



Fabricação de Inversores Fotovoltaicos no Brasil: Oportunidades e Desafios

GUILHERME SOUZA – GENERAL ELECTRIC



GE Power

Power Conversion

Fabricação de Inversores Fotovoltaicos no Brasil: Oportunidades e Desafios
BRAZIL SOLAR POWER
July 2017

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We are GE

We are the world's premier digital industrial company. We transform industry by connecting people, data and machines. Living in perpetual motion, we are sensing, predicting and responding to make the world work better.



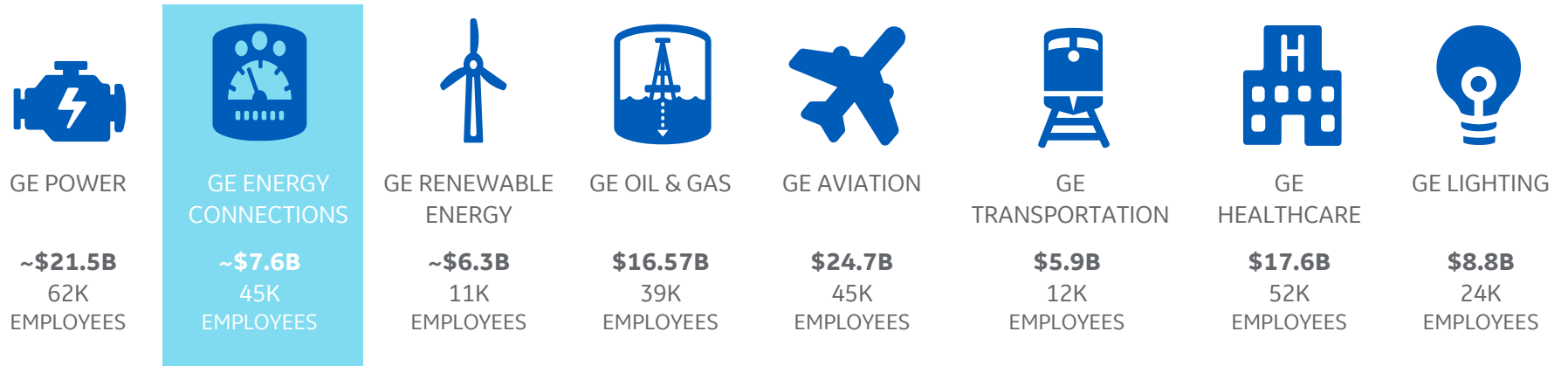
Energy enhanced by the GE Store

Driving competitive advantage across our businesses

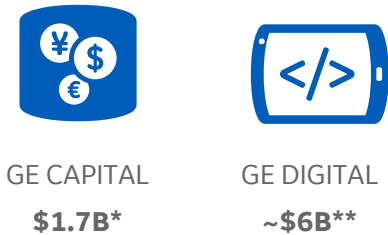


Digital industrial portfolio

Revenue: \$117.4B
GAAP EPS: \$0.17



2015 Revenue



*GE Capital verticals
** Revenue by year end 2016

GE imagines things others don't.
Builds things others can't.
And delivers outcomes that make the world work better.



GE Energy Connections



WE ARE GE ENERGY CONNECTIONS

We don't just create power, we deliver it.
We don't just make electricity, we make progress.



Grid Solutions

Paris, France

Bringing power reliably and efficiently from the point of generation to power consumers



Industrial Solutions

Atlanta, Georgia, USA

Rugged and smart solutions to control electricity from the grid to the point of use



Power Conversion

Paris, France

Applying the science & systems of power conversion to help drive electric transformation of the world's energy infrastructure



