



# NGENX Energy

MODULAR ENERGY  
SOLUTIONS

01-10-2023

MODULAR DATA CENTER SOLUTION ASSESSMENT

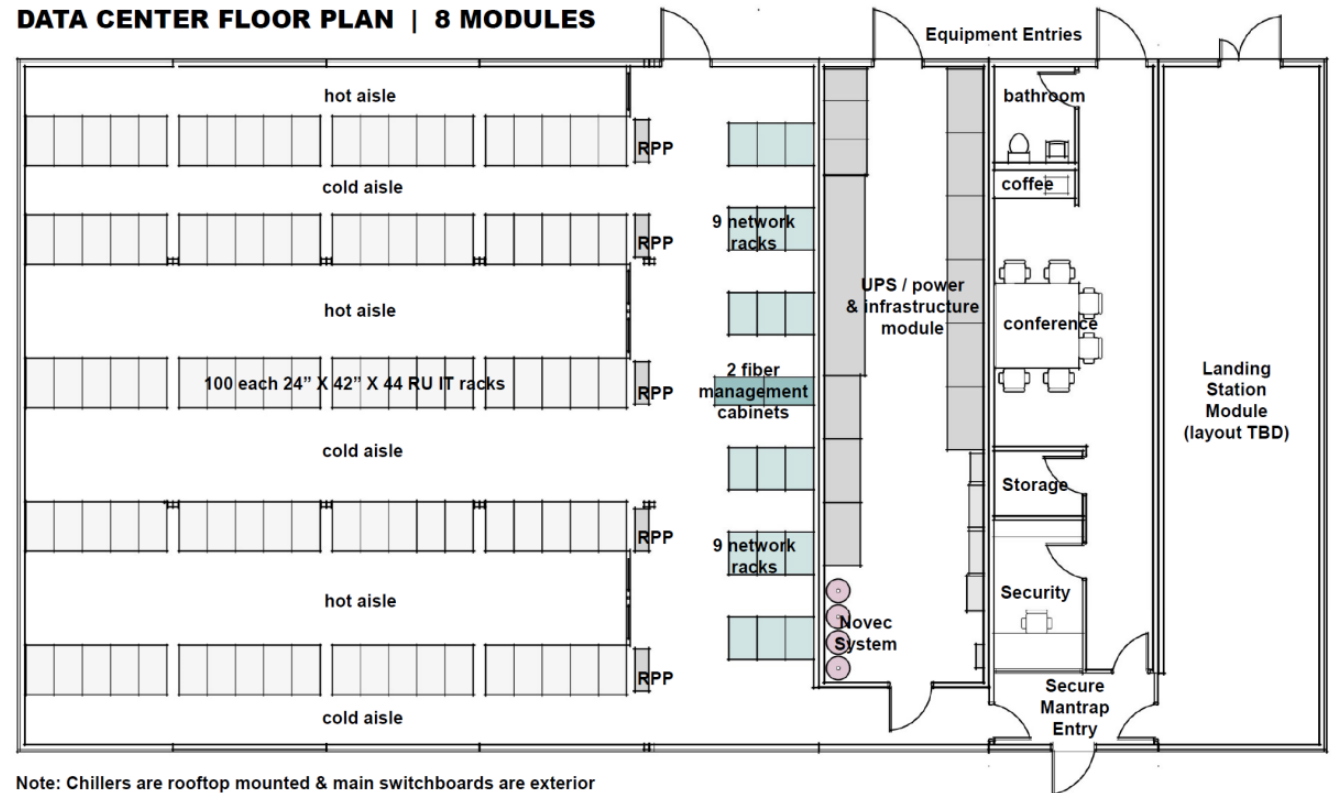


- NGENX Energy has coupled marquee technology providers into a unique application for data center solutions
- Provides redundant resilient power coupled with modular IT infrastructure design
- Scalable from 65Kw to up to 3WM our solutions provide primary power and cooling with inherent redundancy married to a flexible IT
- The IM standalone modular Data Center and Landing Station supports 100 IT racks, 18 network racks and an 11'6" wide X 48' module for landing station gear (to be determined)
- Solution is "plug and play" and includes all fully-integrated data center systems with IT and network racks powered up and server / switch ready. Power and Cooling availability assured with N+1+1 reliability
- All power, cooling, cable management, server racks, DCIM, fire suppression and security systems are factory installed, with the exception of the rooftop chiller plants that would be shipped separately and installed in the field.

