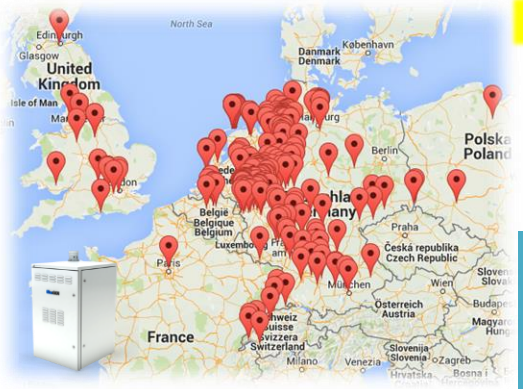
Aris Energy Solutions, LLC & SOLIDpower

Fuel Cells deployment in the U.S.

Steve Almeida Jr
Aris Renewable Energy
Director – Fuel Cells & CHP







- **14 Million operating hours**
- 1,000 installations,
- 10y service contract
- CE certification in Europe, UL in process

Commercialized Fuel Cells products

- **>50 utility customers**
- Microgrid and Virtual power plant demonstrated.

Market Leader in Europe

- **1.5 and 2.5 kW commercialized**
- 3-6-12 kW modules in preparation



kW-to-MW platform WW efficiency record

- **Worldwide Record efficiency : 61%**
- 61% NET AC, delivered onsite, 85% in CHP mode.
- Single system availability >98%
- Historic durability record broken by SP material system (70'000 hours)

Lowest Manufacturing costs

- **Stack mat cost <100$/kW,**
- Unsubsidized grid parity at low manufacturing output (few MW)
- Manufacturing Cost-based LCOE, fuel excluded.
  - < $0.08/kWh @ 10MW/y prod.
  - < $0.06/kWh @ 50 MW/y prod.



SOLIDpower today

- **1000 mCHP systems deployed**
- **14 million operative hours**
- **10 years stack durability record**
- **Market entry data center with Microsoft**
- **10kW system operating in Korea**
- **€40m investment to ramp-up to mass production**

