Aris Energy Solutions

"Modular Fuel Cells Providing Resiliency to Critical Power Users"

Our Mission

Modular Fuel Cell Solutions for a Carbon Neutral Tomorrow

Aris Energy Solutions is the lead distributor of the most efficient 1.5 kW-scale power generator in the world

Significant market opportunity in largely untapped market across the 1-10kW application range, where existing fuel cells in the country are only usable > 100kW

Strong momentum from government initiatives garnering support for renewable energy initiatives and providing funding for businesses to move to carbon neutral means

Product Background

57-60%
Electrical Efficiency

+2,500
Installations

5-7 years
Stack Life

~50%
Carbon Reduction vs. U.S. Electric Grid

25%
Thermal Efficiency

+40 million
Operating Hours

10 year
O&M Agreement

BG-15 Product Features

1.5 kW Modular Electric Power
Up to 13,000kWh of electricity per year

Efficient conversion of electricity
Best in class at 57-60% in comparison to peers

Environmental responsibility
Reduces carbon footprint by 50%

Resilient energy
24/7 always on continuous operation

Service and maintenance
24-month warranty agreement

Proven Track Record in EU…

Paves Way for First Mover Advantage in the U.S.

With **+2,500** BlueGEN fuel cells deployed, the European "PACE" program will continue to **accelerate growth** by deploying hundreds of units annually and continue to **bring costs down**

Microsoft

NASA

nationalgrid

BROOKHAVEN NATIONAL LABORATORY

NFCRC
National Fuel Cell Research Center
University of California - Irvine

Southern California Gas Company

NETL National Energy Technology Laboratory

Along with ongoing projects, Aris was awarded a **$2.7MM grant by the DOE** with NASA, NETL, WVU for resiliency demonstration – success of project will validate the product for **wider commercialization**

Ongoing Projects

$2.7 million DOE grant with WVU / NASA in demonstrating resiliency

Proving hydrogen blending and electrical efficiency at Brookhaven National Lab

Residential Applications

NASA / WVU Project Execution

Phase I – "Island Mode"

NETL

- Demonstrate the BlueGEN's (6kW – Quad) ability to **reliably disconnect from the grid** to power a simulated critical load in "Island Mode"
- Year 3 – replicate the work using the BG-60

Phase II – "Modularity"

WVU / NASA

- **Modular scaling via a 24kW system** of BG-15 units to power NASA data center for 12 months
- Utilize lessons learned from first 12 months, **install an additional 16.5kW** to operate for following 12 months

Phase III – "Critical Power"

Site TBD

- Demonstrate the BlueGEN's **resiliency at commercial partner site** that requires **"Always On" electric power**
- Candidates include national retail bank branches, urban hospitals, industry/telecom, etc.

Techno Economic Assessment by Gaia Energy Research Institute

Developing a path towards commercial sales and marketability through an economic analysis of the product's performance throughout the three-year program

Brookhaven National Lab

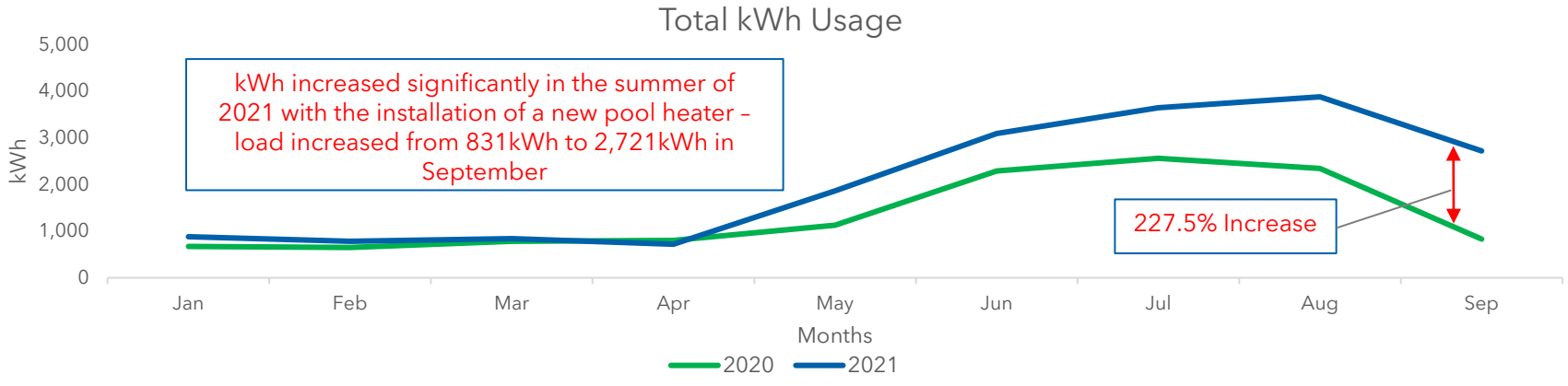
Proving electrical efficiency and successfully demonstrating natural gas blending