# Ready to operate dropped in place with only a gas connection

The IM/NgenX Modular Data Center solution delivers an integrated modular data center design coupled with modular power plant design. Offering integrates redundant generation and potentially eliminates UPS requirements.

## DATA CENTER FLOOR PLAN | 8 MODULES



Note: Chillers are rooftop mounted & main switchboards are exterior

## FULL CUSTOM LAYOUT AND OPTIONS BASED ON CLIENT REQUIREMENTS

\*Provided by IM data Centers



Configurable to your needs –

Options include:

- Conference rooms,
- Network meet-me rooms,
- Security & man-traps,
- Work rooms
- Restrooms
- Custom power and switchgear
- Rack density of up to 150 kW per rack
- Cooling with full or partial immersion
- Dedicated HPC Telco facility

\*Provided by IM data Centers

# Flexible Resilient Scalable design



\*Provided by IM data Centers

# Capable of renewable microgrid integration



# Data Center Specifications



\*Provided by IM data Centers

## OUTLINE SPECIFICATION

### OVERVIEW

- ✓ Enterprise-class, fully-integrated data center
- ✓ Freestanding building, hardened facility
- ✓ Eight modules
- ✓ One hundred 42"D X 24"W X 44RU IT racks
- ✓ Eighteen 36"D X 24"W X 44RU network racks
- ✓ Two fiber management racks
- ✓ 1,000kW IT load @ N+1, expandable
- ✓ Contiguous, user-friendly space
- ✓ Server & DCIM technology-agnostic
- ✓ PUE less than 1.25
- ✓ manufactured & factory-commissioned in the US
- ✓ concurrent manufacturing & site development
- ✓ shipped as fully-assembled modules, minimal site work required

### SIZES & WEIGHTS

<b>Building Footprint</b>	+/- 94' X 49' / 4,606 SF
<b>Building Weight</b>	+/- 350,000 lbs. (w/o IT gear)

### ENVELOPES

<b>Structure</b>	Welded structural steel frames, double primed, 16 gauge frame infills
<b>Exterior Skin</b>	Steel-clad, structural insulated panels, smooth surface w/Kawneer 25-year metallic silver paint finish
<b>Wind Load</b>	175 MPH rated wall assemblies, 173 MPH rated door assemblies
<b>Moisture</b>	Redundant waterproofing & roofing systems, Tyvek wrap, HD tapered TPO single-ply roof membrane
<b>Weather Lock</b>	Entrance vestibule w/double doors to seal environment, walk off mat to prevent tracking
<b>Secure Entry</b>	Access-controlled Mantrap, interlocking doors, separate equipment entry
<b>Roof Screen</b>	Rooftop equipment protection w/perimeter steel roof screen, w/ secure workmen access door
<b>Signage</b>	Exterior graphics customized per Customer requirement
<b>Insulation</b>	Minimum R18 @ walls, R30@ roof, R16 @ floors & R12.5 @ doors

The ability to integrate resilient power generation with renewable energy and energy storage capabilities provides the only flexible microgrid powered data center solution available

# Microgrid Solutions

## USVI Microgrid

- C1000 Turbine
- 750kW Solar
- 625kW Tesla Battery Storage
- Onsite Propane Storage

## Results

- parallel operating Solar/Turbine/Tesla battery
- Utility grid is backup
- Standalone site
- Site “powered” through Hurricane Maria

