Younicos
an aggreko company

GRACIOSA PROJECT

ETIP SNET: South Eastern Region Workshop

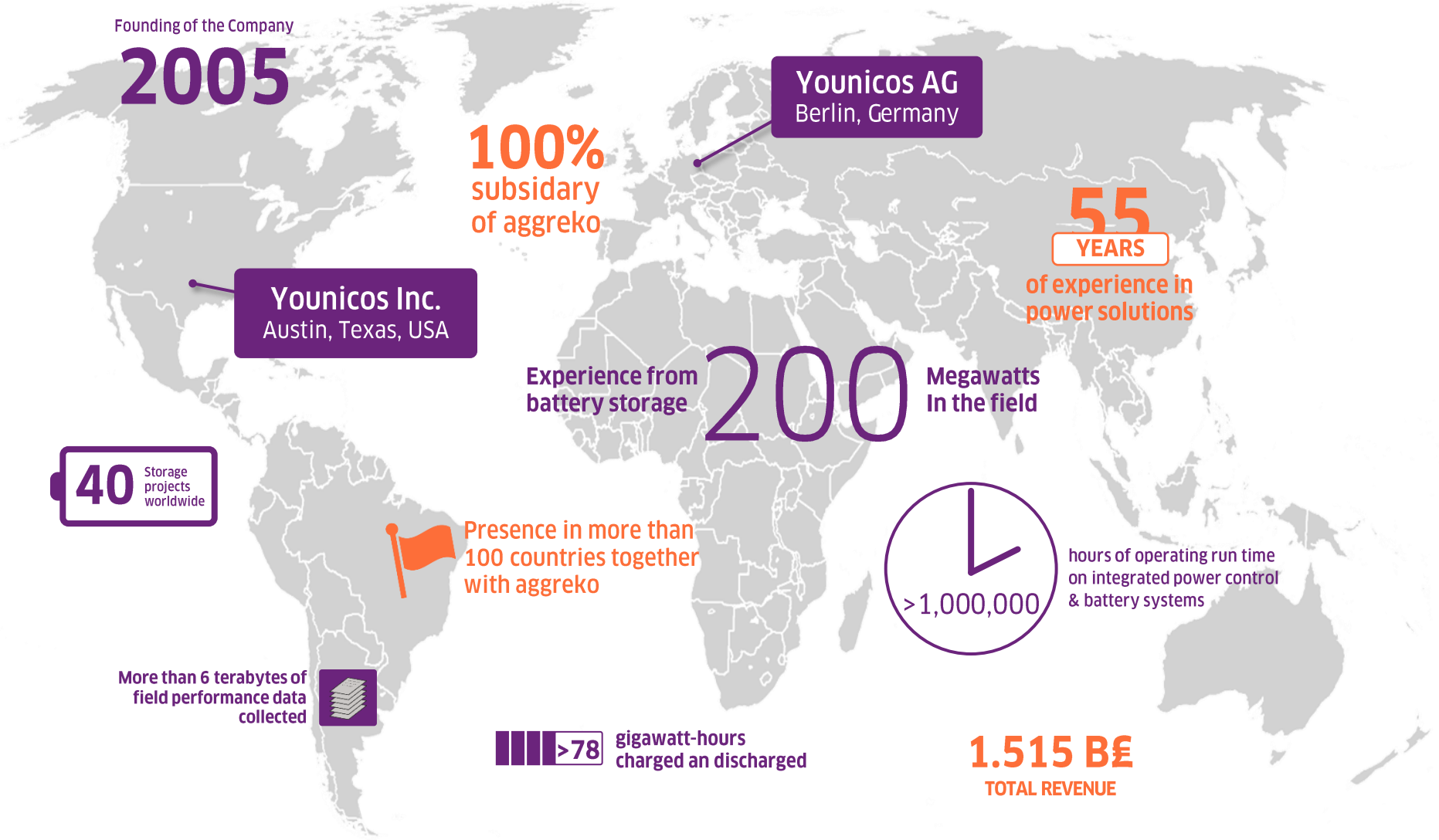
Marco Furtado, Regional Sales Manager

Nicosia, November 23rd 2017

AGENDA

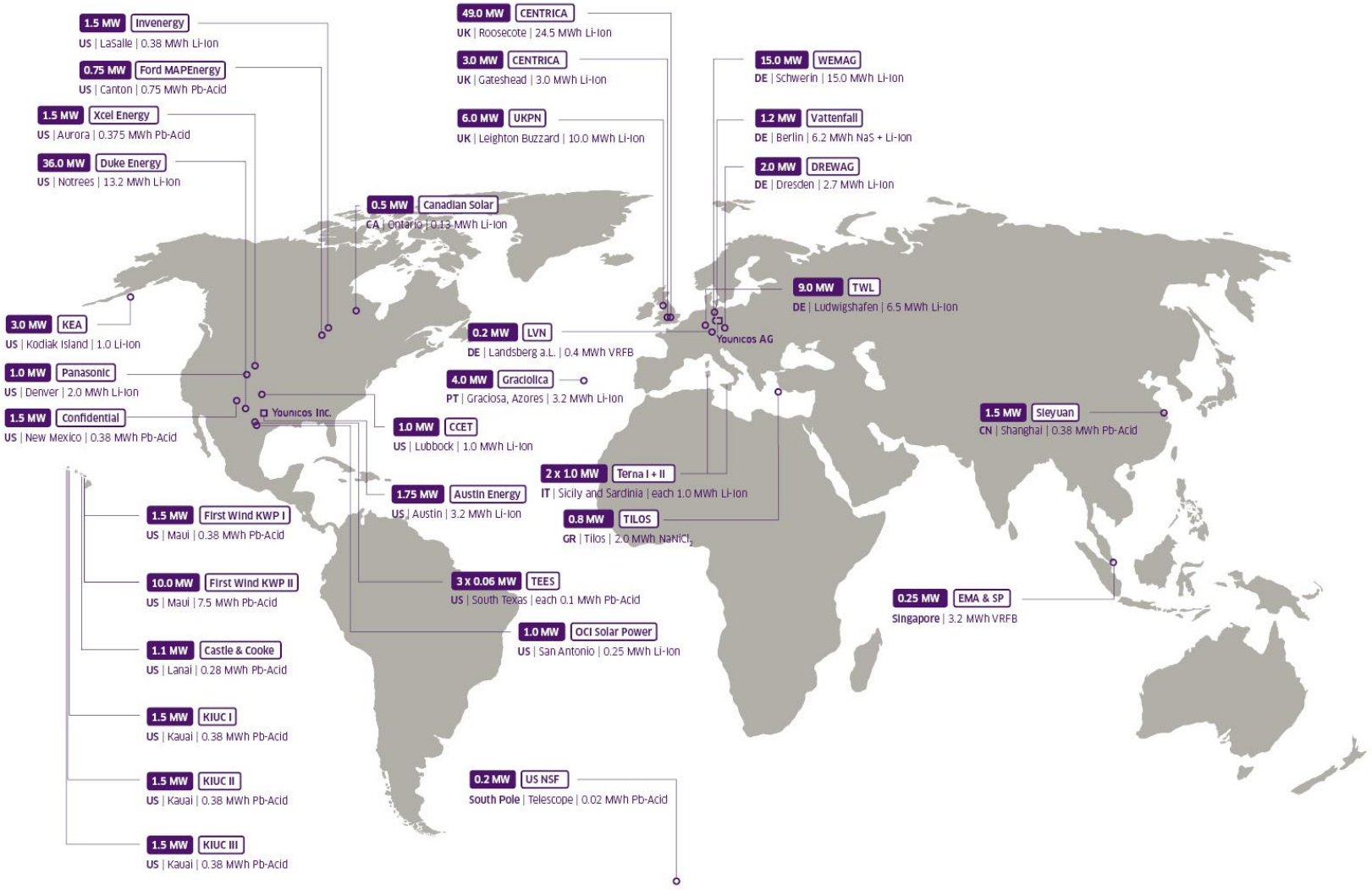
1. Brief Introduction to Younicos
2. Graciosa Project Overview
3. Main Project Challenges
4. Key Takeaways

YOUNICOS AT A GLANCE



We are a global leader for distributed energy solutions based on battery storage.

