



THE FUTURE OF MICROGRIDS

How Energy Storage Systems Add Reliability and Efficiency

Björn Lang – Manager, Sales Engineering

Boston 11/8/17

THERE ARE THREE MAIN DIMENSIONS TO MICROGRIDS

Requirements for a future energy system

Reliability



- Reliability needs to be at least maintained
- Grid quality issues from high RE share need to be contained

Cost-efficiency



- Reduction of fuel consumption
- Reduction on RE curtailment
- Reduction on O&M
- Increasing lifetime of all power equipment

Sustainability



- Clean energy production
- Reduction of CO₂ emissions
- Paving the road towards high RE shares



Energy Storage is the cornerstone of renewable energy based microgrids

Resiliency is the ultimate revenue stacking option for grid-connected microgrids
(and energy storage in general)

Reliability and Efficiency go hand in hand

ENERGY STORAGE WILL BE THE CORNERSTONE FOR EFFICIENT ELECTRICITY SYSTEMS



Decrease operating costs

- Allow gen-sets to operate in optimal range
- Increase gen-set efficiency
- Decrease cycling to reduce O&M

Improve grid stability

- Act as back up power source to keep critical loads online
- Maintain high power quality with VAR support
- Avoid additional grid support equipment expenses
- Response time < 50 milliseconds

Integrate more renewable resources

- Reduce strain on grid caused by intermittency
- Decrease diesel consumption through less curtailment of renewable resources
- Allow for 100% instantaneous RE penetration



