



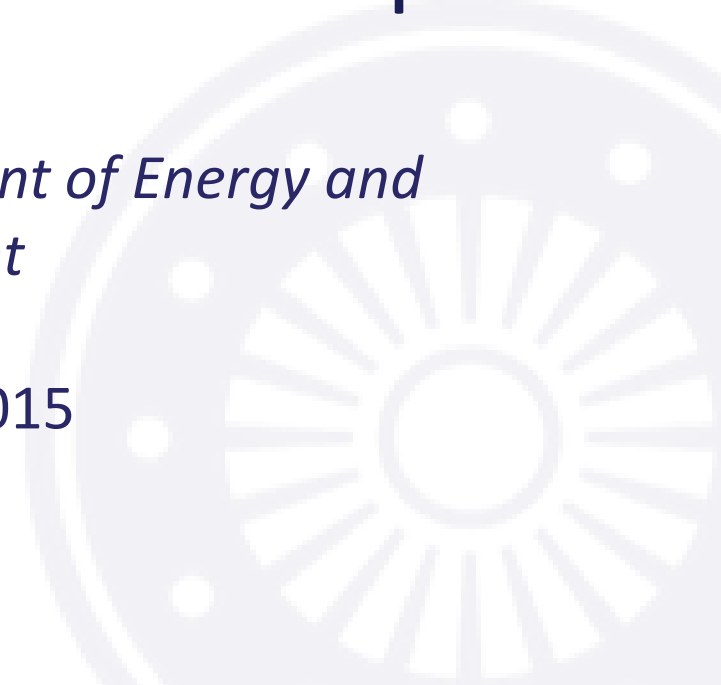
URBAN INGENUITY



DISTRICT ENERGY:  
Deploying Clean Energy  
Microgrids in the Nation's Capital

*Prepared for the Department of Energy and  
Environment*

September 2015





# Deploying Microgrids in the District: *Phase I Analysis and Outputs*

# About this Study

This report is presented to the District Department of Energy and the Environment, conducted under a grant from the DOEE Green Building Fund 2015 Grant #2 (2015-1501-OPS): Microgrid & District Energy Feasibility Study Urban Development Department

This report is submitted by the Community Foundation of the National Capital Region in partnership with a team of leading experts in the field, organized by Urban Ingenuity and CHA

# About the Team

## **Primary research by:**

*Urban Ingenuity* | Shalom Flank and Bracken Hendricks, principal investigators; Ian Fischer, Jackie Weidman, Upasana Kaku

*CHA Engineers* | Timothy Peer, Paul Van Gelder

*Microgrid Institute* | Michael Burr

*VanNess Feldman* | Doug Smith, Shelley Fidler

*Emmett Environmental Law Clinic, Harvard Law School* | Seth Hoedl, summer fellow

*Georgetown University Law Center* | Morgan Gerard, LL.M. candidate

## **With additional analysis and support from:**

Michael Zimmer, Washington Counsel, Microgrid Institute

Peter Douglass, Project Associate, Microgrid Institute

John Jimison, Managing Director, Energy Future Coalition - UN Foundation

Uwe Brandes, Executive Director, Georgetown University's Master of Professional Studies in Urban and Regional Planning

# Goals of the Study

Phase I supported robust analysis on deploying clean, resilient, distributed-energy micro-grids in the District. The study focused on four core areas:

**Task I:** Evaluating Microgrid Potential

**Task II:** Developing a Financial Model

**Task III:** Framing Regulatory Barriers and Options

**Task IV:** Tools for Stakeholders

# Task I Analysis: Identifying Sites

**Survey of energy-intensive sites, including high-density commercial, residential, government, and institutional loads across the District:**

- Planned Unit Developments and Campus Plans
- DMPED priority “Real Estate Projects” and New Communities Initiative
- Business Improvement Districts and Great Streets
- NCPC planning efforts
- Existing steam and CHP systems
- Relevant permit-holders (eg Title V)

# Task I Outputs: Site List and Scoring Worksheet

## Output 1: Preliminary List of Microgrid Sites in DC

## Output 2: Draft Microgrid Scoring Worksheet

- Can provide initial analysis of project feasibility and community benefit specific to the DC environment for any candidate site
- Inputs include quantitative and qualitative factors, eg capital costs, existing infrastructure, disaster resilience, site energy resources, developer attitude
- Final score balances economic, financial, and regulatory concerns to allow comparison across diverse project types

# Task I: Next Steps

## Next steps for microgrid potential analysis:

- Narrow and prioritize list of candidate sites to produce hierarchy of project opportunities
- Incorporate a broader group of sites to evaluate, and engage key stakeholders to further inform prioritization
- Refine and expand scoring worksheet tool to provide more user-friendly tool