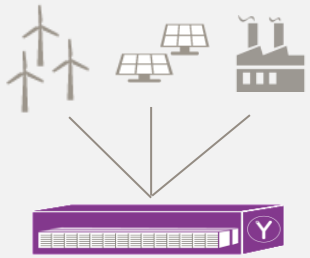
FROM SOUTH POLE TO ALASKA: EXPERIENCE FROM 200 MW IN THE FIELD



OUR SOLUTIONS ARE GREAT FOR SOLVING THE ENERGY CHALLENGES OF EVERY MARKET PLAYER

Grid Tied

Power Generation



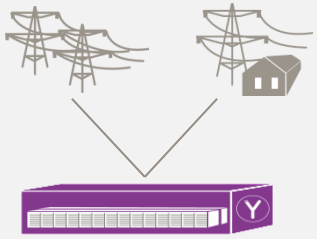
Stabilization of RE feed-in

Modeling of Power Gradients

Peak shaving

Price arbitrage

Power Transmission & Distribution



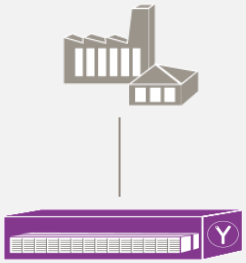
Ancillary Services, e.g. Frequency Regulation

Voltage control

Blackstart capability

Short circuit capability

Commercial and Industrial

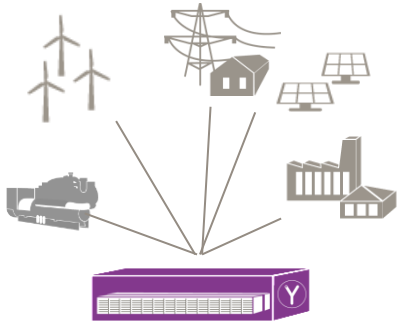


Price arbitrage

Blackstart capability

Short-circuit capability

Microgrids



Diesel Abatement or 100% Renewables

Offgrid or Grid-connected

Genset Optimization

Graciosa Project

GRACIOSA, AZORES – SETTING THE COURSE FOR FUTURE GENERATIONS

Key factors until 2017

- One of 9 islands of Azores
- 4500 inhabitants
- Annual production: 13,9 GWh
- Peak load: 2,3 MW
- Installed capacity (Diesel): 4,6 MW

HISTORY OF THE GRACIOSA PROJECT

Graciosa Chosen as Pilot Project

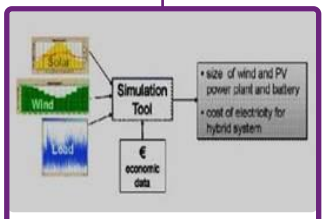
Technology Center Construction

LOI with EDA

PPA Negotiations

Ground Breaking Ceremony

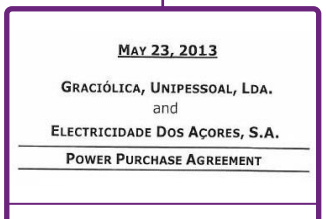
2006 2007 2008 2009 2010 2011 2012 2013 2014