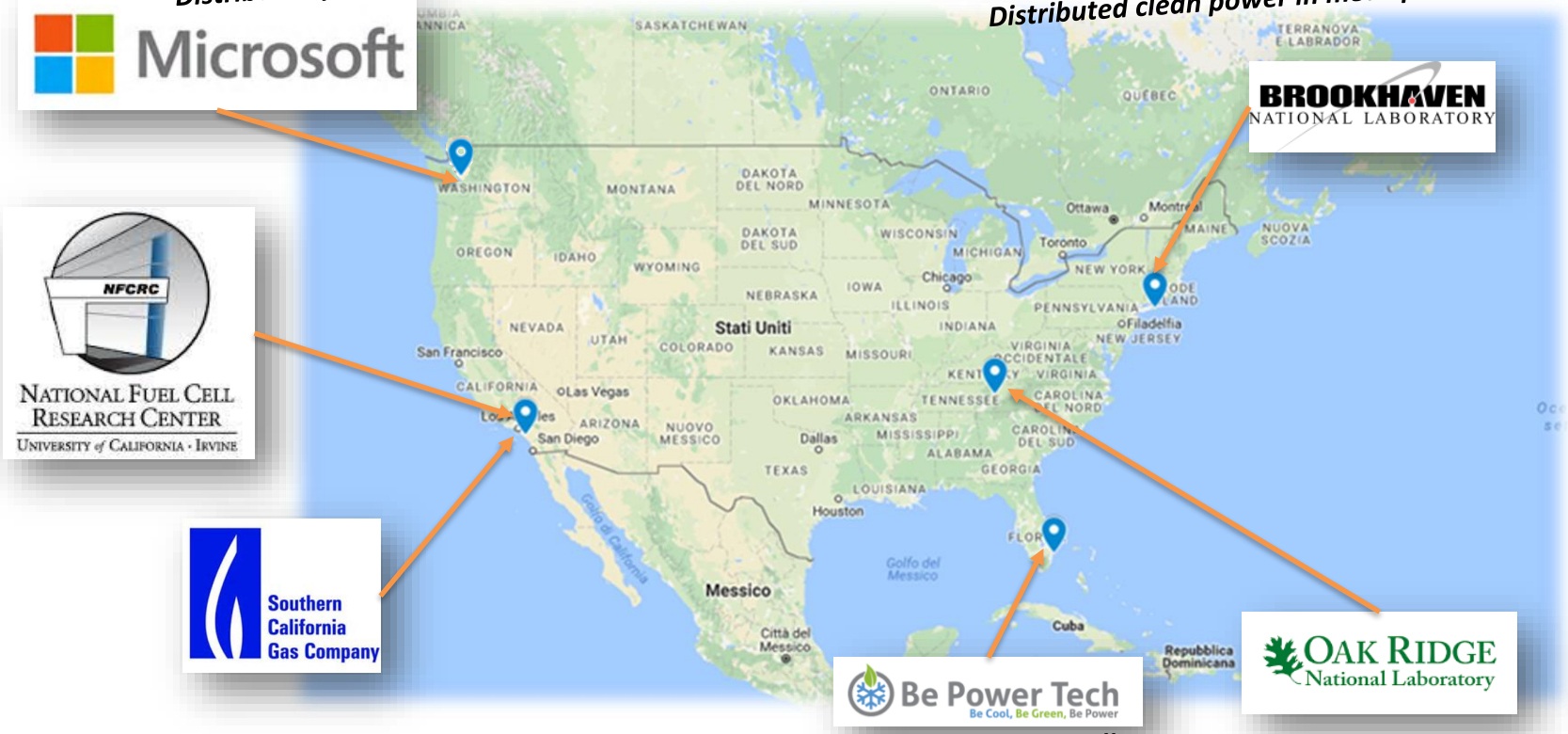
DOE National Labs

Distributed power in cloud data centers

Microsoft

Distributed clean power in metropolitan areas

BROOKHAVEN NATIONAL LABORATORY



NFCRC
NATIONAL FUEL CELL RESEARCH CENTER
UNIVERSITY of CALIFORNIA · IRVINE

Southern California Gas Company

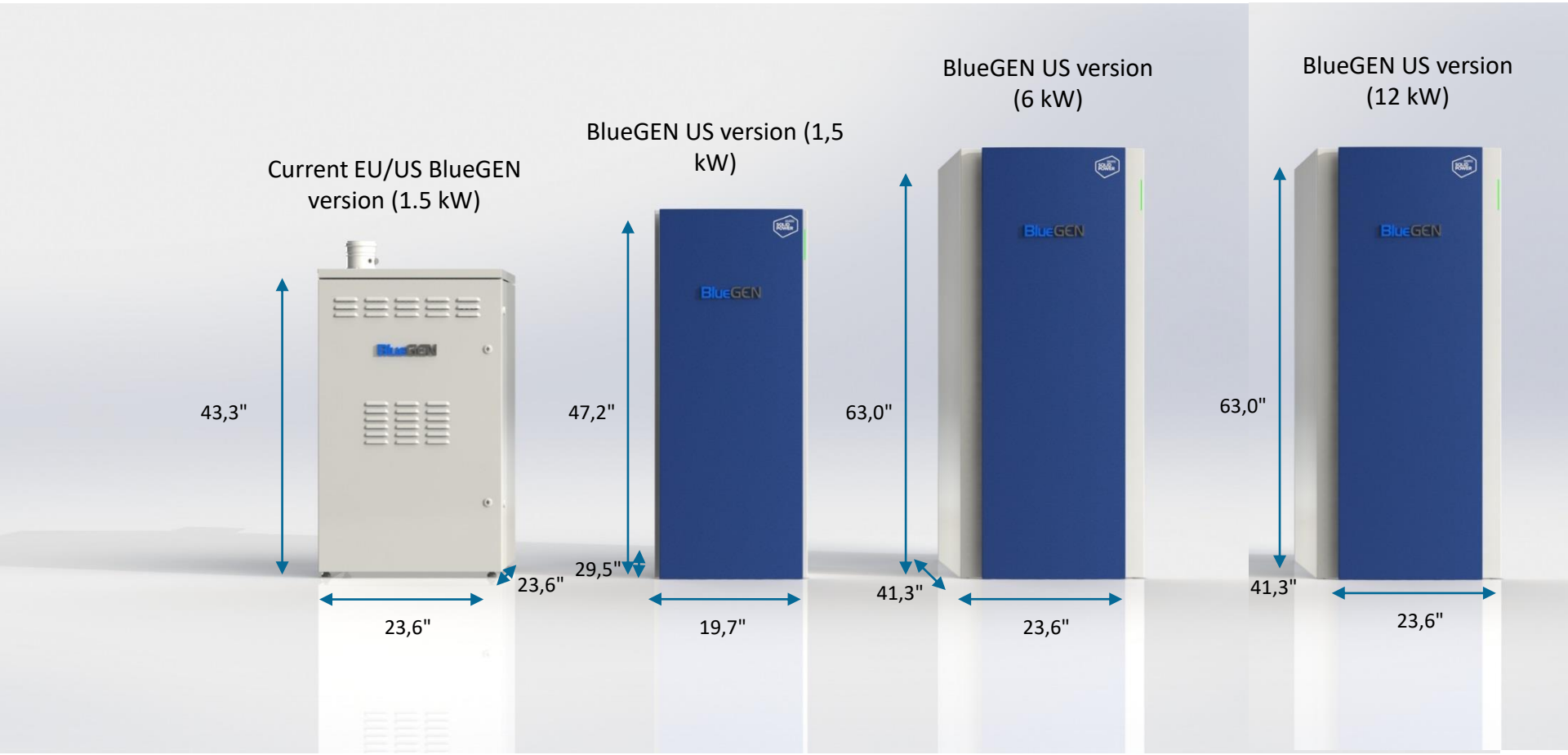
Be Power Tech
Be Cool, Be Green, Be Power