GRACIOSA: FULL-SCALE ISLAND MICRO-GRID WITH UP TO 65% RE SHARE

Commissioned Q1 2016

2.8 MW/3.2 MWh Battery Storage

4.5 MW Wind & 1.0 MWp PV

RE limit without Battery Storage: 15%



PROVEN FEASIBILITY BY A DEMONSTRATION SITE IN OUR TECHNOLOGY CENTER



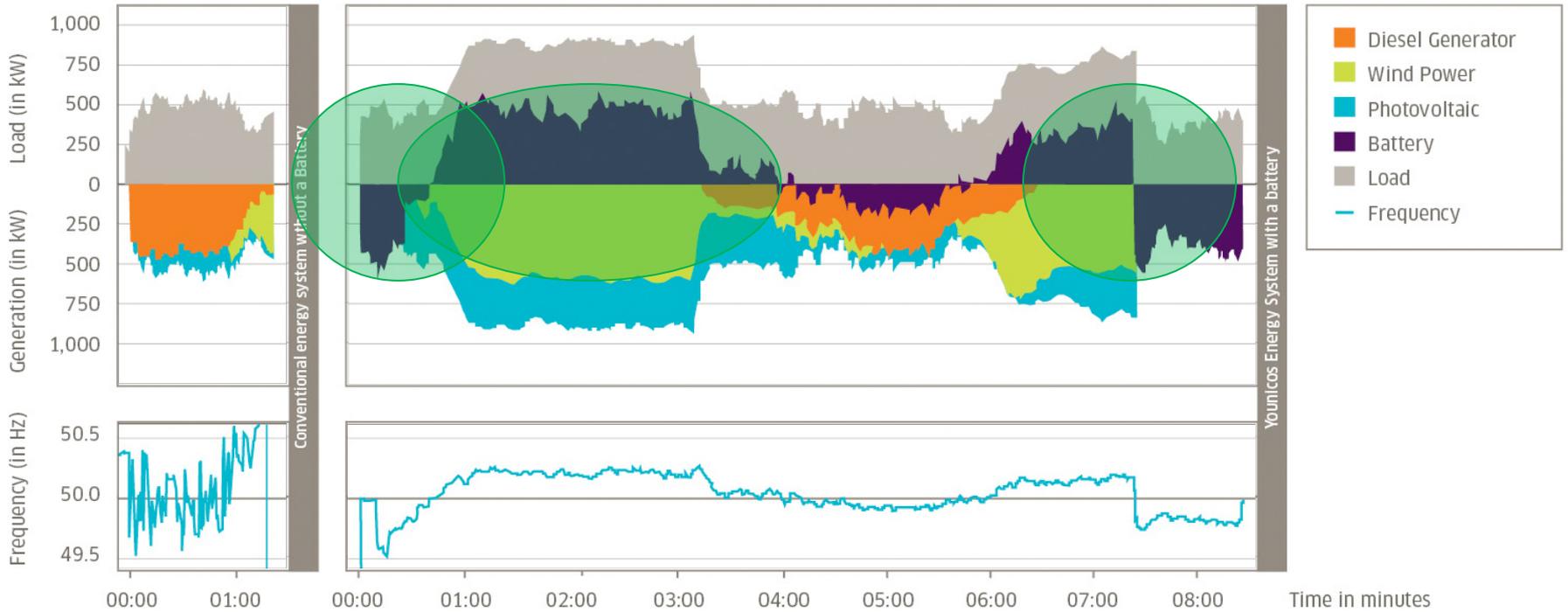
Island replica scale 1:3

- Demonstrate the functionalities of Younicos' technology
- Perform technical due diligences by local utilities or regulatory bodies
- Train local personnel in the operation and maintenance of such state of the art energy systems

We replicated a fully automated MW-scale island system in our headquarters in Berlin.



Demonstration Results



RESILIENCY AS REVENUE STACKING OPTION



Denver, Colorado, United States

Panasonic Operations Hub

- 1 MW/120 min
- Lithium Ion
- 4 Y.Cubes
- Commissioning: Q1/2017
- Client:



RESILIENCY AS REVENUE STACKING OPTION



Multi-Use Storage for Greater Market Impact

Frequency Regulation

Solar Firming & Shifting

Peak Shaving

Energy Arbitrage

Back-up Power

capability to create islanded microgrid
for 24/7 operation of the Panasonic
NOC

Only needed when the other services
cannot be provided (there is no grid)

New service for utilities

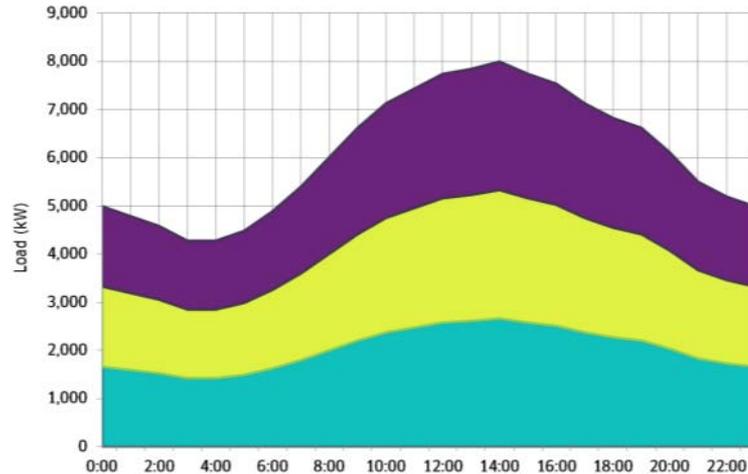




EFFICIENCY AND RELIABILITY GO HAND IN HAND

Operation without ESS

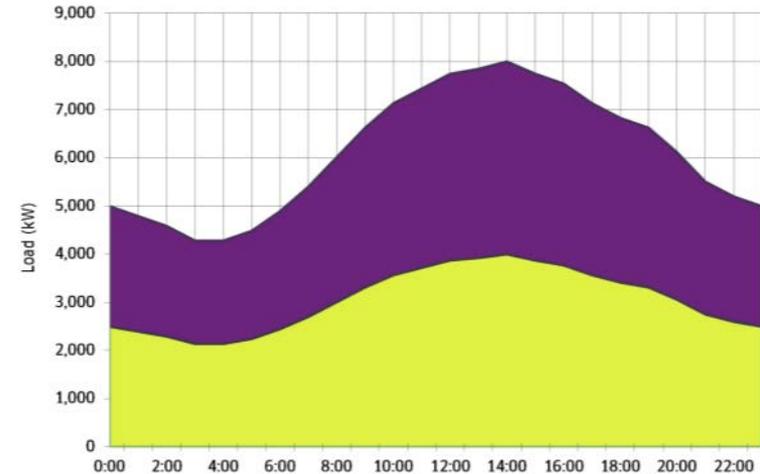
Existing Operation – Load Shared Across 3 Generators



