Packaged CHP eCatalog and Accelerator Program

June 10th, 2020
1:00 to 2:30pm
Bruce Hedman
Entropy Research, LLC
Agenda

1. Richard Sweetser, Exergy Partners Corp.
2. Aaron Tasin, 2G Energy Inc.
3. Brandon Bowser, Maryland Energy Administration
4. Q&A Session
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…and then select the room “Packaged CHP eCatalog”

Let’s try a couple polls now!
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Non-traditional CHP Markets Are Growing

- Large CHP potential in small/midsized industrials, commercial, institutional, government and military applications
- Markets utilize smaller, packaged CHP systems (< 10 MW)
- Markets have limited CHP experience
- Users have limited technical resources
- History of issues with CHP system performance and with CHP sales and service support
- Many perceived risks by both users and suppliers

Non-traditional markets represented 35% of the capacity and 70% of the projects installed since 2008
Better Buildings Accelerators demonstrate innovative policies and approaches designed to accelerate investment in energy efficiency.

Objective:
Populate, launch and publicize the eCatalog and promote packaged CHP.

Goals:
Verify packaged CHP system performance in industrial, commercial, institutional and government markets.

CHP Engagement Partners:
Utilities, states and federal agencies committed to promoting packaged CHP via CHP deployment and/or incentive programs.

CHP Supplier Partners:
CHP packagers and solution providers participating in the national eCatalog.

https://betterbuildingsolutioncenter.energy.gov/accelerators/packaged-chp
Today’s Presenters

Richard Sweetser
Exergy Partners Corp

Aaron Tasin
2G Energy Inc.

Brandon Bowser
Maryland Energy Administration
Richard Sweetser
Exergy Partners Corp.

Submit Questions
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Packaged CHP Systems

Richard Sweetser, President - Exergy Partners Corp.
Packaged CHP Systems eCatalog Coordinator

June 10, 2020
eCatalog Briefing Outline

- eCatalog Background
- eCatalog Definitions
- eCatalog Demo

Reducing Risk with Recognized Packaged CHP Systems in the DOE eCatalog
Packaged CHP Market Challenges

- CHP viewed as a discretionary purchase
- Lack of user awareness / understanding
- Under-developed sales and service infrastructure
- Every installation is considered unique
- High soft costs
- End-user responsibility
NYSERDA’s Packaged CHP Catalog

- NYSERDA Packaged CHP Catalog - Reduce perceived risk of installing and operating CHP by offering comparable standardization of CHP systems and field service agreements.

- Independent endorsement based on in-depth analytical review
- Single-point-responsibility as the basis for customer-vendor relationship
- Comparison shopping to promote competition and expand offerings

Source: NYSERDA CHP Catalog

v1: 8 Vendors & 36 systems
v2: 10 Vendors & 64 systems
v3: 13 Vendors & 141 systems
v4: 22 Vendors & 219 systems
v5: 26 Vendors & 253 systems
NYSERDA CHP Program Successes

- Commoditization of offerings and expansion of options
- Project cost reductions and time compression
- Increased program uptake
- Less dependent on subsidies (incentives ramping down over time)
Robust Market Engagement Was Key to Success

- **Public events** – Opportunities to provide introductions to CHP and connect end users with suppliers
- **Education** – Personalized understanding of technology and value proposition to specific business
- **Pre-screening** – High-level review of specific costs and benefits offered by CHP
- **Technical assistance** along project development path
- **Concierge to access financing, navigate permitting, identify supporting resources**
Public Events - Talk and Tour

- **Introduction** to CHP technology
- Opportunity to **view successful CHP** installation – seeing is believing
- Engage with current CHP end-users other customers
- Learn about the **CHP project process**
- Connect with suppliers
Education and Outreach

• **Address common misperceptions** on CHP technology
• **Engagement with decision makers** at all levels of organization
  – Facility managers, sustainability coordinators, C-suite, and everything in between
• **Identification of a project champion** within the organization
• **Providing clear and actionable information** to customers
• **Early-stage screening** to discover any CHP show-stoppers
Ongoing Technical Assistance Was Critical