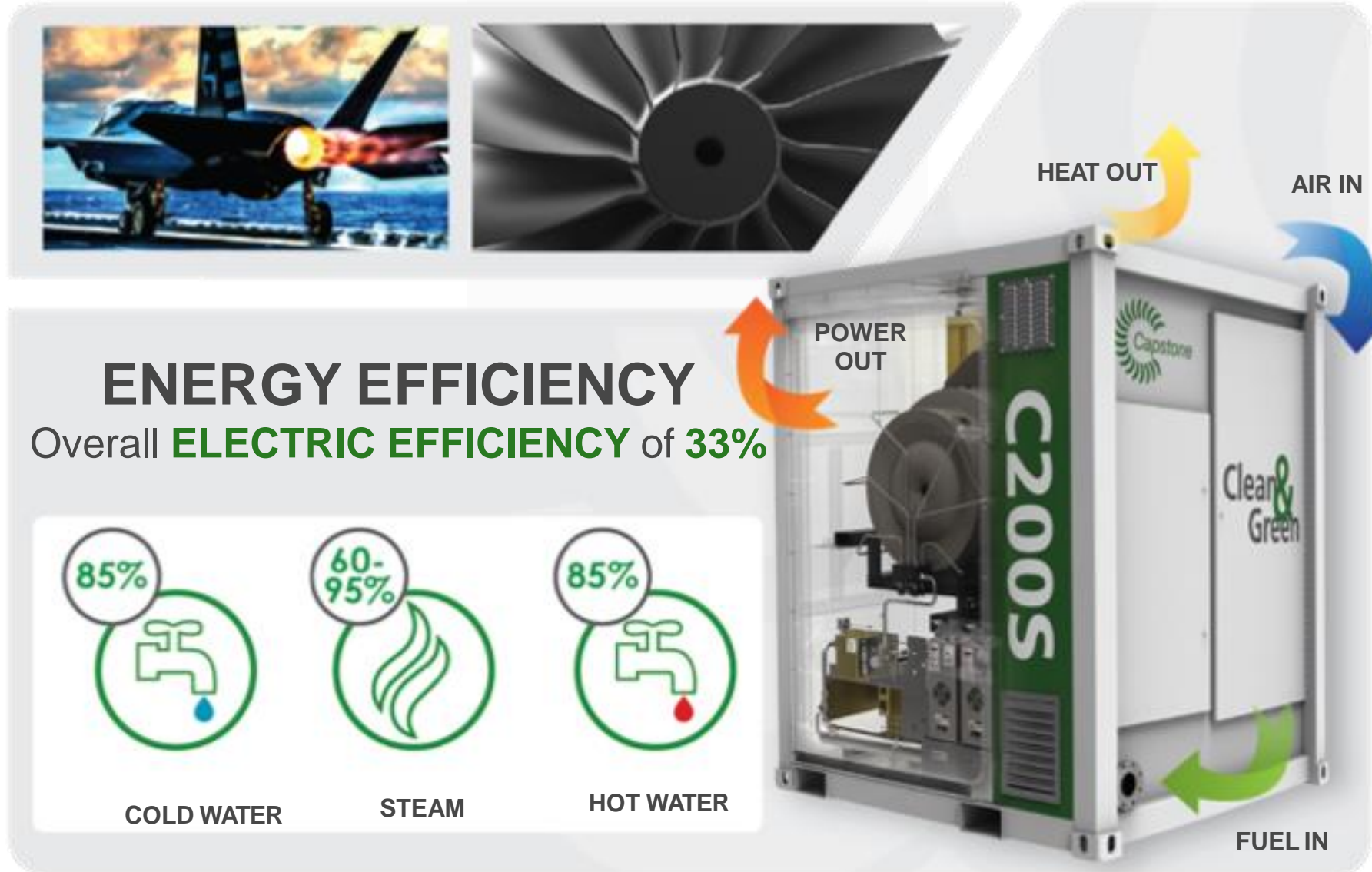




# Modular Data Center Integration with in-rack cooling capability



# Power and Cooling



# Rotor Shaft



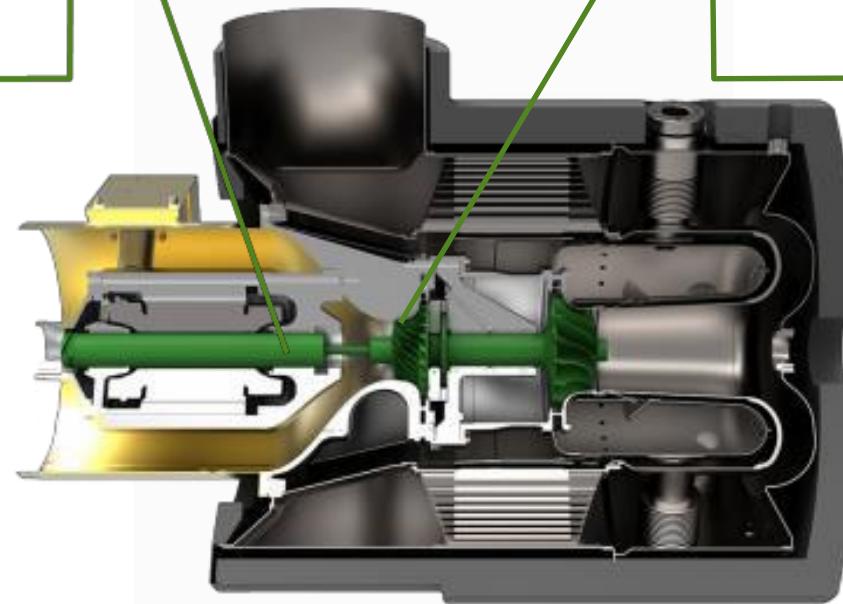
# Microturbine Generation



Air Foil



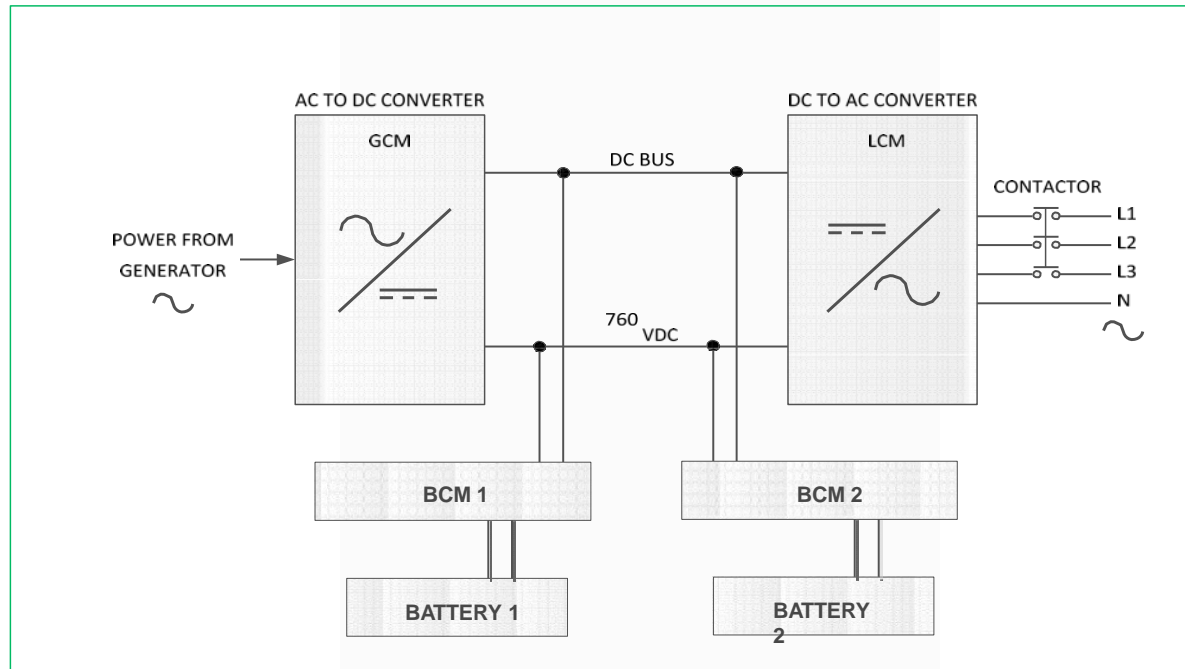
Rotor Group



- Single stage design
- Recuperated
- Single moving part

- Air lubricated
- Air cooled
- Low emissions < 9 ppm NOx

# Power Electronics



- Inverter-based technology
- Superior turndown ability
- Batteries utilized to support step loading, Black Start and Island Mode
- Power Electronics are UL1741 Listed and IEEE 1547 Compliant
- No Synchronization Equipment Required.

# DG & CHP with Ultra Low Emissions

- Natural Gas Microturbines:
  - 40 PPM CO
  - 9PPM NO<sub>x</sub>
  - 7 PPM VOC
- Optional LE Design
- Ultra-low NO<sub>x</sub>
  - Less than 5ppm
- No additional catalyst requirement
- Considered an insignificant source of emissions in all 50 states