- Load split evenly across 3 diesel generators
- Each DG acts as spinning reserves to keep serving load in case a single generator trips
- Operation at lower loading increases fuel consumption

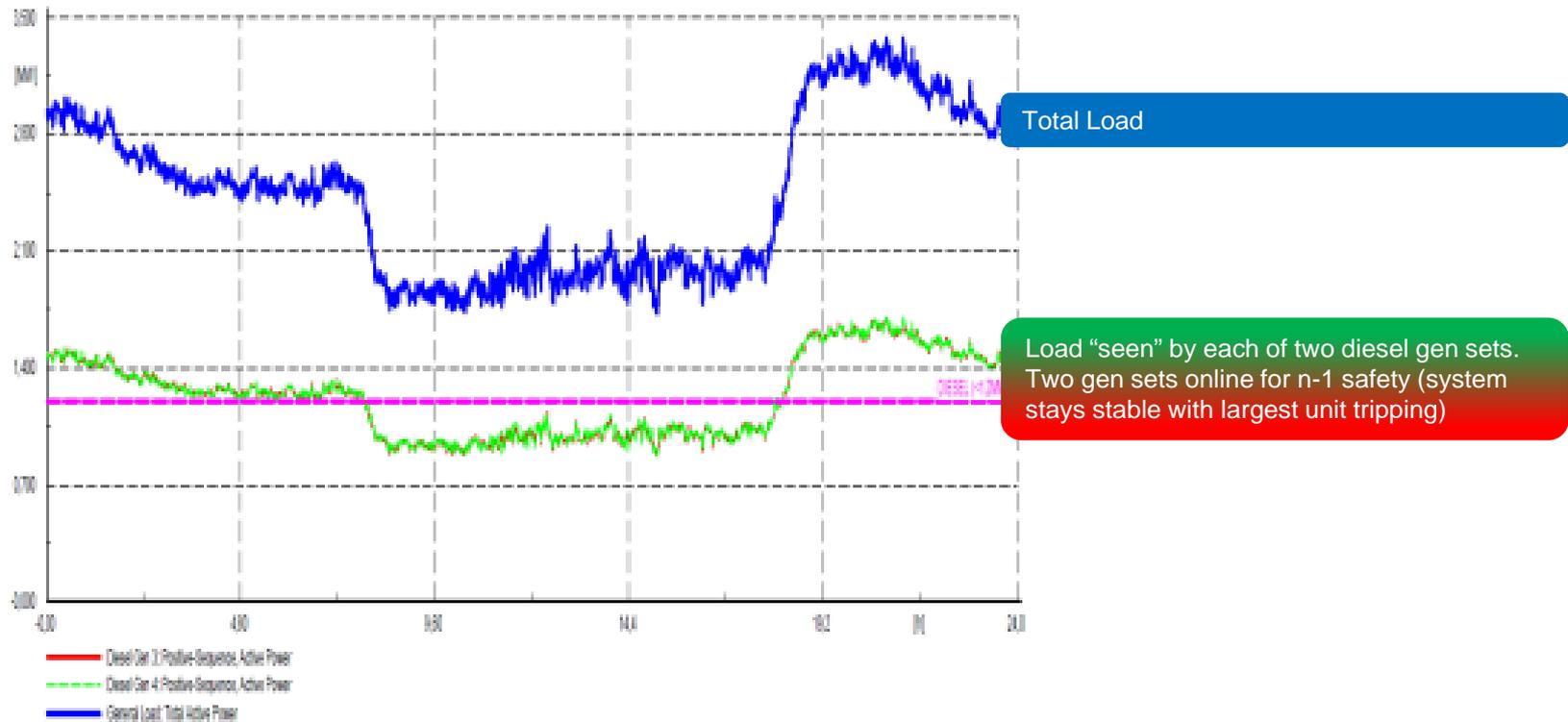
Operation with ESS