Technical Pre-Evaluation

Technology Center Inauguration

Proof of Concept



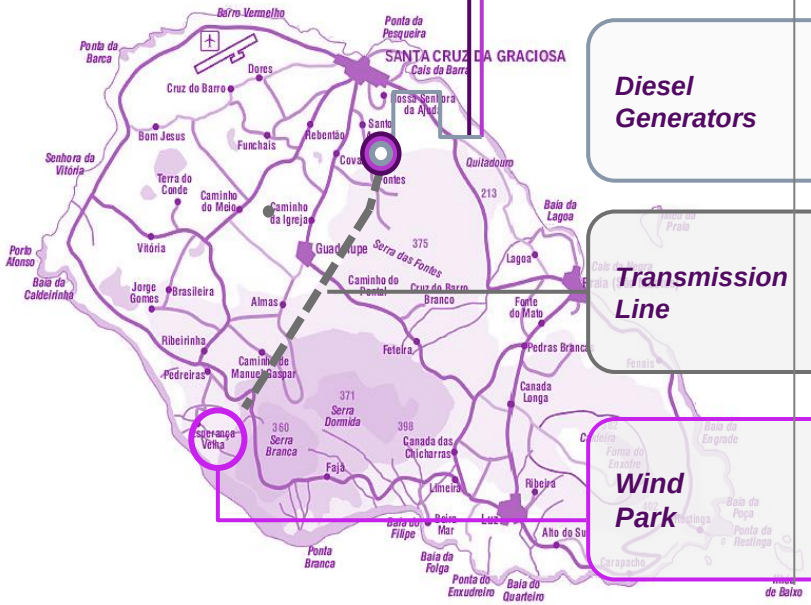
Signing of PPA & PIR*

* Project of Regional interest

…2015

Younicos
Let the fossils rest in peace.

Provides the energy control system



	MWh-s installed	*Current Status*	
Battery Power Plant	***3.2***	**Commissioning**	
Photovoltaic Plant	***1.0***	**Ready for production**	
Diesel Generators	***4.6***	**Commissioning of the interconnection**	
Transmission Line	**-**	**Completed**	
Wind Park	***4.5***	**Completed**	

…2016

Main Project Challenges

CHALLENGES

High diesel fuel costs

- Can be >€1/liter in remote locations

Inefficient diesel generator operations

- Operation at reduced output for reliability needs increases fuel costs
- Constant cycling of units to meet load leads to more frequent O&M

Grid instability

- Weak grid can lead to loss of critical loads
- Poor power quality may require purchase of additional electrical equipment
- Transient events occur < 10 milliseconds
- Diesel response > 200 milliseconds

Unable to achieve high renewable penetration

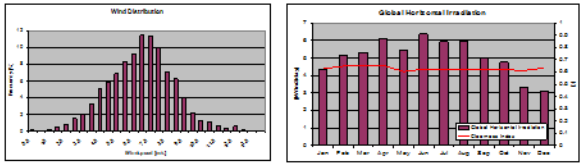
- Intermittency of solar and wind can cause grid disturbances
- Curtailment of renewables common to maintain grid reliability

We tailor the optimal energy system according to your needs

Finding the optimal energy system with our Y-island simulation tool

Y-island simulation tool

Climate Data



Financial Inputs

- Specific component costs
- O&M costs
- Fuel costs
- Financing parameters
- Local construction costs

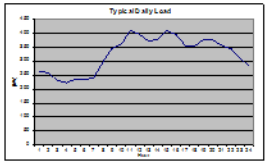
System Analysis

Simulation of various scenarios/configurations on a 8760h/a basis over the complete project time

Financial Analysis

Evaluation of key financial parameters for each scenario (Investment, $/kWh,…)