# Broad Product Offering



## Features

## Benefits



Only one moving part

Longer service intervals, low operating cost



Patented air bearing technology

No lubricants or coolants needed



Stand alone or grid connect

Multiple applications and industries



Wide fuel range

Operates on gaseous, renewable and liquid fuels



High power density

Compact footprint, small modular design



Advanced combustion controls

Low emissions, no exhaust aftertreatment



Clean waste heat

Thermal energy for cogeneration/trigeneration



Remote monitoring

View performance and diagnostics 24/7

# C1000S Series Turbine

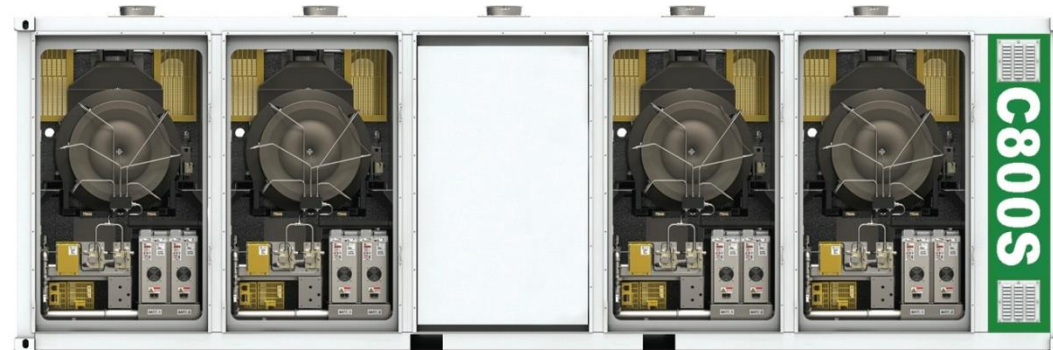




# Resiliency (N+ Redundancy)



C600 Power Package



C800 Power Package

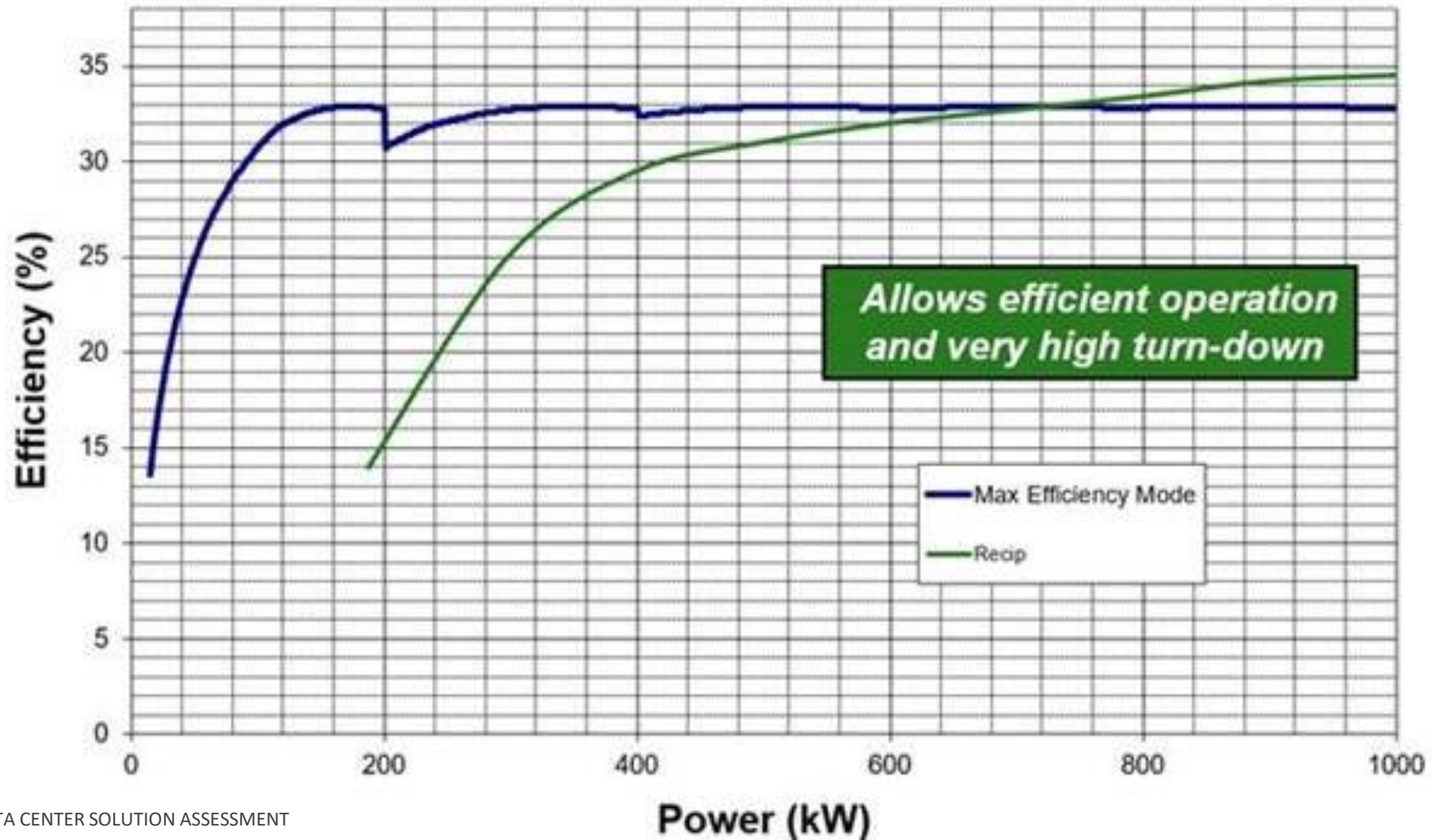


C1000 Power Package

- C600 to C1000 Series
- Operates as a single scalable genset
- Stable combustion from idle to 100% load