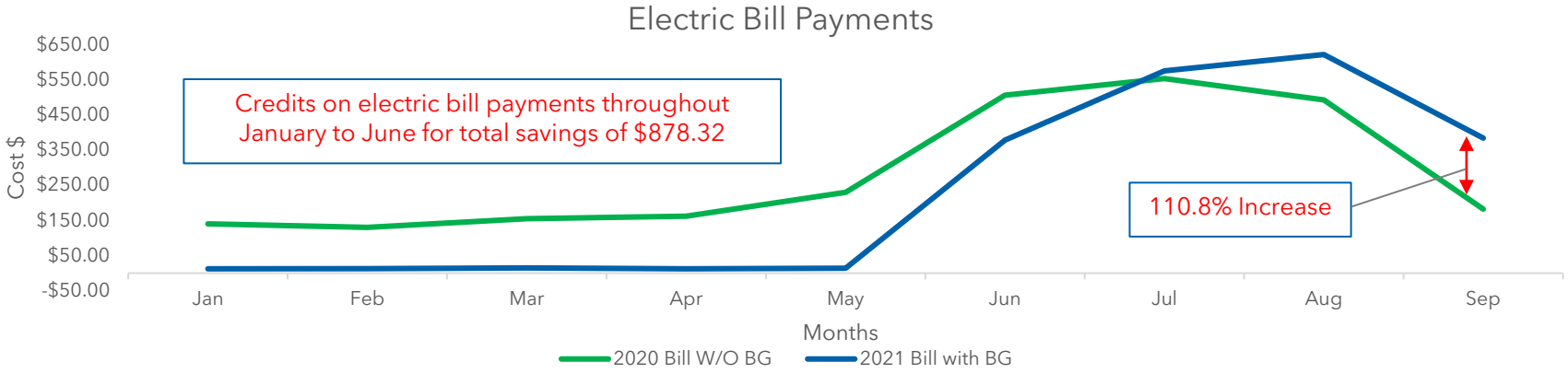
- **Continuous 24/7 production at 6 kW – generating 52,000+kWh/Year**
- 60%+ net electrical efficiency with minimal degradation
- 12 mT/year carbon reduction, offsets electricity-based carbon emissions of 2.5 average US residences
- Offsetting monthly Electricity Delivery & Demand

- **1.5kW fuel cell with CHP**
- Has operated at increments of 5% up to 20% green hydrogen blend in natural gas
- Electrical production, electrical efficiency, thermal production, and emissions data collected

Residential Applications (Long Island, NY)