OAK RIDGE National Laboratory

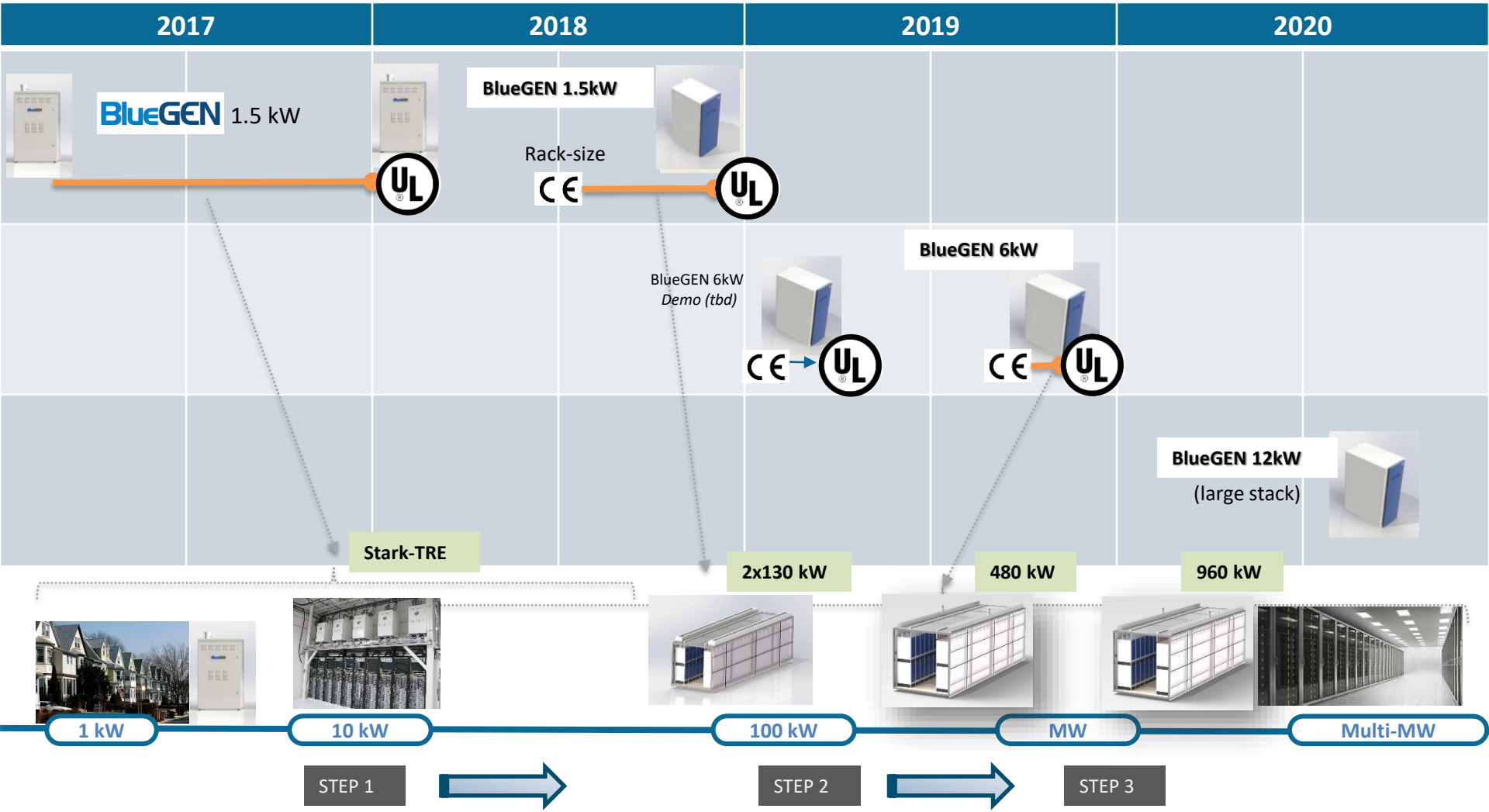
Power and cooling:
«The AC system which produces power»