Existing Operation – Load Shared Across 3 Generators

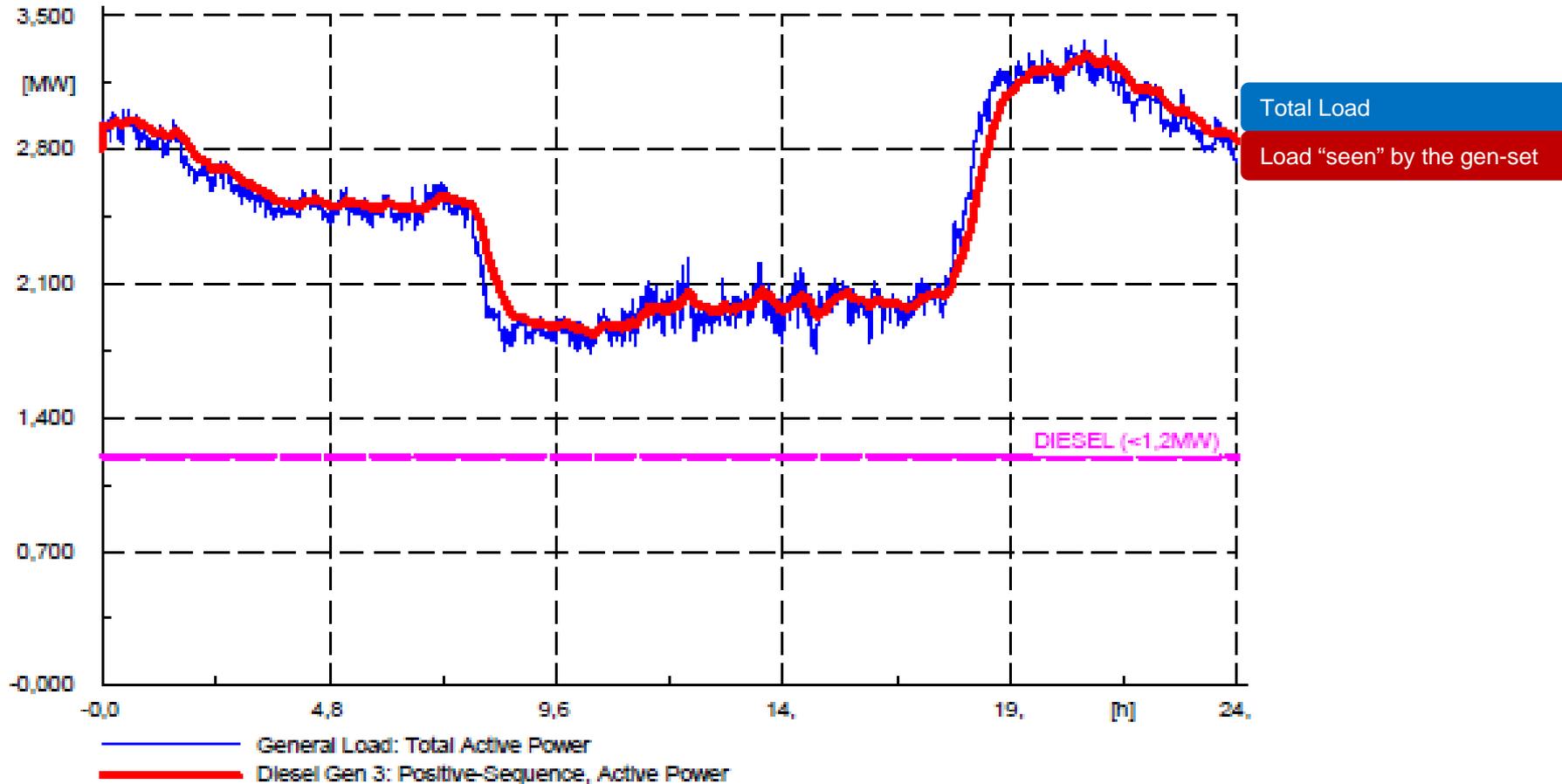


- Load split evenly across 2 diesel generators
- ESS provides spinning reserves while 3rd generator remains offline
- Operation at higher loading increases efficiency and reduces required O&M