- Many projects stall at the vendor bid solicitation and selection process
- Proposals come in all different shapes and sizes
- Lack of meaningful and accurate data for customers to make a decision
- **Once customers lose interest, the project usually doesn’t get revived**
The Packaged CHP Systems eCatalog
DOE Packaged CHP eCatalog

- A national web-based searchable catalog (eCatalog) of DOE-recognized packaged CHP systems and suppliers with the goal to reduce risks for end-users and vendors through partnerships with:
  - **CHP Packagers** that assemble and support recognized Packaged CHP Systems
  - **Solution Providers** that install, commission and service packaged CHP systems
  - **CHP Engagement partners** that provide CHP market deployment programs at the state, local and utility level

- **Pre-engineered and tested packaged CHP systems that meet DOE performance requirements**

- **End-users and design engineers search** for applicable CHP system characteristics, and get connected to packagers, installers and CHP engagement programs

- Allows users to **compare technology options on a common basis**

https://chp.ecatalog.lbl.gov/
Packaged CHP eCatalog Status

- Launched Nov 8, 2019
- 31 recognized Packagers
- 19 recognized Solution Providers
- 201 Package Offerings
  - 118 reciprocating engine
  - 82 microturbine
  - 1 gas turbine
  - 196 natural gas
  - 5 digester gas
  - 55 grid parallel only
  - 134 grid islandable/auto transfer
  - 24 kW to 7.5 MW
  - Multiple suppliers and packages in every zip code
- 9 Customer Engagement Partners

https://chp.ecatalog.lbl.gov/
eCatalog Live Demo
Aaron Tasin
2G Energy Inc.

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We Care for a Better Future.

CHP Packaged Solutions.
• Founded 1995 - Headquarters in Heek in North West of Germany
• Solution provider: development, project engineering, production, service
• CHP systems for biogas, natural gas, propane and hydrogen applications 60 – 2,500 kW electrical power
• Strong focus on R&D
• 10 national and international subsidiaries
• Since 2007 listed on the German stock market
• 650 employees
• Over 6,000 CHP plants in more than 50 countries worldwide
Market Trends

- Non-traditional Applications
- Resilience
- Complete Solutions
- Flexible Financing Solutions
- No Touch Solutions
- Carbon Reduction
- Low Risk
Traditional CHP Installation

Hundreds of components must be Engineered, purchased, and installed inside a building by local mechanical and electrical contractors who rarely install CHP systems:
A packaged CHP system is:

- Standard repeatable design which includes (but not limited to):
  - 100% pre-wired
  - 100% pre-piped with customer ready connection
  - Properly ventilated
  - Sound insulated
  - Fire rated insulation
  - Gas detection and smoke alarm
  - Fluid containment
  - Auxiliaries sized appropriately and shipped with connecting piping and wiring complete
  - Packager has bulk purchasing power that local contractors do not
Hot water is not the only method of utilizing “waste heat”
Sound emissions.

- CHP in a Highline Super Silent at a distance of 33ft
- CHP in a standard container at a distance of 33ft
- CHP in a Sound capsule at a distance of 3.3ft
- Vacuum at 3.3ft distance
- Edge of a traffic road in 16ft distance
How a packaged CHP system is built
Initial Design of system includes:

- Stress analysis
- Wind Load
- Snow Load
- Static and Dynamic Forces
- And more
- Design would be repeatable for similar systems
Custom purpose-built container

Container size, noise rating, wall openings are determined and fabricated per the engineered analysis:
Custom Built Container

The top, bottom, and sides are welded together
The engine, pumps, valves, heat exchangers, wiring, etc are installed
Custom Built Container

Finished Product ready for shipment and installation
Container options
### Compact container.

**Available sizes (LWH)**
- 20ft x 8ft x 9.5ft

**Noise emissions**
- Standard: 65 dB (A)*
- Super Silent: 55 dB (A)*

**Info:**
- Sheet steel container
- Walls and roof are sound-proofed with 80mm rock wool
- Interior clad in non-woven material and galvanised perforated sheet metal
- Integrated electrical installation

*all sound pressure levels are measured at a distance of 33ft in free field conditions*
Compact container.