Scalable Offerings

1,5 kW, 6 kW and 12 kW units - comparison



Planned Product Roadmap in US: Modular Approach



Small Business / Residential Applications





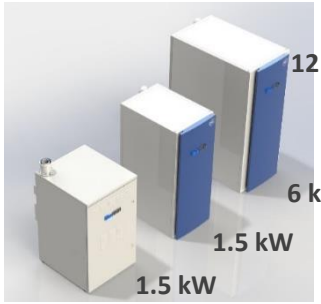


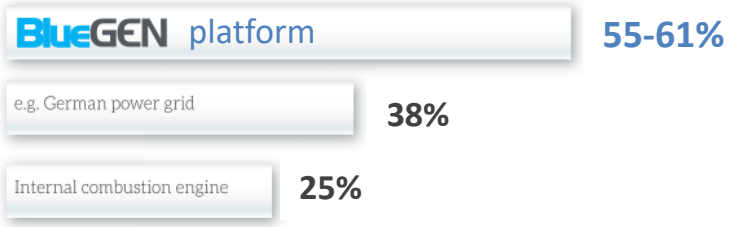




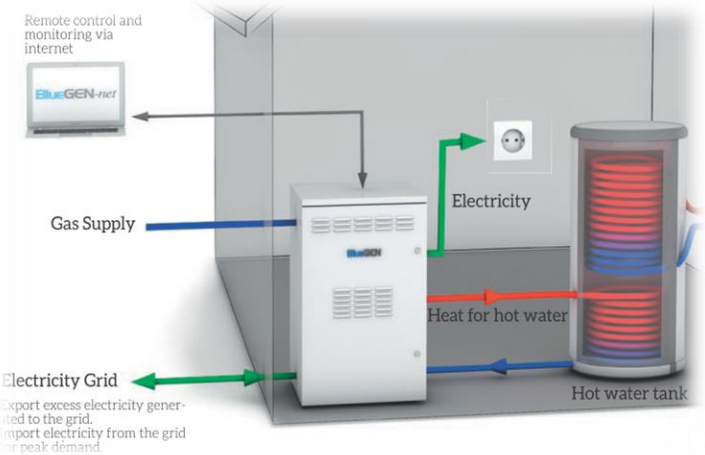
Fuel Cell Configuration

BlueGEN platform





- ❑ kW to MW modular, flexible
- ❑ Highest electrical efficiency
- ❑ CHP mode – Heat recuperation: 85% total efficiency
- ❑ Indoor, simple installation (equivalent to a gas boiler)
- ❑ Low-pressure gas: 9–20mbar 0.13 – 0.30 PSI
- ❑ Modulation – Load following possible