EFFICIENCY AND RELIABILITY GO HAND IN HAND



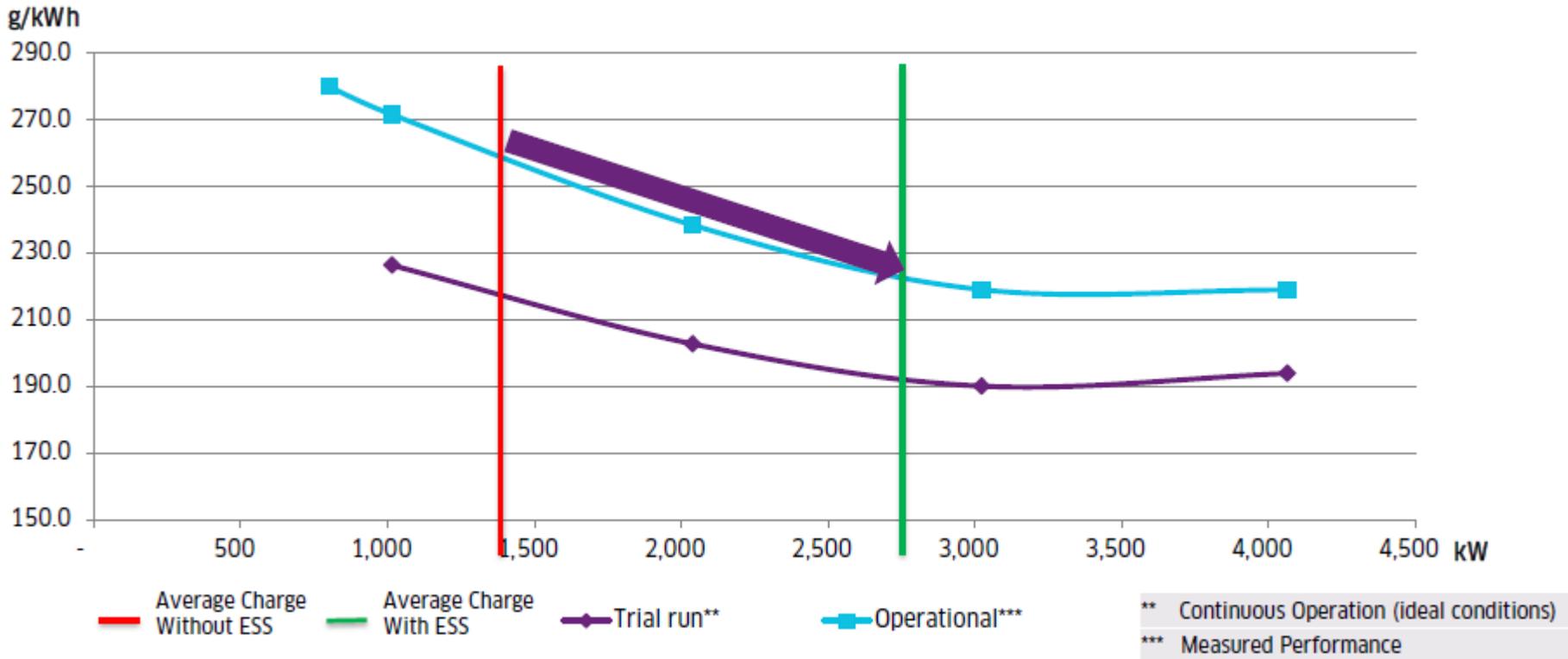
EFFICIENCY AND RELIABILITY GO HAND IN HAND