Load Profile



Technical Data

Local Conditions

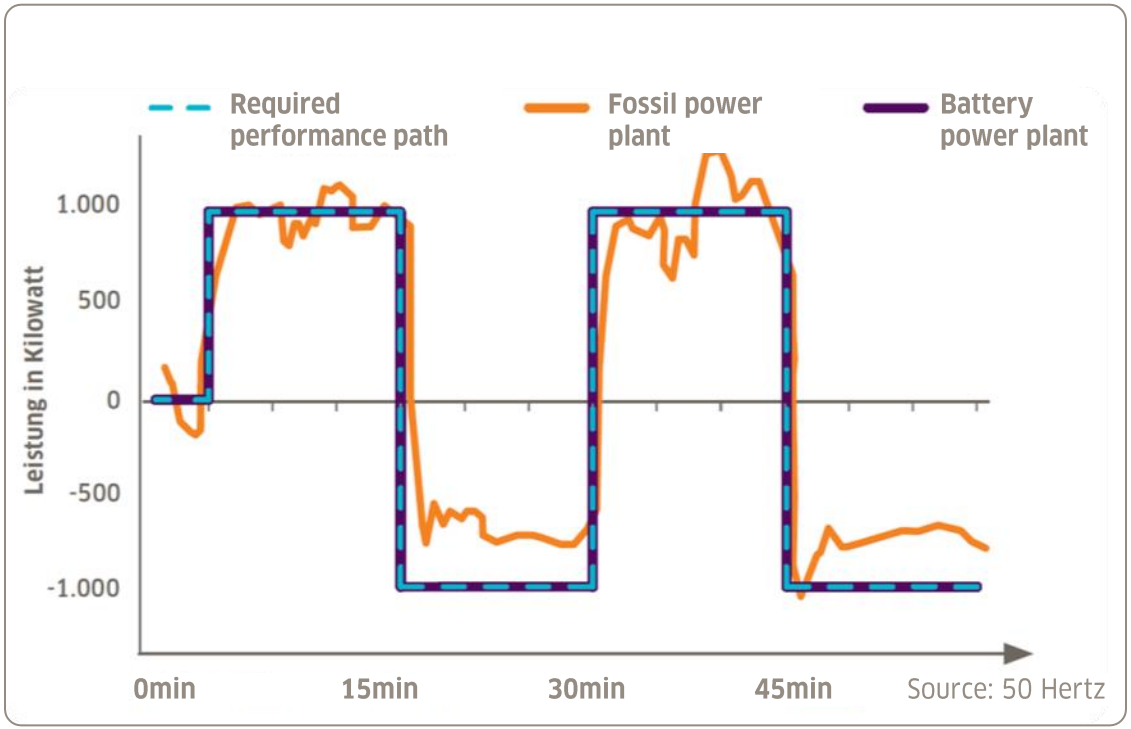
- Biomass potential
- Available land
- Aesthetic considerations
- Deferrable loads

Solution Matrix

Optimum Solution(s)

BATTERIES ARE MORE FLEXIBLE AND ACCURATE THAN CONVENTIONAL POWER PLANTS

Performance test for primary control reserve (Germany)



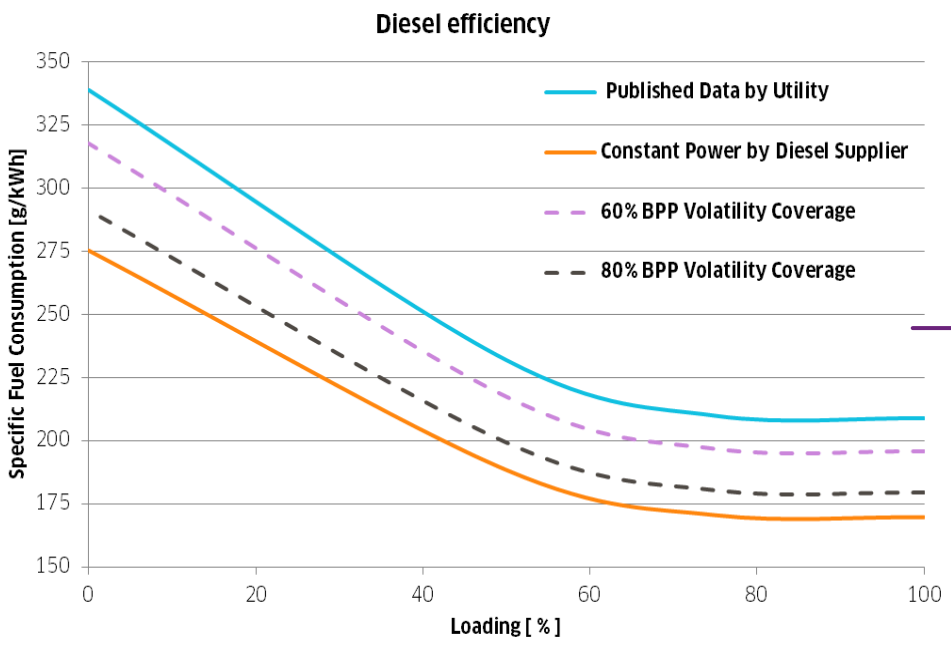
Why Batteries?