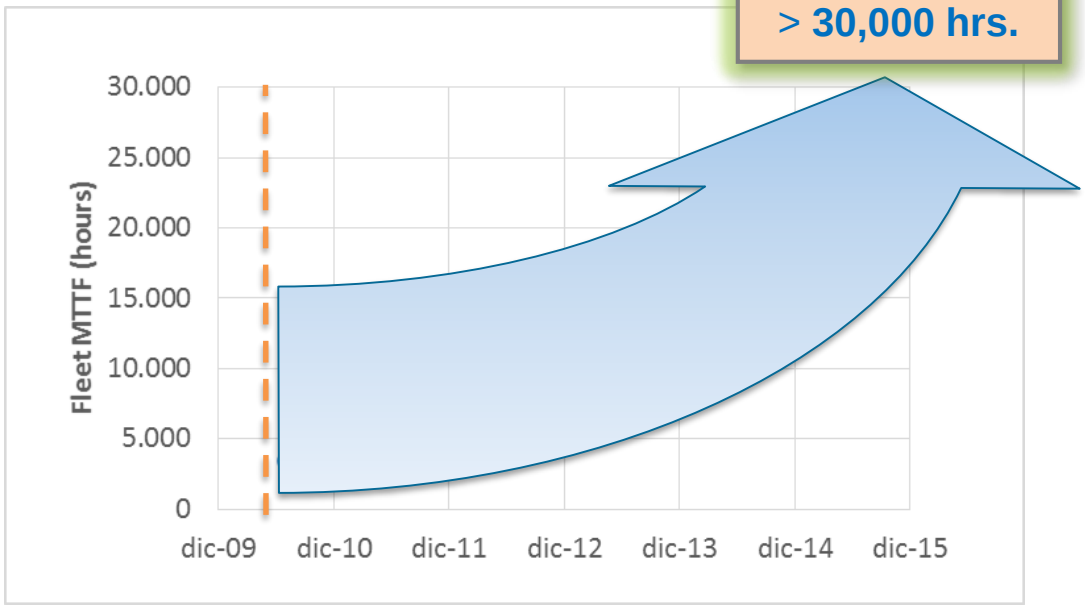


Operational Reliability

BlueGEN

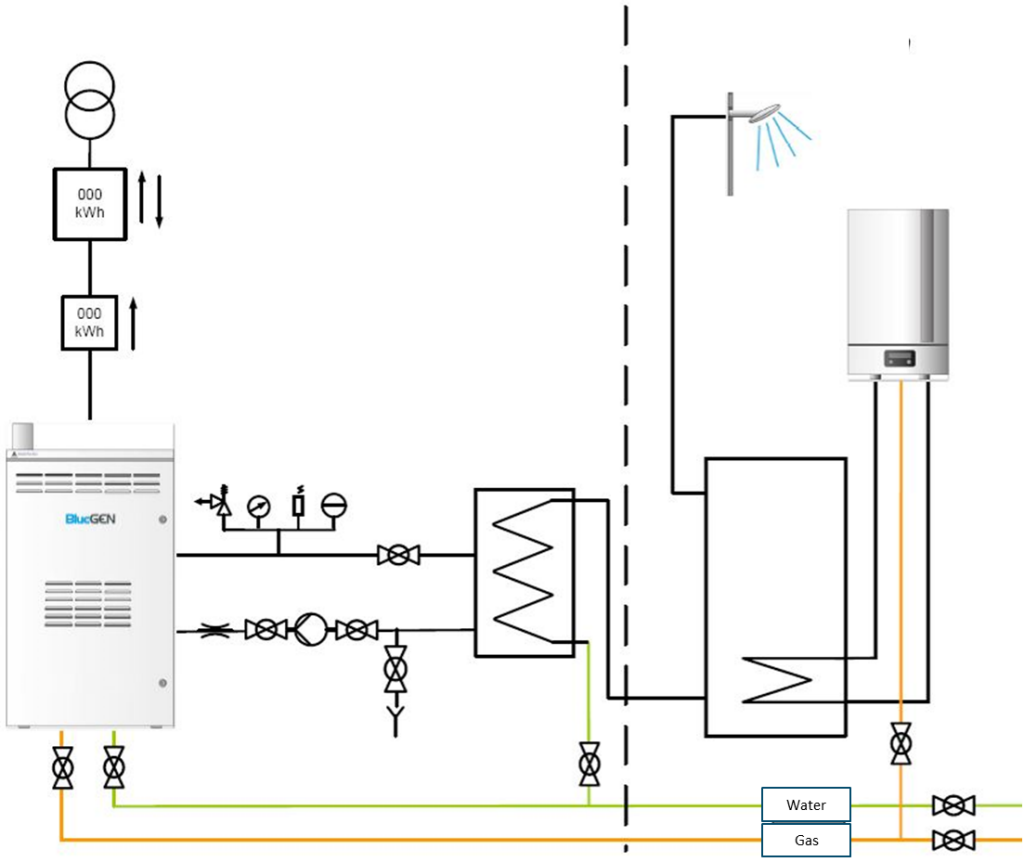


> 14,000,000 hours



MTTF
= Mean Time Between Failures
= (Σ running hours / Σ failures)

CHP Configuration



Services Required

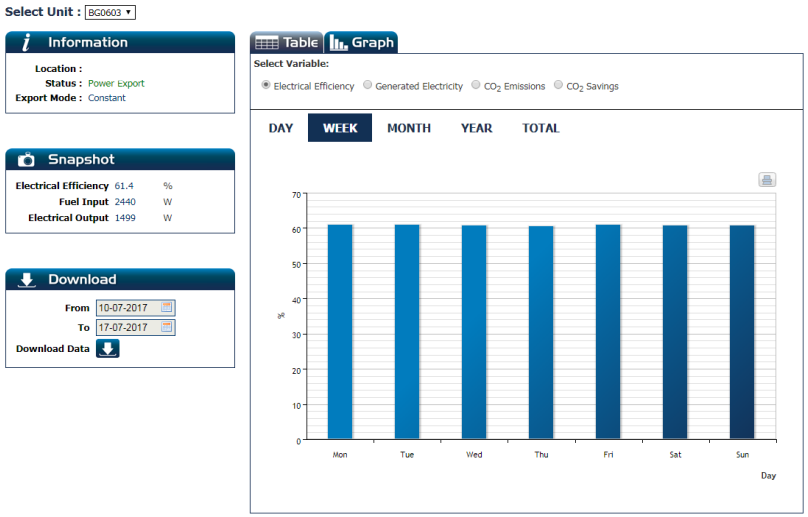
- ❑ Electricity source / load
- ❑ Gas (0.13 - 0.35 psi)
- ❑ Water (mains pressure)
- ❑ Drain
- ❑ Combined air intake and exhaust
- ❑ Internet
- ❑ Heat recovery (Optional)

System Monitoring / Serviceability

- ❑ 24 / 7 online monitoring
- ❑ Customer web portal / Virtual Power Plant
- ❑ 6 – 12 month service interval (water quality dependant)
- ❑ Remote software updates
- ❑ Hardware updates during maintenance