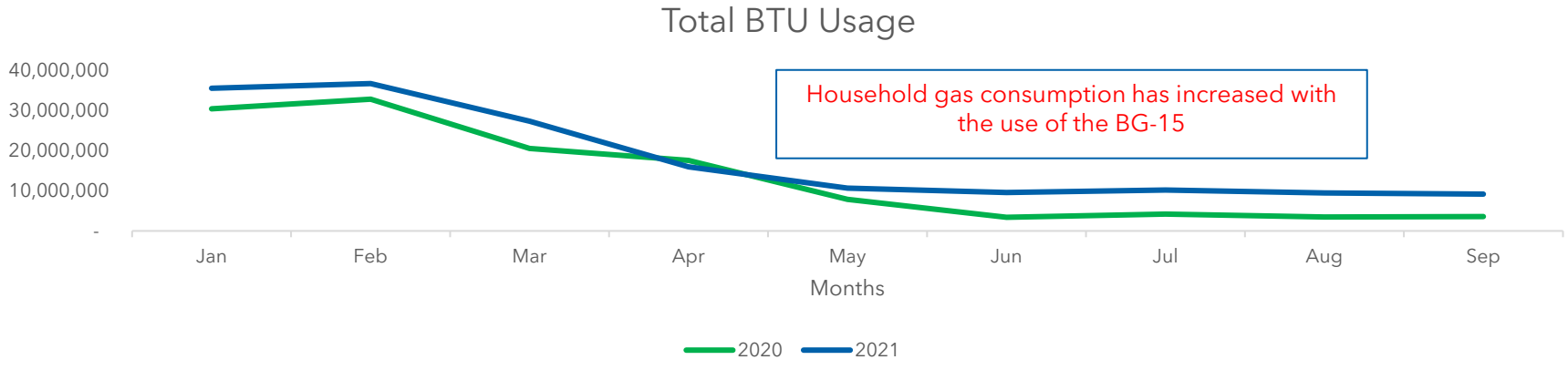
Highlighting fuel cell's efficiency and compatibility with U.S. grid infrastructure

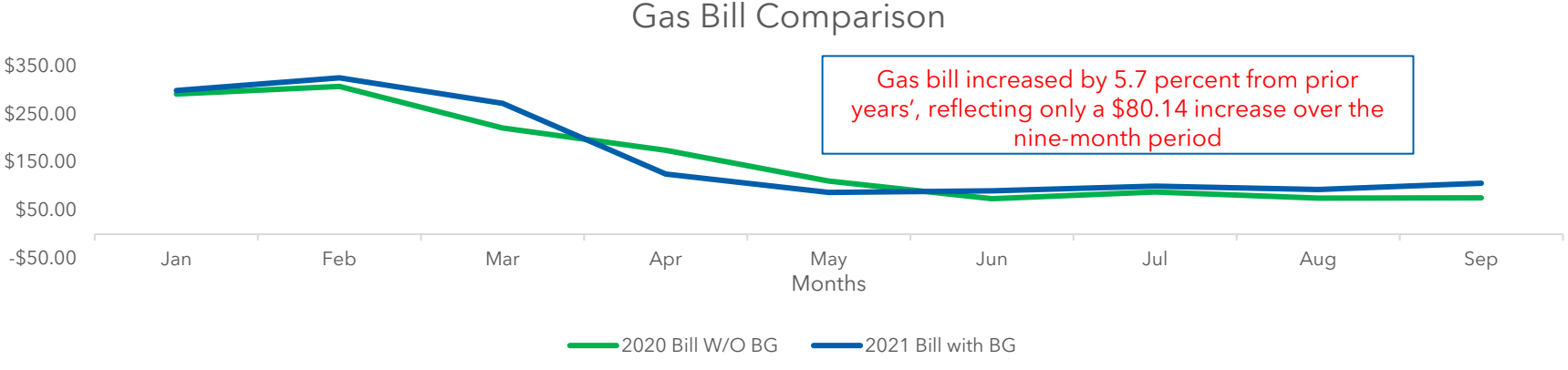




Residential Applications (Long Island, NY)

Fuel cell economics in a residential setting



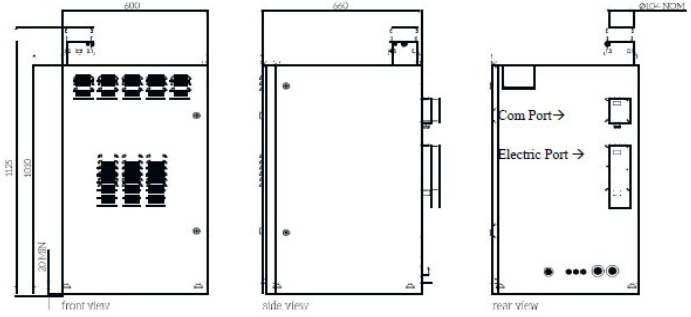


Product Specifications

1. Concentric flue adapter (60/100 mm)
2. Fuel Cell Module
3. Waste heat recovery unit (hidden from view)
4. Gas safety double block valves
5. Condensate tank (hidden from view)
6. Air delivery system
7. Water treatment system
8. Power system
9. Gas desulphuriser