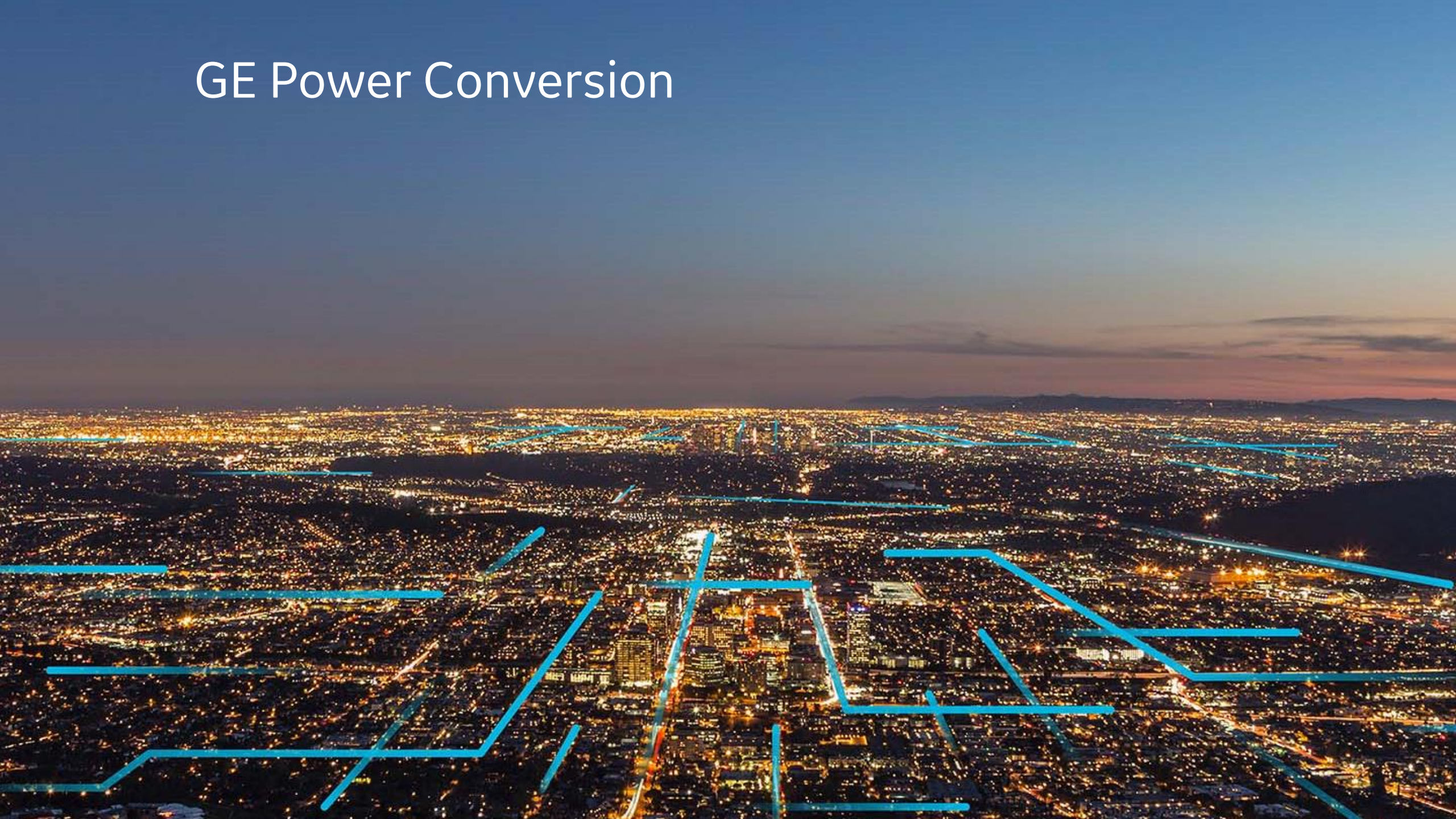
Automation & Controls

Charlottesville, Virginia, USA

