



Prime Power Cluster Mesh System – Data Center Use Case in 2025

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Data Center Use Case for Cluster Mesh System Prime
Power 2025



This webpage QR code

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Cluster Mesh System — Natural Gas Direct Combustion Use Case

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The Problem We're Solving

Distributed power generation using natural gas has historically been dominated by large reciprocating engines or gas turbines that are expensive, mechanically complex, require significant infrastructure, and only make economic sense at scale. Smaller sites — remote data centers, edge deployments, industrial co-generation installations — are left choosing between oversized equipment, expensive grid connections, or unreliable diesel. Meanwhile, the thermodynamic potential of high-grade combustion heat is routinely underutilized, with exhaust gases vented to atmosphere carrying significant recoverable energy with them — including a largely ignored resource: water.

What the Cluster Mesh Changes

When natural gas is used as the direct heat source rather than waste heat recovery, the Cluster Mesh operates in a fundamentally different thermodynamic regime. High-grade combustion temperatures drive the ORC working fluid at elevated pressure and temperature differentials, pushing net electrical efficiency beyond 45% — competitive with or exceeding conventional reciprocating gas gensets, without their mechanical complexity or emissions profile. The distributed node architecture means this performance is achieved across a scalable mesh rather than a single large machine.

Natural gas combustion → high-grade thermal input → high-efficiency ORC nodes → electricity + recoverable exhaust condensate

Specific Use Cases

1. Primary Power Generation for Off-Grid or Grid-Constrained Data Centers

Many high-demand sites — remote edge deployments, military installations, mining operations, oil field compute — cannot access reliable grid power at the capacity needed for modern AI workloads. Natural gas, whether from pipeline, LNG, or field gas, is widely available where grid infrastructure is not.

The Cluster Mesh running on direct natural gas combustion delivers utility-grade power at greater than 45% efficiency, distributed across nodes sized to the load — no oversized single generator sitting at partial load and burning efficiency points.

Result: Reliable, scalable, high-efficiency primary generation wherever natural gas is accessible, independent of grid infrastructure.

2. Combined Heat and Power (CHP) for Data Center Campus Operations

High-grade combustion exhaust, even after driving the ORC cycle at peak efficiency, still carries thermal energy usable for facility heating, absorption cooling, or domestic hot water. The Cluster Mesh becomes the thermal and electrical spine of a full CHP installation.

- Electrical output feeds compute loads directly
- Residual thermal output drives absorption chillers for cooling
- Further cascaded heat feeds facility HVAC or hot water systems

Result: A single natural gas input stream serves electrical generation, cooling, and heating simultaneously — dramatically improving total fuel utilization and reducing the facility's effective energy cost per kilowatt-hour of compute delivered.

3. Combustion Exhaust Water Recovery (to be developed)