Serviceable Parts

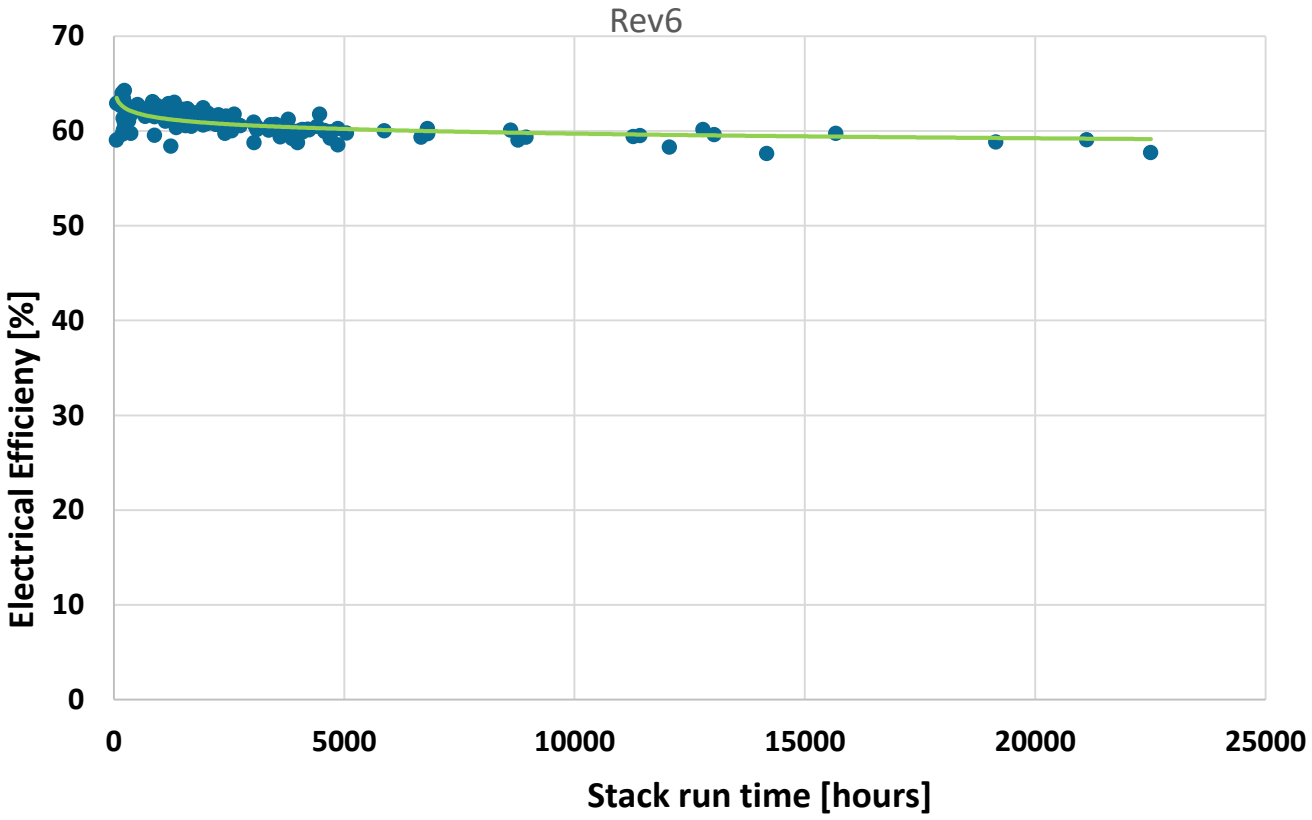
- ❑ Air filter
- ❑ Water Filters
- ❑ Gas Filter (in US every 10 years)







Minimal Stack Degradation



Planned Product Roadmap in US: Modular Approach

2017	2018	2019	2020



BlueGEN 1.5 kW

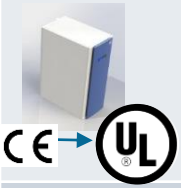


BlueGEN 1.5kW

Rack-size



BlueGEN 6kW
Demo (tbd)



BlueGEN 6kW



BlueGEN 12kW
(large stack)

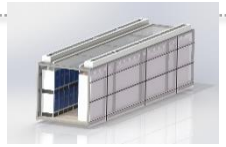


Stark-TRE





2x130 kW



480 kW



960 kW

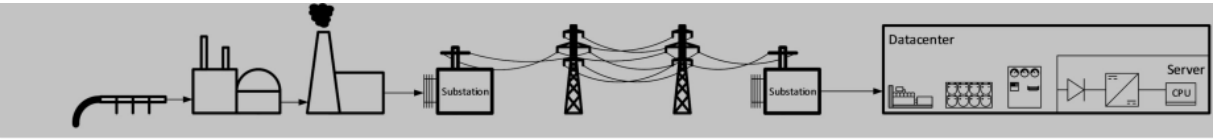




1 kW — 10 kW — 100 kW — MW — Multi-MW

STEP 1 → STEP 2 → STEP 3

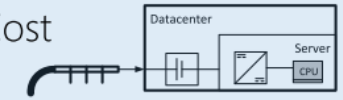
Alternative to Traditional Utility Energy Infrastructure