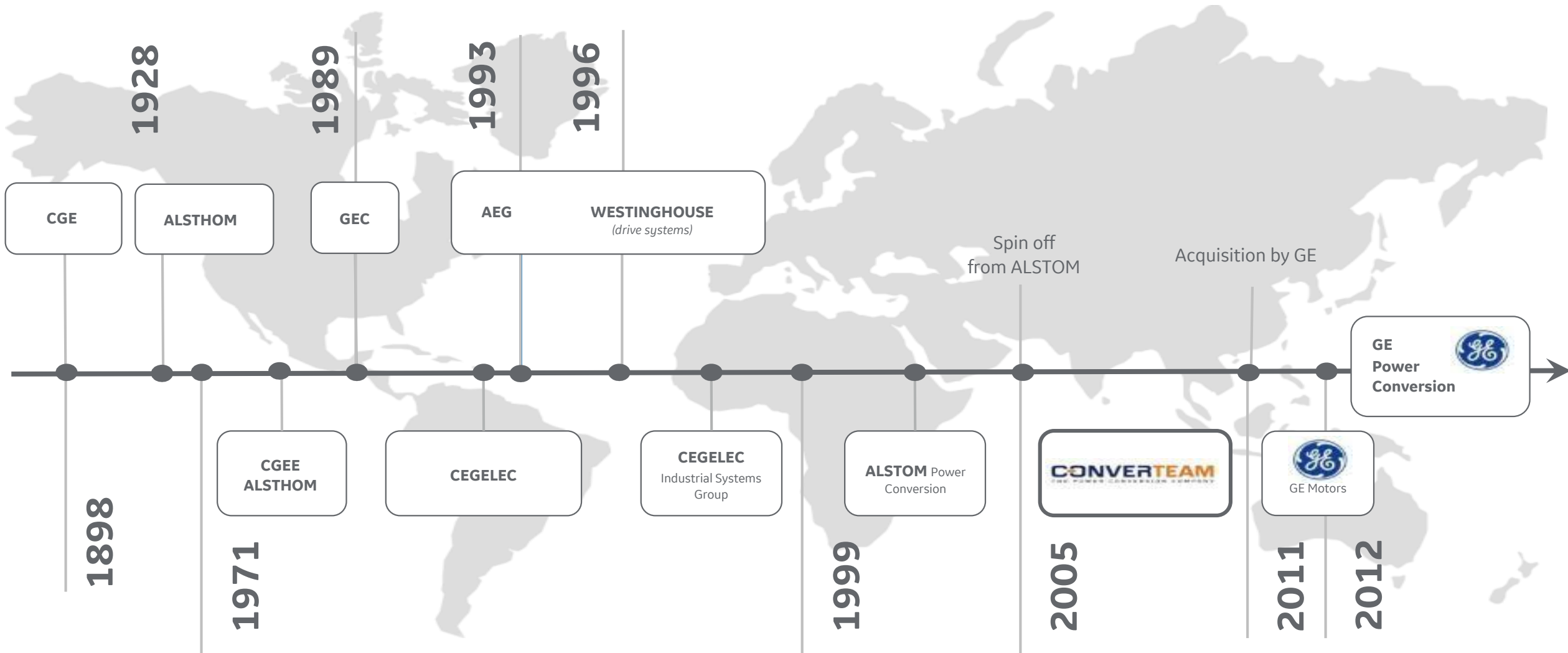
Providing high performance control solutions for a connected world