- Batteries do not have must-run requirements
- Batteries response faster and more accurate than conventional power plants*
- Marginal cost of batteries is lower than of conventional plants

Batteries can replace conventional plants in the provision of grid stability

*Battery power plant's response time< 35 ms

DIESEL EFFICIENCY



Increase generator efficiency

- Operate generators at optimal loading
- Reduce cycling of generators

Reduce operating costs

- Use less fuel to serve same load
- Cut O&M expenses

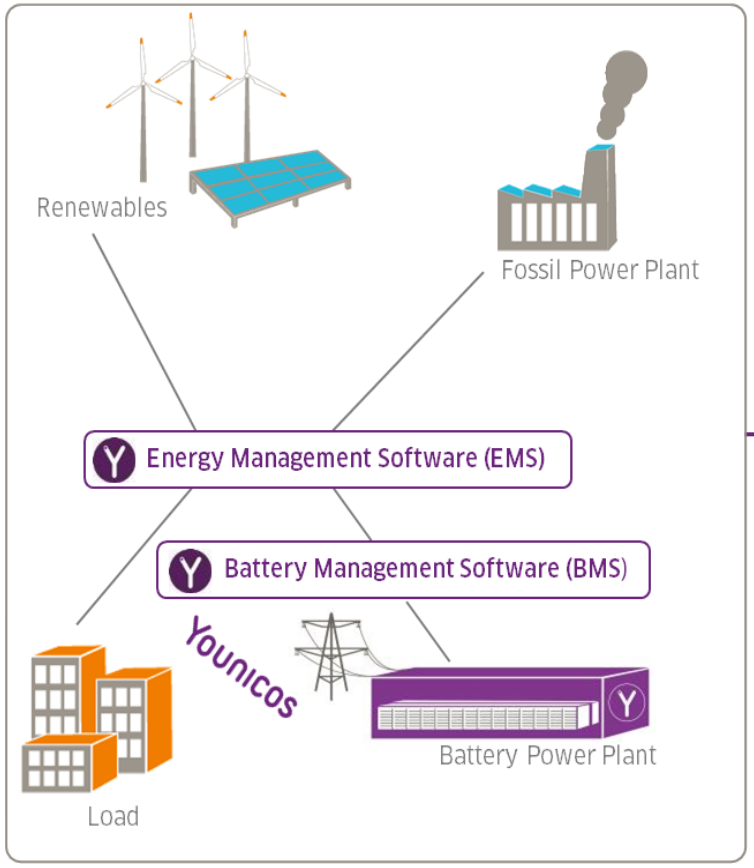
Improve grid stability & power quality

- Millisecond response to frequency events
- VAR support to keep power factor constant

Integrate renewable generation

- Smooth volatility to keep grid stable
- Reduce curtailment

YOUNICOS SOLUTIONS FOR MICROGRIDS



Decrease operating costs

- Allow diesels to operate in optimal range
- Increase diesel generator efficiency
- Decrease cycling to reduce O&M

Improve grid stability

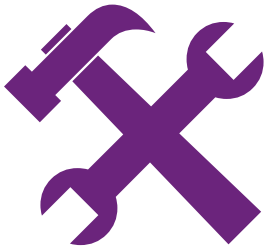
- Act as back up power source to keep critical loads online
- Maintain high power quality
- Avoid additional grid support equipment expenses
- Response time < 50 milliseconds

Integrate more renewable resources

- Reduce strain on grid caused by intermittency
- Decrease diesel consumption through less curtailment of renewable resources

COMMERCIAL ASPECTS

Reliability



- Diesel substitution, grid stability services e.g. voltage and frequency control
- Battery balances demand and supply instantaneously (Grid-Forming)
- Less downtime than diesel-based system

Cost-efficiency

- Cost savings due to lower diesel consumption
- The project will result in local value creation
- Independence of rising fuel prices