# Task II Analysis: Key Financing Principles

## Initial analysis on drivers of microgrid financeability:

1. The load is the asset
2. Commit to market pricing
3. Size the project for economic returns
4. Share avoided capital cost savings
5. Monetize benefits to the regional grid
6. Maximize returns from renewable energy
7. Phase the project effectively
8. Think outside the grid
9. Define the energy product as a value-added service
10. Future-proof technology
11. Minimize capital costs

# Task II Outputs: Survey of Existing Tools

## **Output 1: Survey of existing public and private financing tools to reduce costs and improve returns**

- Private market structures to access more efficient capital (Yieldcos, private equity debt, REITs, MLPs)
- Federal incentives to drive down costs (ITC and MACRS, New Market Tax Credits, DOE Loan Guarantees and Resiliency Investments)
- Local incentives, (PACE, bonds, TIF financing)
- Utility partnerships and rate-payer incentives (SEU rebates, cogen tariffs)

# Task II Outputs: Draft Case Study

## Output 2: Financing case study based on team experience

**Site:** 50+ acre, mixed-use redevelopment.

**Challenge:** Optimize site design to provide the best possible returns, while providing clean, reliable, resilient, energy, heating, and cooling at market rates or better.

| Scenario                    | Capital Cost (millions) | 20-Year NPV (millions) | IRR on Equity |
|-----------------------------|-------------------------|------------------------|---------------|
| Initial 4-Engine Plan       | \$ 21.5                 | \$ 0.8                 | 7.8%          |
| Capital Offset              | \$ 21.5                 | \$ 5.9                 | 23%           |
| Interconnect Energy Centers | \$ 24.0                 | \$ 8.2                 | 27%           |
| Add 5MW Solar               | \$ 42.0                 | \$ 12.1                | 28%           |
| Consolidate Energy Centers  | \$ 39.8                 | \$ 13.9                | 32%           |

Thoughtful project design will result in a better and more lucrative project that is able to adapt to changing conditions over the term of development.

| Energy Center | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| <b>1</b>      | T    | T    | T    | E    | E    | E    | E    | E    | E    | E    | E    |
| <b>2</b>      | -    | -    | -    | T    | T    | E    | E    | E    | E    | E    | E    |
| <b>3</b>      | -    | -    | -    | -    | E    | E    | E    | E    | E    | E    | E    |

### Keys to Financial Viability:

- Larger Engines
- Interconnection
- Solar
- Phasing
- Capital Offsets

# Task II: Next Steps

## Next steps to developing a financing model:

- Enhance inventory of existing financial tools to inform policy recommendations
- Conduct a financial modeling demonstration with the input and involvement of leading experts and financial practitioners
- Integrate recommendations with guidance on green banks and other financial incentives

# Task III Analysis: Regulatory Barriers

**Initial characterization of barriers to microgrids to provide analysis and preliminary recommendations**

Key questions explored include:

- Microgrids and competition
- Public utility laws and regulation
- Pre-approvals and licenses
- Pepco's franchise
- Pepco-owned microgrid
- Public power & public-private microgrids

# Task III Outputs: Initial Reports

## **Output 1: Analysis of barriers to microgrid development and recommendations**

- Working documents and preliminary drafts of a research report
- Draft matrix depicting the regulatory status of various microgrid scenarios under current law

## **Output 2: Report on barriers and unresolved legal issues for hypothetical case of municipal utility microgrid**

- Mechanism for understanding alternative ownership and regulatory frameworks for facilities with District ownership of real estate and other assets

# Task III: Next Steps

## Next steps for framing regulatory barriers and options:

- Expand upon the findings of this report to build future guidance to PSC, City Council, Executive Agencies, and other stakeholders
- Develop a more detailed framework that can serve to guide new legislative or regulatory initiatives
- Stakeholder outreach around microgrid agenda

# Task IV Outputs: Stakeholder Tools

- **Output 1: Microgrid 101 Powerpoint Slide Deck (Follows)**: Provides an overview of microgrids & their benefits
- **Output 2: Matrix of Microgrid Models**: Compares and evaluates existing models and tools
- **Output 3: Review of Microgrid Deployments and Policies**: Provides case studies in jurisdictions and geographies that are similar to the District
- **Output 4: Gantt Chart for Developing a Microgrid**