GE Power Conversion

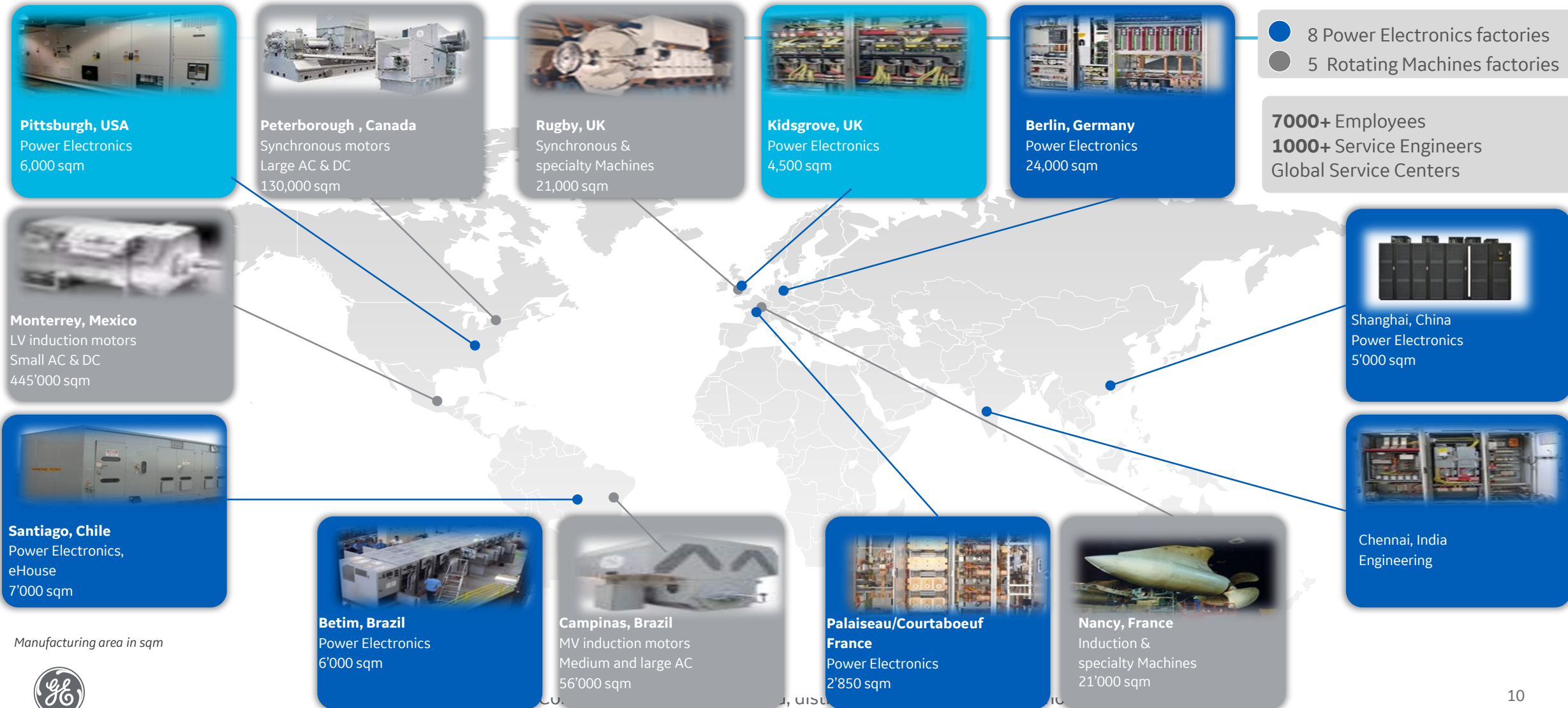


A Hundred Years Of Global Experience



Our Global Manufacturing Footprint

GE...A Global Partner with Local Footprint ... Operating from 160+ locations worldwide



Manufacturing area in sqm



Betim Factory



Betim Factory Overview



Area = 13.221m²

- 5.910m² – Manufacturing and test area;
- 3.371m² – Warehouse;
- 1.970m² – Offices;
- 1.970m² – Finish goods area;

- **1st floor:** Supply chain, Finance, Eng (PEP), Tax;
- **2nd floor:** Human resources, Services, Eng(Product & Systems research), Information technology, ITO, Project Management
- Around 400 employees, MFG team represent 21% of the total;
- We are here working together since 2014;



Our Core Industries



Solar



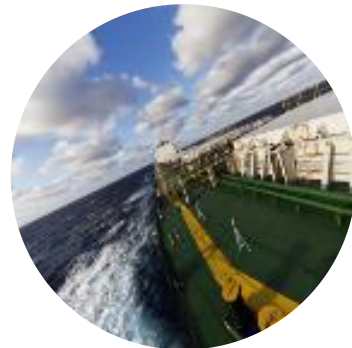
Wind



Power



Oil & Gas



Marine



Mining & Metals



Industries



RENEWABLES

We convert renewable energy into powerful, reliable and efficient electricity.

Our products and solutions enable operational efficiency, reliability and availability for higher yield, grid compliance and stability.