Available sizes (LWH)
23ft x 10ft x 10ft
AddOn: 31.5ft x 10ft x 10ft

Noise emissions
Standard: 65 dB (A)*
Super Silent: 55 dB (A)*

Infos:
– Sheet steel container
– Walls and roof are sound-proofed with 80mm rock wool
– Interior clad in non-woven material and galvanised perforated sheet metal
– Integrated electrical installation

*all sound pressure levels are measured at a distance of 33ft in free field conditions
Options

Highline Container.

Available sizes (LWH)

30ft x 10ft x 12ft

Noise emissions

Standard: 55 dB (A)*
Super Silent: 45 dB (A)*

Infos:

– Optimised design of the standard container version
– Coolers and supply/ exhaust air ducts integrated into container roof
– Frequently used in industrial zones and built-up areas

*all sound pressure levels are measured at a distance of 33ft in free field conditions
Options

Heavy Container.

Available sizes (LWH)

- 40ft x 10ft x 10ft
- 50ft x 10ft x 10ft
- 55ft x 10ft x 10ft

Noise emissions

- Standard: 65 dB (A)*
- Super Silent: 55 dB (A)*

Infos:

- Sheet steel container
- Walls and roof are sound-proofed with 80mm rock wool
- Interior clad in non-woven material and galvanised perforated sheet metal
- Integrated electrical installation
- Static calculation for weights up to 60 tons total weight

*All sound pressure levels are measured at a distance of 33ft in free field conditions
Optional equipment

**Warm country version.**

If it gets too hot inside the engine room, electronics can be damaged. Consequences are reduced power or an emergency shut-down.

**Modifications:**
- Switch cabinet air conditioning system
- Combustion air cooling
- Larger emergency and mixture cooler
Optional equipment

Cold country version.

The cold country version is designed for a temperature of -31 °F and prevents damages of the components.

Modifications:
• Air intake and outlet louvers with servo motor
• Electric engine preheating
• Electric frost protection heating
• Cover flaps on the ventilation in the oil room
• Auxiliary heating and isolation of the exhaust gas condensate line
Case Studies
**Why CHP:** Energy savings, resiliency of being able to operate the entire hospital with loss of grid power, and lower emissions

**Fuel Type:** Natural Gas  
**Application:** Hospital  
**Size of CHP:** 2 x 1,560 kW

**Project Description**
- Location: Salisbury, Maryland  
- Facility peak load: 5 MW  
- Use of thermal energy: Heating, Domestic Hot Water

**Highlights***:
- Energy Savings Agreement (ESA) with 17% reduction in energy cost.  
- CHP plant can be islanded if the electric grid fails  
- Reduces greenhouse gas emissions by 50%

*Source: Mid-Atlantic CHP TAP Project Profile*
Why CHP: Ability to fully operate hotel and convention center during a grid outage, plus significant energy savings, and environmental benefits.

Fuel Type: Natural Gas  Application: Hotel & Convention Center
Size: 3 x 2,000 kW

Project Description
• Location: National Harbor, Maryland
• Facility peak load: 10 MW
• Use of thermal energy: Heating, DHW, and Reheat

Highlights*:
• Energy Savings Agreement (ESA) with 15% reduction in energy cost.
• CHP plant can be islanded if the electric grid fails
• Reduces greenhouse gas emissions by 59%
Why CHP: Energy savings, environmental benefits, and the ability to operate the entire hospital in case of a grid outage.

Fuel Type: Natural Gas  Application: Hospital
Size: 4 x 2,000 kW + HRSG + hot water

Project Description
Installation of 4 x 2,000 kW CHP facility producing:
• 52,000 MWh electricity annually
• 12,000 lb/hr of 115 psi steam
• 14,000 MMBtu/hr hot water
• 800 tons chilled water (Future)

Savings
• 52,000,000 kWh annually at $0.0515/kWh
• Reduced steam need – lower boiler wear & tear
  • Steam production
  • Direct hot water to hot water heating
• Reduced electric load from offloading chillers – absorption chiller
• Showcases 2G packaged systems
• Allows channel partners to showcase 2G packaged systems
• Expands 2G’s presence beyond traditional markets and locations
• Connects 2G with new Customer Engagement Partners
• Provides fair performance comparison
• Reduces risk for all parties
Thank you very much for your attention!

