301988>  
 Badgett, A., et al. "Economic Analysis of Wet Waste-to-Energy". Energy 176, 2019, <https://www.sciencedirect.com/science/article/pii/S0360544219306085>



# Thank you! Questions?



NREL/PR-7A40-78548

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the Joint Institute for Strategic Energy Analysis. The views expressed herein do not necessarily represent the views of the DOE, the U.S. Government, or sponsors.

**JISEA** Joint Institute for  
Strategic Energy Analysis