Wind



On & Offshore

- Turbine drive train
- Farm architecture

Solar



Utility Scale PV

- Inverters
- Plant Level control
- Farm architecture

Wet Renewables



Tidal & Hydro

- Water to Wire Systems

- Power Quality
- Grid Integration
- eBOP
- Services
- Testing Solutions
- Energy Storage

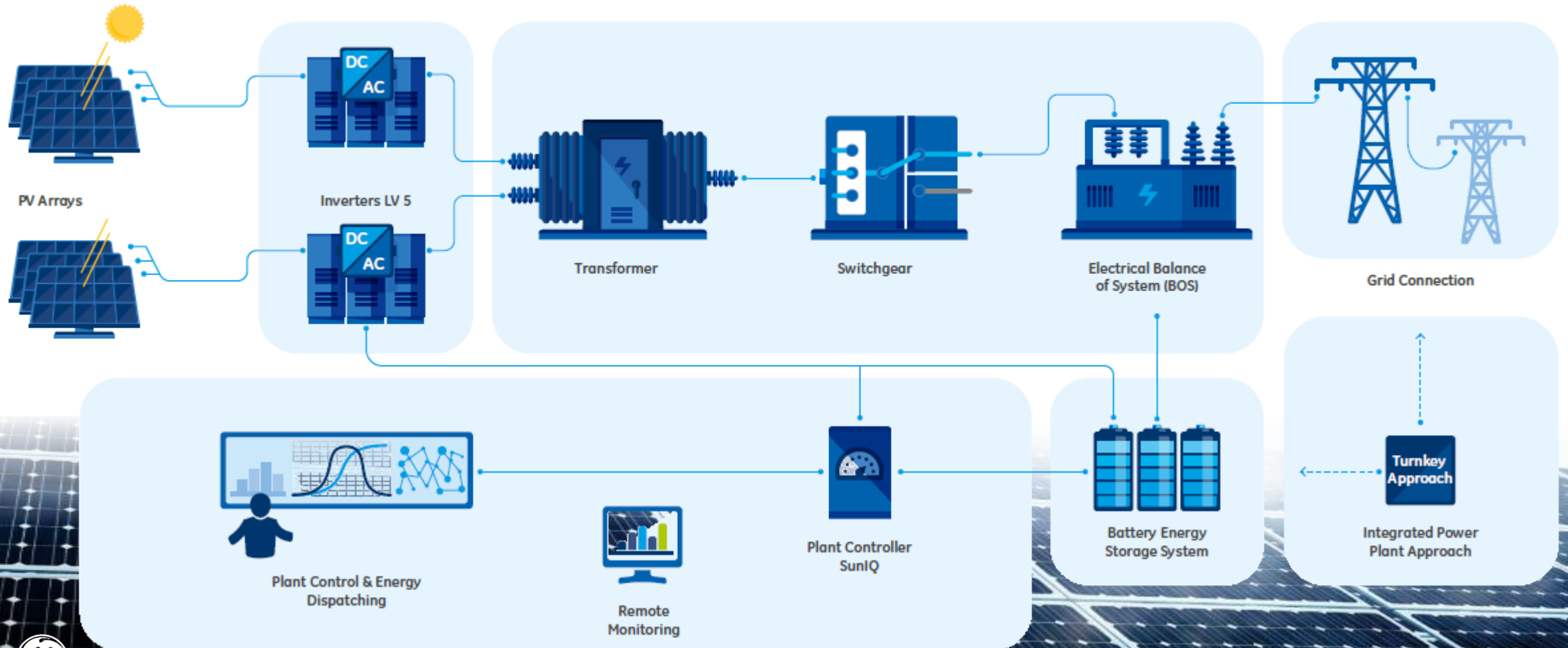
HELPING OPERATORS MEET OPERATIONAL REQUIREMENTS AND LOWER ENVIRONMENTAL IMPACT





Solar Capability

Your partner for utility-scale PV solutions, helping to reduce LCOE.



Solar Capability

Your partner for utility-scale PV solutions, helping to reduce LCOE.

GE's Proven 1.5 kV solar inverter solutions can enable up to

\$5.8 M

reduction of system cost for a 200 MW PV power plant .