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Brandon Bowser  
Maryland Energy Administration

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Resilience Value Proposition

GRID THREATS
severe storms
cyberattacks
high summer
grigid winter temps

POTENTIAL SITES
businesses
health care
higher learning campuses
government facilities
multi-family housing

RISING TECH DEPLOYMENT
distributed energy resources (DERs)
PV
storage
CHP
grid-interactive solutions
Incentives

MEA offers grants and low-cost financing solutions for clean energy technologies and energy efficiency upgrades

Focus on CHP Grant Program and Resilient Maryland Program

Anticipation: U.S. DOE CHP eCatalog will expedite project design
CHP

Up to $500K toward the equipment and installation costs

Both standard and innovative CHP approaches are welcomed

Minimum 60% annual fuel use efficiency required \((\text{Electrical Output} + \text{Recovered Thermal})/\text{Fuel Consumed}\)

First-come, first served basis

Two phase payout: groundbreaking (30%) and commissioning (70%)

Stackable with other incentives and capital sources (e.g. utility incentives, C-PACE, etc.)
Since FY 2015:

42 active and completed awards

Value of over $13 million dollars

Broad appeal: agricultural, county government, critical infrastructure, hospital/medical, hospitality, industrial, manufacturing, multifamily housing, and university/college.
MEA CHP Total Active and Completed Awards, FY 2015 - Present

- University/College: 12%
- Agricultural: 7%
- County Government: 5%
- Critical Infrastructure: 12%
- Hospital/Medical: 33%
- Hospitality: 10%
- Industrial: 2%
- Manufacturing: 5%
- Multifamily Housing: 14%
- Hospital/Medical: 33%
Influx in demand for smaller, packaged units in multifamily housing complexes (FY 2019 – 20)

Developers are integrating packaged CHP as part of clean, efficient facility management strategies

Growing emphasis on resilience benefits over economic benefits

Increase in thermal load-following systems to enhance resilience in FY20
MEA’s grantees, applicants, and the energy industry stakeholders and influencers we have worked and partnered with note that surmounting the initial planning & design hurdle is typically the “make or break” point.

Organizational decision-makers and capital providers need proof of concept through vetted designs and modeled performance, savings, and ROI to provide buy-in.

This step can be costly to adopters, who often don’t have adequate access to the capital necessary to complete this phase. Provides grants for DER system feasibility analysis, engineering, and design to help get projects to “shovel-ready”.
Resilient Maryland Program Operation

Four Areas of Interest (AOIs)

AOI 1: Community/Campus Microgrid Planning (Up to $100,000 per Project)
AOI 2: Resilient Facility Power System Planning (Up to $25,000 per Project)
AOI 3: Advanced CHP Planning & Design (Up to $10,000 per Project)
AOI 4: Resiliency Hub Planning & Design (Up to $10,000 per Project)

Grantees will use funds to complete a set of final project deliverables

Detailed Feasibility Report
Preliminary Engineering & Designs
20-Year Pro Forma Financial Model
Greenhouse Gas Reduction Report
Implementation Barriers Report
Resilient Maryland Response

25 unique project proposals

Applicants demographic: government (fed, state, local), agricultural, low-to-moderate income (LMI), multifamily housing, food processors, universities, essential infrastructure, businesses, and nonprofits

15 Projects awarded for a combined total of $1.15 million of state investment

Grantees will be prepped for equipment procurement and system installation

Lessons Learned - replicable and scalable DER system models + insights into common project barriers
CHP eCatalog Benefits

- Functional and intuitive user interface
- Highly-customizable search filters make planning unique energy profiles and building characteristics seamless for managers
- Pre-vetted DOE technical metrics, eliminate engineering / design costs
- These benefits pair well with the holistic energy management goals of Maryland’s rate base
Long-term Goals

Large need for replicable, scalable, and cost-effective DER system designs in Maryland

Enormous potential for eCatalog to serve as a nonbiased & accredited tool in this endeavor

Trusted engagement partner, drive eCatalog development and outreach
Questions?

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Q & A

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