Technical specifications

Operation mode	Power-led, continuous (approx. 8,700 h per year)
Fuel type	Natural gas, bio-methane
Fuel cell technology	SOFC (Solid Oxide Fuel Cell)
Fuel consumption 1)	8.5 MBH
Electrical efficiency 1) (output)	Up to 60 % (1.5 kW)
Thermal efficiency 1) (output)	Up to 25 % (0.6 kW)
Overall efficiency 1)	Up to 85 %
Electrical energy generated per year 1)	~ 13,000 kWh_{el}
Thermal energy generated per year 1)	~ 5,220 kWh_{th}
Control	Remote monitoring and control via Internet
Weight, Dimensions (H x W x D)	430 lb, 39.7 x 23.6 x 26 in
Noise level	< 47 db (A)
Service interval 2)	12 months
Full maintenance service	Yes (120 months)
Subsidies	Subsidy programmes differ by country. Please contact your local distributor to find out more.



1) At maximum electrical efficiency, nominal output of 1.5 kW
2) Replacement of filters depending on local water, air and gas quality

Upcoming Developments

BG-15:

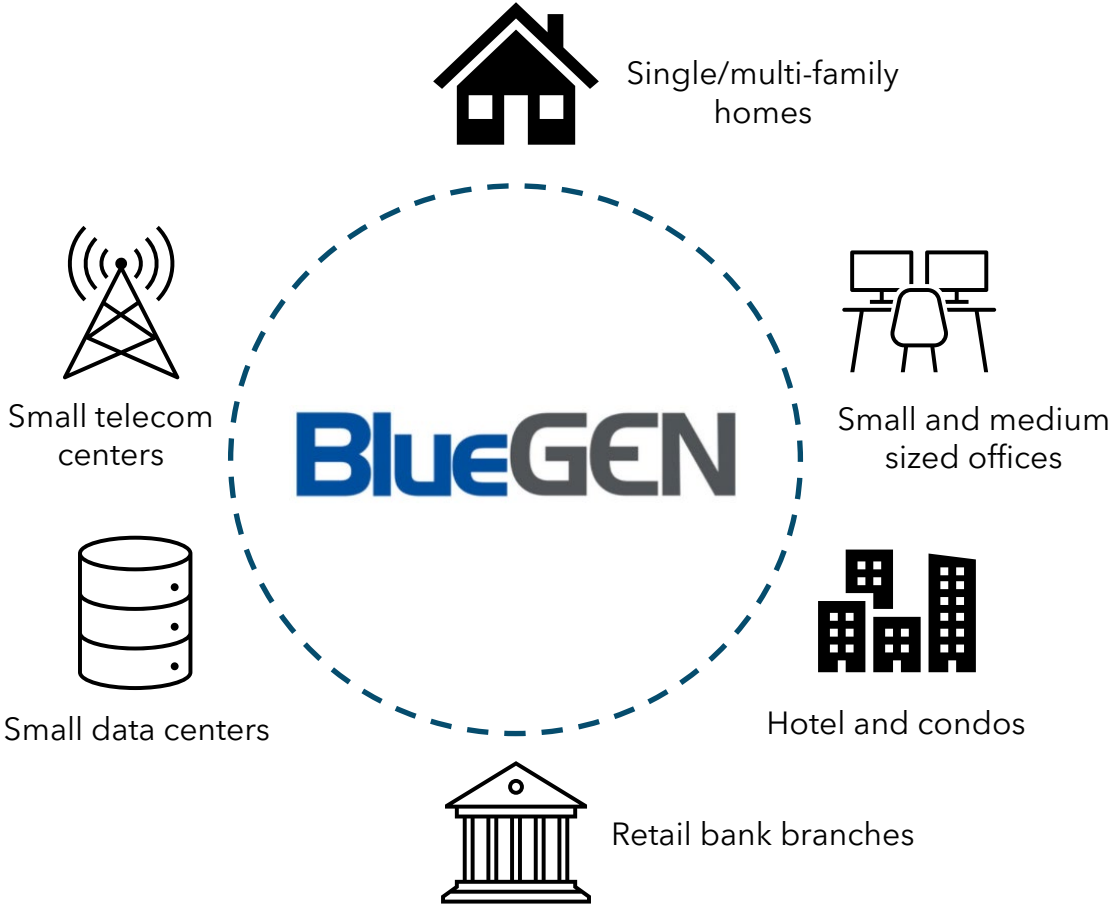
- BG-0 to be superseded by BG-15
- Updated outer shell
- Load-following capabilities for always-on resilient power
- Reduced installation costs with remodeled design for smoother and quicker implementation