# Task IV: Next Steps

## Next steps for stakeholder tools and a “Go To Market” package:

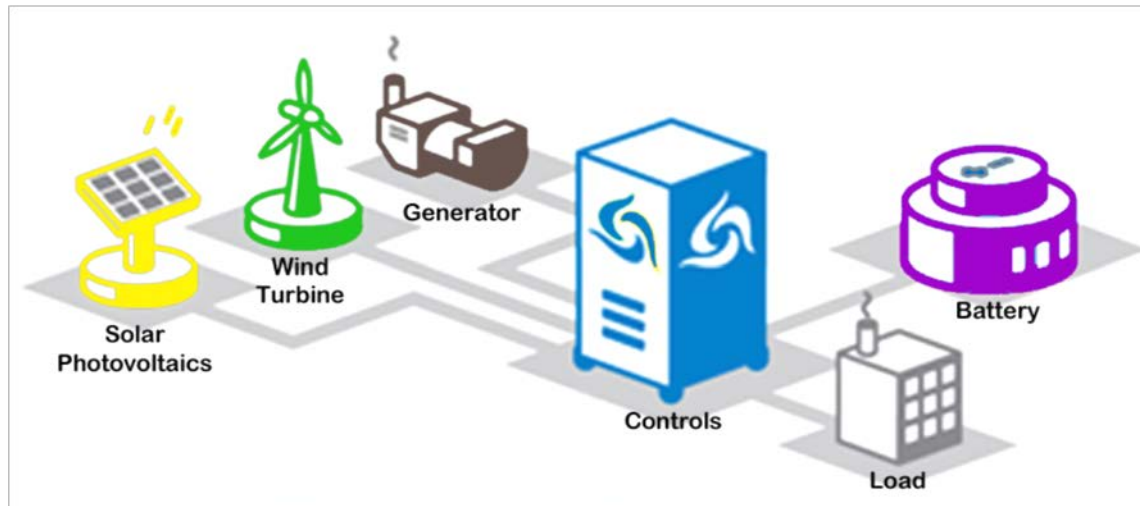
- Package initial findings in a manner that is easily accessible and provides clear guidance to policy-makers and project developers
- Outreach to developers and government agencies
- Develop a suite of additional materials, including sample pricing and rate structures, term sheets, legal templates, and collateral for stakeholders



# Microgrids 101: *An Introduction*

# What are Microgrids?

- Small energy system capable of balancing captive supply and demand resources to maintain stable service within a defined boundary
- Combines distributed generation (DG) resources
- Can work as an “island,” separate from the large grid, in case of outages

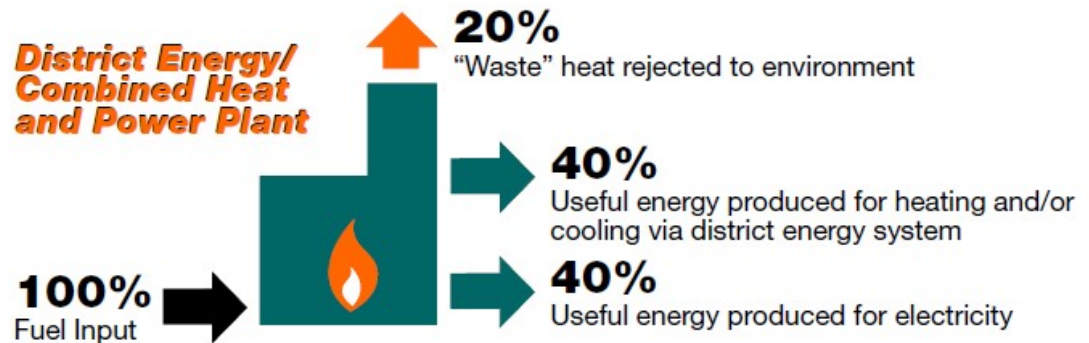
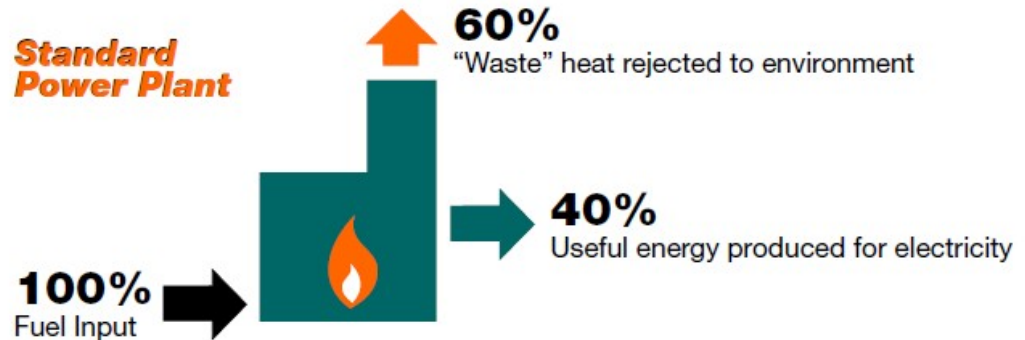


# The Three Types of Microgrids

- 1. Isolated microgrids**, islands, and other remote sites are not connected to a local utility grid.
- 2. Island-able microgrids** are fully interconnected and capable of both consuming and supplying grid power, but can also maintain some level of service during a utility outage.
- 3. Non-synchronous microgrids** are connected to utility power supplies, but aren't interconnected or synchronized to the grid (can consume power from the grid but can't supply it).