Input (100%) Generation ~~Transmission~~ ~~UPS~~ ~~Back-up generators~~ ~~Power distribution~~

Efficency to data center (≈18%)

Less Infrastructure + Less Complexity = Reduced Cost & Risk



50% decrease in physical infrastructure on-site

5-10% decrease in total DC COGS rate

2x efficiency improvement

SIMPLICITY

Streamlined Design Reduces Risk
Minimal customization
Reduced failure zone

LOWER COST

Elimination of electrical distribution
Less site equipment to maintain
Waste heat reuse
Simple energy supply chain

IMPROVED EFFICIENCY

Dramatic improvement in efficiency
Lower PUE
Reduced losses
Reduced TTM- construction time down 6 months
Reuse of waste heat

Efficiency to data center (≈60%)

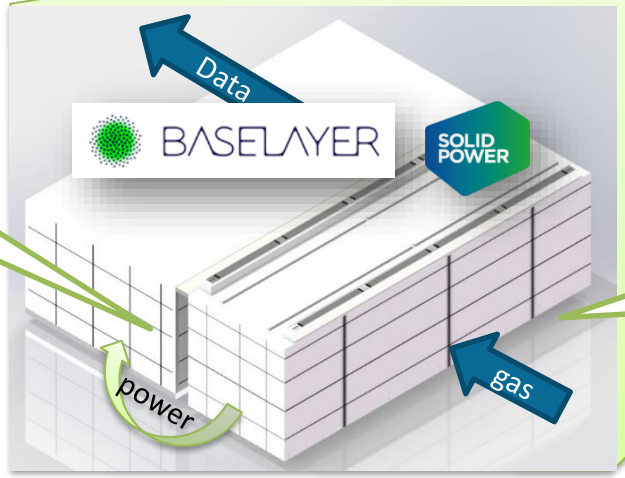


Multi-site Demonstration Potential

Multi-site building & grid integration MW-demonstration

Residential	Multi-apartment	Commercial-SME		Grid-scale & Data Center
1.5 kW	10 kW	100 kW	1 MW	Multi-MW
				

Baselayer
Modular Data Centers
Integrated with Fuel
Cell and Energy Storage

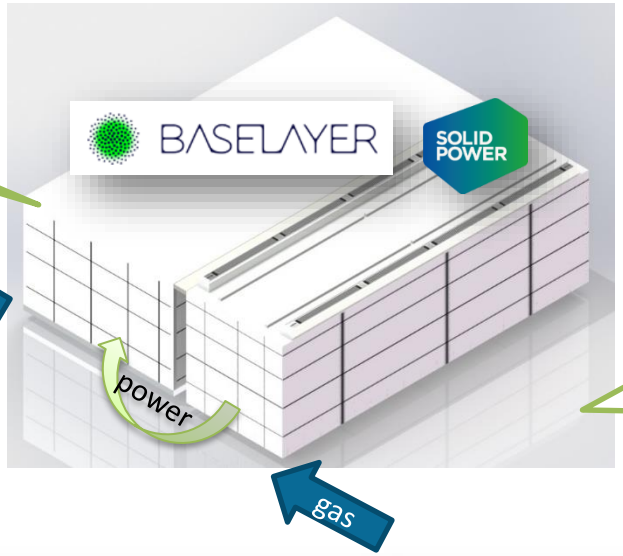


PowerRACK™ module
480 kW (6kW modules)

- Input = ONLY low pressure gas
- Output = 99.999% power for each single rack of the IT module
- Individual power generator
- DC (or AC)
- Load following

Power Rack & IT Configurations

IT module
Baselayer XC10



PowerRACK™ module
130 kW (1,5 kW modules)
480 kW (6kW modules)
960 kW (12kW modules)

- Input = ONLY low pressure gas
- Output = 99.999% power for each single rack of the IT module
- Individual power generator
- DC (or AC)
- Load following