BG-60:

- 6kW load as opposed to 1.5kW in BG-15
- Stackable and modular capabilities up to 480kW
- Cost reduction opportunities with larger/modular installations

Target Markets

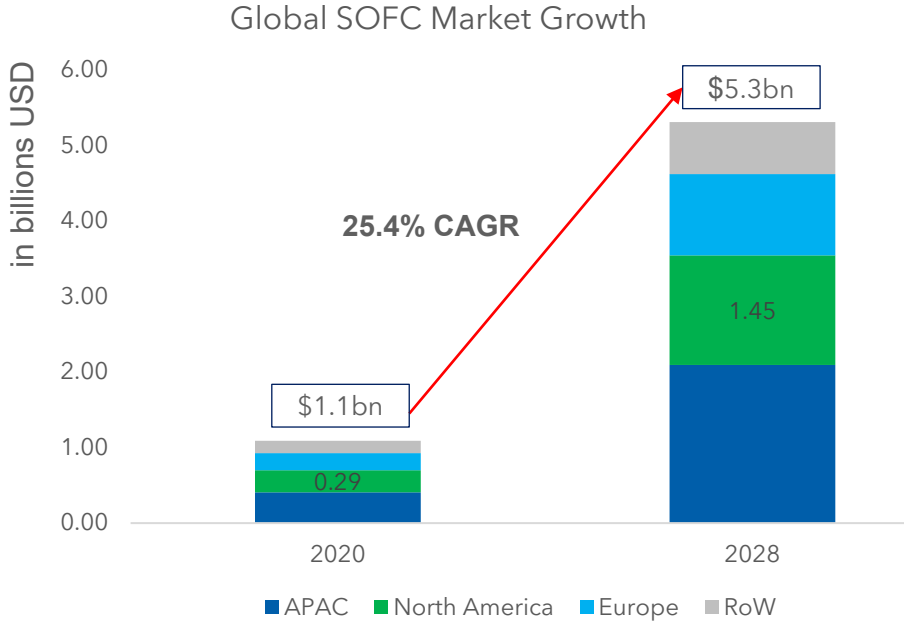
Providing **reliable and resilient power** to customers with a need for **critical power**



Industry supported by long-term drivers

SOFC will play a crucial role in the transition from fossil fuels to alternative sources of energy

North America has the second largest market share with 26.8%, behind the APAC region's 37.6% - SOFCs primarily find wide-scale applications in the stationary segment in North America



SOFC Market Drivers

Continued Macro Trends Towards Decarbonization
BG-15 fuel cells support this through combustion free reaction and zero other harmful emissions (50% carbon reduction vs. fossil fuel use)

Electric Grid Continues to be Pressured
With weather/natural disasters, an aging infrastructure, and a growing consumption of electricity (energy demand forecasted to grow 28% by 2040), there continue to be a greater need for alternatives sources of resilient energy

The Rise of Biogas and Hydrogen
Producing green power & heat by using 'green gas' in existing gas distribution infrastructure

Bipartisan Infrastructure Bill
Approximately $10 billion has been allocated to further developing fuel cells and electrolyzer technology in increasing the availability of green hydrogen

Technology Maturity
Market acceptance of fuel cells allow mass production and drives cost reduction

Source: Fortune Business Insights, 2020


Creating a Carbon Neutral Tomorrow
Through Modular Fuel Cell Solutions
ARIS
ENERGY
SOLUTIONS
DEPARTMENT OF ENERGY
UNITED STATES OF AMERICA