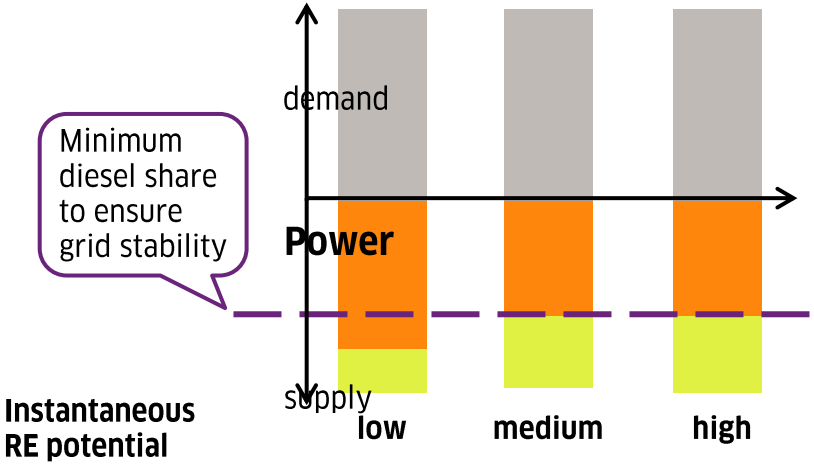
Sustainability

- 100% Renewable Energy penetration is possible
- Decrease of carbon footprint


Key takeaways
Source: EDA

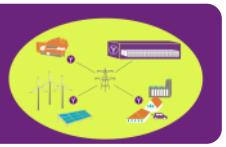
GRACIOSA SOLUTION & SOFTWARE ENABLES HIGHER RENEWABLE SHARES THAN CONVENTIONAL HYBRID SYSTEMS

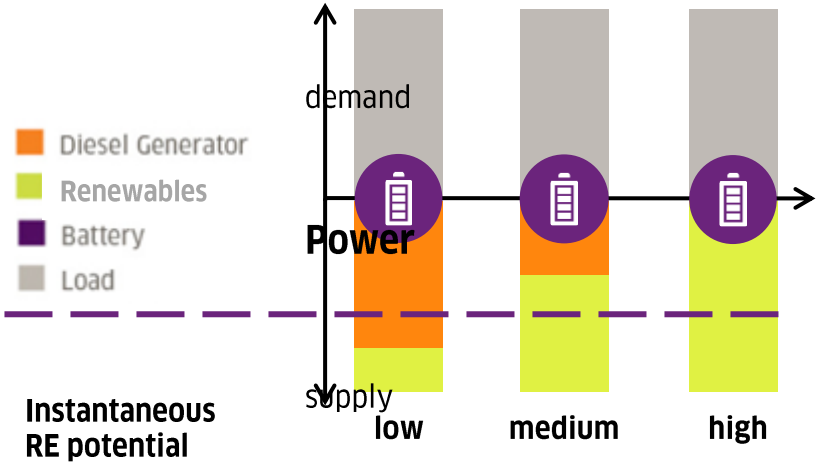
Renewables + standard diesel gen-set



- Diesel generator responsible for grid stability
- If RE supply exceeds a threshold share on consumption, RE have to be curtailed
- Therefore, total RE share on annual consumption is limited to 15%

Younicos Island Solution





- Younicos Battery Power Plant provides grid stability
- In times of high RE supply, diesel can be switched off
- Switching of the diesel is the leverage to high RE share on annual consumption

BATTERY STORAGE SYSTEMS – SECURING, OPTIMIZING, REVENUE POTENTIAL

Revenue opportunities from battery storage

Balancing services , renewable integration , grid investment deferral

Optimizing of production processes and energy procurement

Peak-Load management, reduction of grid fees, optimizing of diesel consumption

Securing production processes against risks from low energy quality from the grid

Black-Start capability, UPS, voltage support, short-circuit power, islanding, reducing of power oscillation

WE OFFER YOU MORE THAN JUST A BATTERY

One-stop power solutions. Ready to implement.

Unique track record. Worldwide.

Superior software. Y.Q makes the difference.

Scalable hardware design. From small- to grid-scale.

Simulating and testing: our technology centers.

Battery Expertise: Optimization from the cell to the grid.

24 / 7 operations and maintenance: hassle-free.

Thank you for your attention!

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

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