- Catastrophic failure is limited to a 200kW engine
- All Capstone Microturbines are UL2200 Listed



# Part Load Efficiency



# Chilled Water

- 20 to 400 tons
- Single to triple effect
- Hot water, steam, and exhaust driven
- COP 0.7 to 2.5
- Indoor and outdoor rated

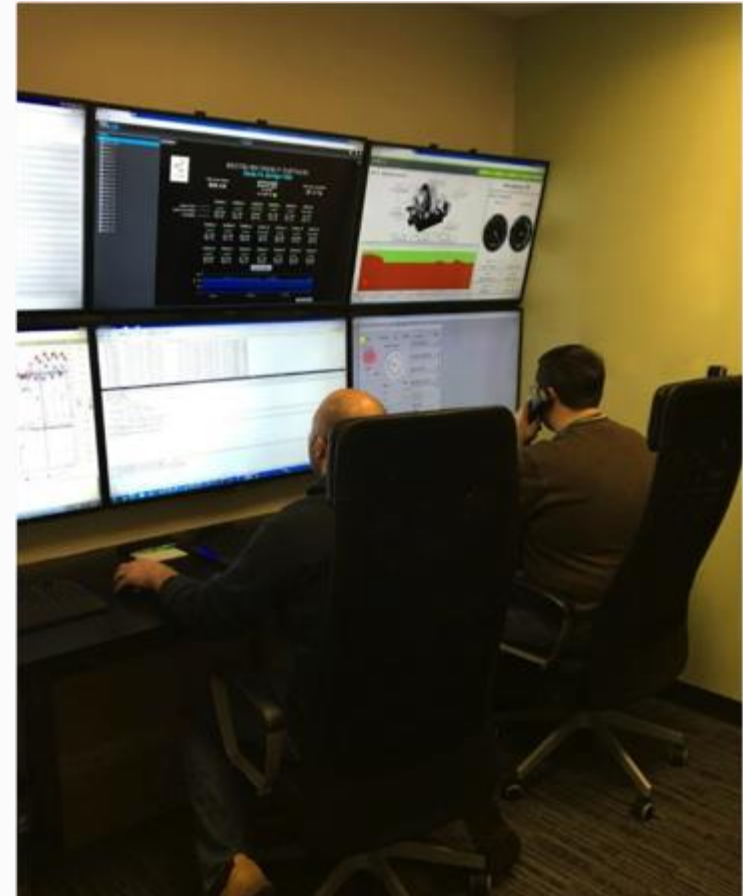
## Absorption Chiller

	C65	C200	(2)C200	C600	C800	C1000
Tons of Chilled Water	25	65	130	195	260	325



# Remote Monitoring

- Web access to sites
- Data logging
- Alarming
- Remote trouble shooting
- Less down time



# Case Studies



# PSECU – Harrisburg, PA

- C800 MicroTurbine
- 800 kW of Electricity
- Hot Water & Chilled Water Produced
- Primary power to data center (grid connect)

## Benefits

- Payback is exceeding the original model
- System helped client achieve LEED Gold status
- Has provided backup power to site multiple times since installation