BlueGEN module,
1.5 kW
19 inch, 2 levels

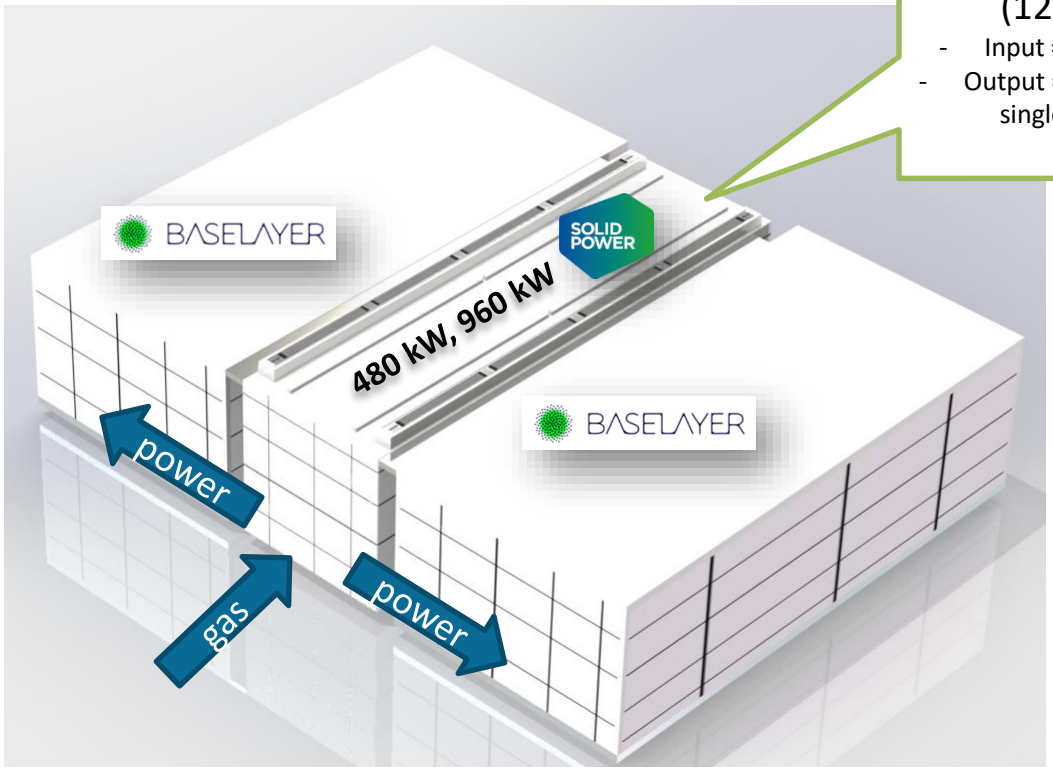






BlueGEN module,
6kW, 12kW
19 inch, 2 levels
to power
12kW-24kW Racks

Modular Data Station (On-site)



PowerRACK™ module
(12kW modules)

- Input = ONLY low pressure gas
- Output = 99.999% power for each single rack of the IT module

DOE National Labs

Multi-site building & grid integration MW-demonstration

Residential	Multi-apartment	Commercial-SME		Grid-scale & Data Center
1.5 kW	10 kW	100 kW	1 MW	Multi-MW
				

- Con Edison
- Aris-DGC
- Baselayer
- Willdan Energy
- Microsoft

Via Government Agencies, ESCO's, Utilities, Architects, Building Contractors

To Government End Users, Residential, Multi-Family, Developers, Property Managers, Small and Med Commercial, including Major Retailers, Restaurant Franchises, Banks, Data Centers

Project Goals

Multi-site building & grid integration MW-demonstration

Residential	Multi-apartment	Commercial-SME		Grid-scale & Data Center
1.5 kW	10 kW	100 kW	1 MW	Multi-MW
				
70 sites 100 kW	70 sites 100 kW	3-4 sites 400 kW		1-2 sites 400 kW

Project Goals:

- Building and grid integration in different applications kW to MW. Guidelines and standardization
- Demonstration of Business and Financing Models: End User owned, ESCO-owned, Utility owned/financed
- Non-Wire Solutions, Demand response delivered by fuel cells and fuel cells-battery hybrid systems
- Unsubsidized, full-economic value grid-parity demonstration according to BCAH (Benefit Cost Analysis Handbook) of New York Joint Utilities

Project Goals and Partnerships

- SOLIDpower's sees the combination of its low cost technology and the large US market size/demand, as the key to breakthrough the traditional fuel cell industry cost/volume dilemna
- SOLIDpower targets a 5,000 unit minimum volume committment from its overall US partnerships to achieve the first level of cost reduction.
- Aris Energy Solutions intends to achieve the 5,000 unit volume by its 2017-19 efforts and seeks to aggregate demand across the early markets
- Aris seeks the interest and then a staged committment level from participants in the early markets for:
  - Initial scoping and feasibility discussions
  - Client interest to participate in the proposed Multi-Site NY Demonstration Project
  - Client confirmation of interest through Demonstration Project and beyond with non binding LOI's
  - Purchase contract with deposit
- Client benefits:
  - Help solve their energy and resiliency challenges
  - Sustainability leadership via leading edge, yet proven technology
  - Priority order execution and fulfillment based on first come first serve LOIs



Thank you

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