INCREASED EFFICIENCY DUE TO HIGHER GEN-SET LOADING



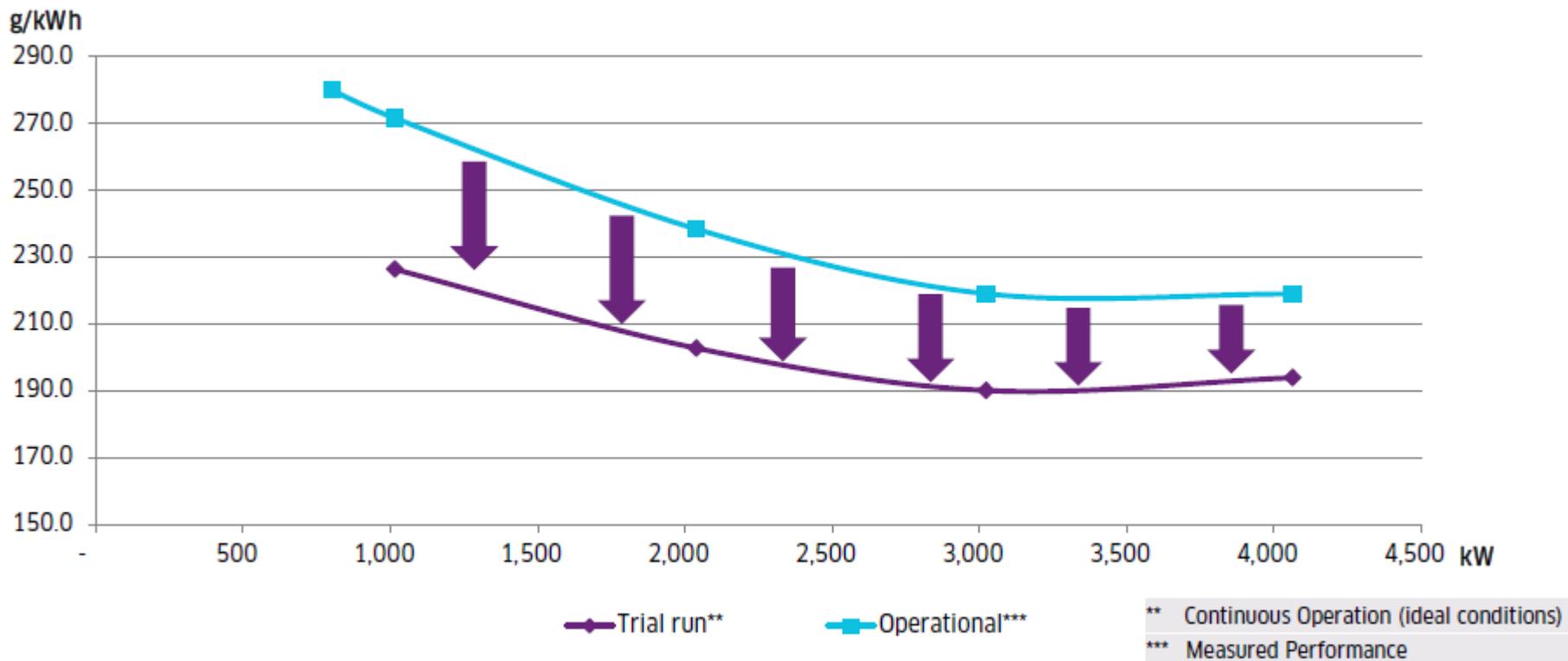
Specific Consumption on a Island Thermal Power Station



INCREASED EFFICIENCY DUE TO SMOOTHER LOAD PROFILE



Specific Consumption on a Island Thermal Power Station



Additional advantages:

- Lower total run time hours
- Less strain on generators (reduction of load jumps)
- Reduction in O&M / oil consumption

SUMMARY



- Fast and accurate energy storage systems can provide resiliency (especially in combination with renewable energy systems)
- (Electrochemical) Energy storage is inherently modular and has a very high reliability
- Reliability and microgrid capability are a potential new revenue stream for utilities
- System efficiency and reliability / resiliency can be tackled with the same solution

FURTHER QUESTIONS?
WE ARE LOOKING FORWARD TO HEARING FROM
YOU!

Björn Lang
Yunicos

www.yunicos.com

Bjoern.Lang@yunicos.com