# OATI Data Center

## Microgrid Solutions

- 600 kW of Microturbines
- 125 kW Solar PV
- 24 kW Wind
- 125 kW Ensync Battery
- 1500 kW Diesel Generator

## Results

- System has 2 modes of operation: “Normal” and “Emergency”
- OATI’s Grid mind schedules available distributed generation resources and orchestrates operation of prioritized loads
- Microgrid can power 100% of building for several days without grid





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# PUE Improvement under chilled water approach

MOD CW PUE = 1.15

Mod approach with CW CRAHs, PUE @ full load

eCentre PUE (yearly)	Average (kW)
IT load	1000.0
Total Data Centre power consumption	1058.8
Total Energy Centre power consumption	87.5
<b>PUE</b>	<b>1.15</b>

Data Centre (yearly)	Average (kW)		
IT load	1000.0		
Cable loss for IT load	10.1	Loss=	1.0%
Cable loss for cooling system	0.5	Loss=	1.0%
Supporting infrastructure (Lightning, fire fighting, access system, CCTV)	2.0		
<b>Total Data Centre power consumption</b>	<b>1058.8</b>		
Data Centre cooling system	Average (kW)		
Total cooling demand: IT load, Supporting infrastructure, cable losses	1016.7		
Cooling system electrical power – CRAH fans	46.2		

**PUE 1.15  
versus ~1.7 for  
traditional  
brick and  
mortar**

<b>Energy Centre (yearly)</b>	<b>Average (kW)</b>		
UPS system output power	1021.3		
Outgoing switchgear loss	11.23	Loss=	1.1%
UPS system loss (incl. battery charge)	53.8	Loss=	5.0%
Supporting infrastructure (DCIM, Lightning, fire fighting, access system, CCTV)	1.5		
Power for calc. of incoming switchgear loss	1146.3		
Incoming switchgear loss	12.6	Loss=	1.1%
<b>Total Energy Centre power consumption</b>	<b>87.5</b>		
<b>Energy Centre cooling system</b>	<b>Average (kW)</b>		
Total cooling demand: Supporting infrastructure, UPS & switch gear losses	84.2		
Cooling system electrical power – CRAH fans	8.4		

# CHP Financial Assessment



Project Name: DXN Australia  
 PA Project #: 04-02002020  
 Date Modified: 4/23/2020

## Direct Purchase Model - Pre-tax Returns

### Project Specifications

Project Size	<b>1,000 kW</b>
Total Project Cost	\$3,966 /kW <b>(\$3,966,000)</b>
Investment Tax Credit Available upon Completion	\$0
Clean Energy Program Grant	0% \$0

Net Project Cost, after up-front Rebate, ITC	<b>(\$3,966,000)</b>
Year 1 Cash Flow Improvement	\$961,962
Year 1 CF as Percentage of Net Project Cost	-24.3%
Year 2 Cash Flow Improvement	\$1,073,748
Two Years' CF as Percentage of Net Project Cost	-51.3%

### Economic Summary

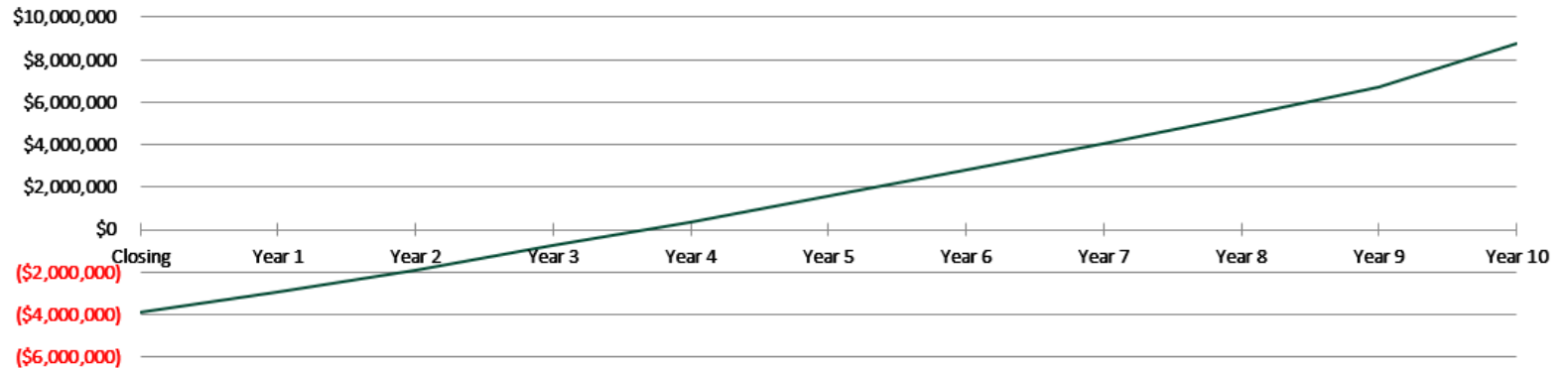
Pre-tax Return - No Debt	30.7%
Cumulative Free Cash Flow	\$8,732,523
Simple Payback Period in Years	3.7