# What is District Energy?

- Uses steam or hot and chilled water to provide heating and cooling to many buildings
- Often include combined heat and power (CHP) plants to meet both electric and thermal needs



# Microgrid and DG Technology

## Cogen & Thermal:

- Gas or diesel cogeneration
- Combined Heat Power (CHP)

## Renewable Energy:

- Fuel cells and microturbines
- Solar Photovoltaic (PV)
- Geothermal

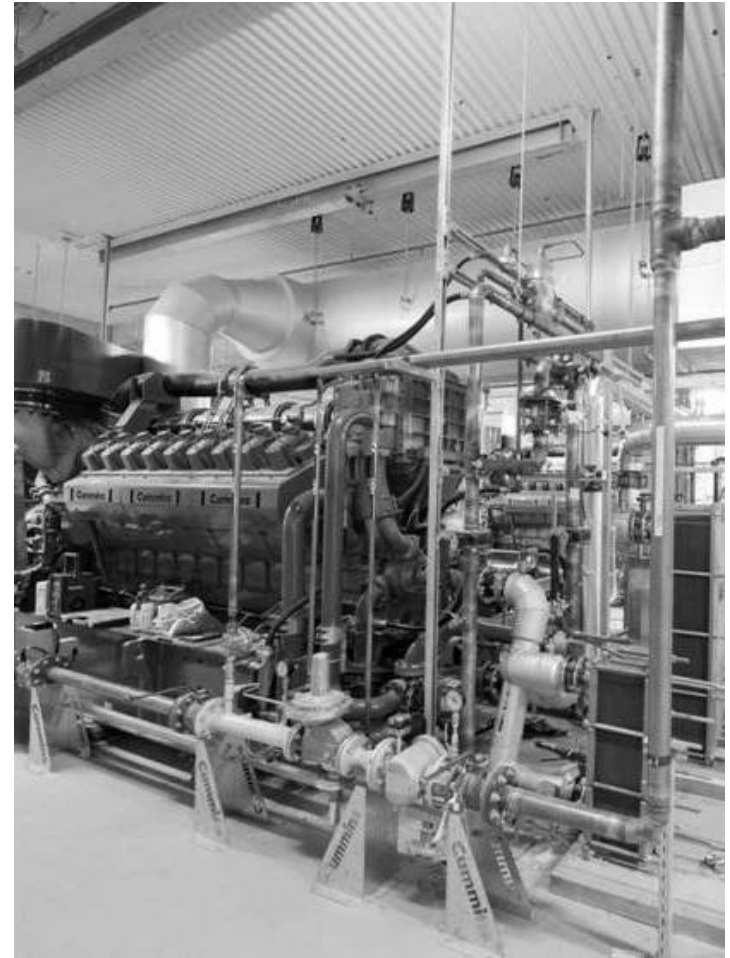
## Storage and Controls:

- Storage capacity (batteries, Flywheel)
- Energy management and automation systems



# Why Microgrids and District Energy?

- Microgrids combine local energy assets, resources, and technologies into a system to satisfy host requirements
- Provides economies of scale that are necessary to make alternative and renewable fuels practicable
- More reliable, efficient, cost-effective energy infrastructure for the community





# Operational Benefits

**Microgrids improve system reliability, reduce costs, and provide other operational benefits:**

- Cut energy demand and fuel use by integrating renewables, demand management, and reducing energy losses
- Lower maintenance costs and operational expenses
- Improved reliability and resiliency of electricity and thermal systems
- ‘Future proof’ energy systems by allowing easy integration of newer, more efficient technology as it is developed



# Environmental and Community Benefits

## **Microgrids support community infrastructure and environmental sustainability:**

- Cut carbon emissions, other waste, and pollution
- Improve grid security and system efficiency
- Reduces the need for new transmission and distribution infrastructure
- Boost economy through infrastructure investment and local job creation
- Create competitive advantage for local businesses
- Back-up power for critical community infrastructure

# Financial Benefits

## **Microgrids improve the bottom line for property owners and local businesses:**

- Reduced energy costs and more predictable energy expenditures for property owners and businesses
- Displaces the need to install separate space heating and cooling and hot water systems in each building, reducing building capital costs
- Retain more money in the local economy
- Increase investment through public private partnerships

# Thank You

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