*Project cost is a budgetary price only.  
 Final turnkey cost to be reviewed after final engineering.*

### Key Project Drivers and Assumptions

Current Utility Electricity Rate	\$0.2600 /kWh	Electricity Produced by Cogen	8,284,770 kWh	Annual Elec. Savings from Utility Offset	\$2,154,040
Electric Utility Cost Escalator	2.0%	Steam Capacity	- MMBTU/hr	Annual Savings from Steam Production	\$0
Current Natural Gas Rate	\$1.63 /therm (15.8/MJ)	Hot Water Capacity	4.100 MMBTU/hr	Annual Savings from Hot Water Production	\$0
CHP Natural Gas Rate	\$1.63 /therm (15.8/MJ)	Chilling Capacity	400 RT	Annual Elec. Savings from Chilling Offset	\$562,567
Natural Gas Escalator	1.0%	Chilling Operating Hours	4282 hrs/year	CHP Annual Operating Hours	8,497
Operating Expense Rate	\$0.02 /kWh produced			CHP Annual Fuel Consumption	(96868.08)
Operating Expense Escalator	1.0%			CHP Annual Fuel Cost	#####

### Cumulative Project Cash Flow - Pre-tax



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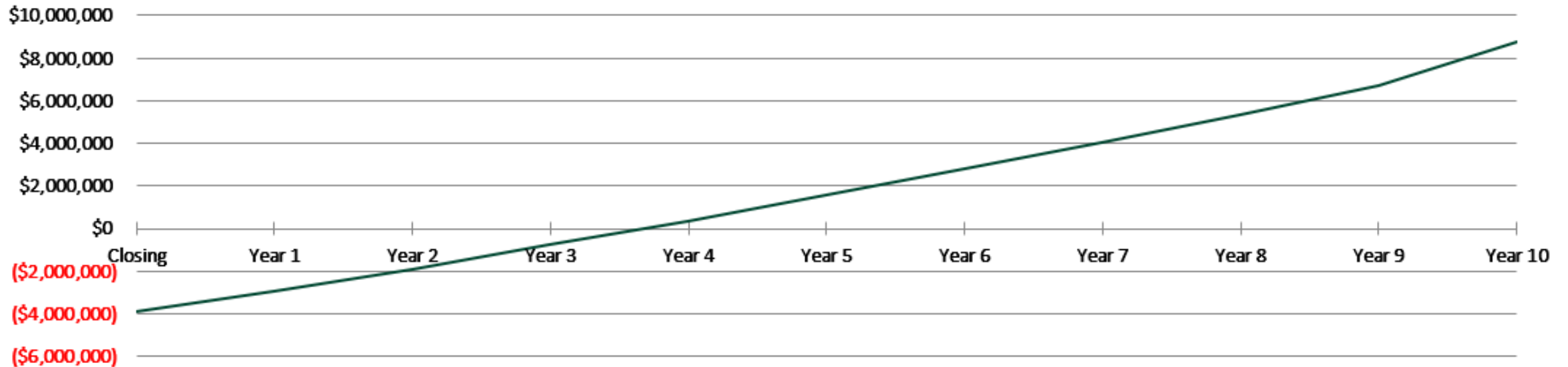
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**Direct Purchase Model - Pre-tax Returns**

**Key Project Drivers and Assumptions**

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Operating Expense Rate	\$0.02 /kWh produced			CHP Annual Fuel Consumption	(96868.08)
Operating Expense Escalator	1.0%			CHP Annual Fuel Cost	(\$1,578,949.70)

**Cumulative Project Cash Flow - Pre-tax**





# Wrap Up

# Thank you

QUESTIONS?