LV5 / LV5+ Solar Inverters & Skids



LV5+ Solar eHouse Solution



AC BOP Sub-station



SunIQ Plant Level Control



Project Lifecycle Services



Energy Consulting & Hybrid Power System Integration



Digital Solar Services

MORE THAN **4GW** Inverters Shipped

UP TO **3%** Less System Cost

UP TO **30%** Less Overall Cost of maintenance

MORE THAN **99%** EU Efficiency for higher AEP



Solar Capability - Brazil

Your partner for utility-scale PV solutions, helping to reduce LCOE.



MORE THAN	750	Inverters to be Shipped <u>in Brazil</u>
MORE THAN	60%	Of Local Content (measured in Value & Weight)
THE 1 st	1500V	Solar Central Inverter Manufactured locally
UP TO	99%	Availability Guarantee through O&M Contracts
UP TO	20yrs	Of LTSA Covered through O&M Contracts



LV5 Central Solar Inverter



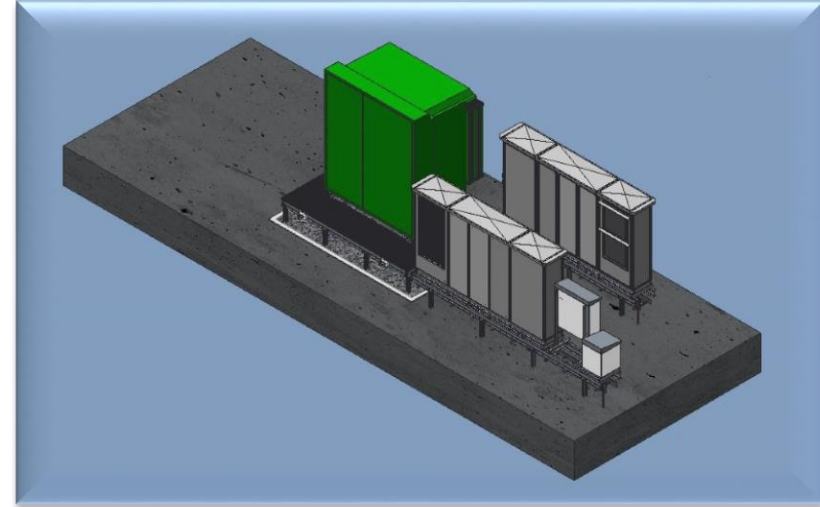
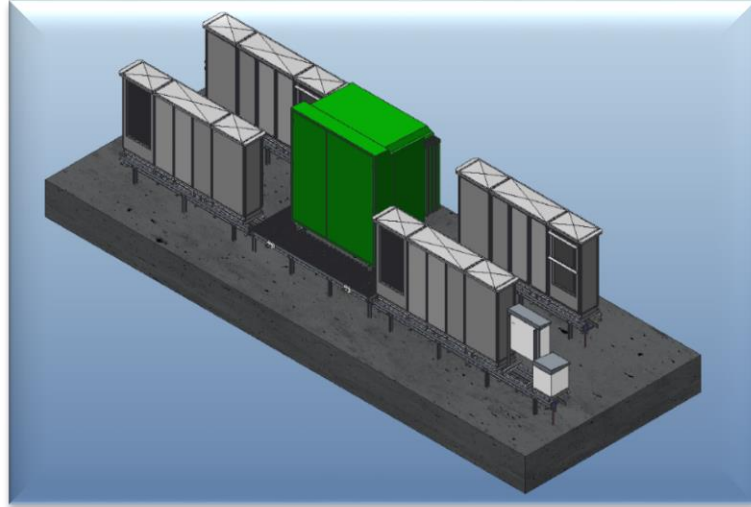
LV5 up to 1.1MVA

Available offerings for Inverter only and complete system solutions

- LV5 solar inverter specifically designed for the solar industry builds on experience in the renewable energy industry over the last 15 years
- Covers the full range of utility scale requirements
- 98.5% peak efficiency ensures the maximum energy harvest
- Ensures smooth integration into the grid
- Voltage Ride-through ensures no immediate disconnection during grid faults
- Capability to provide active and reactive current for Power Factor control and Voltage regulation
- Preload from AC grid for grid support at night
- Equipped to manage battery storage integration*



LV5 Skid Solution – Compact



- Inverter LV5-1510-SLR arrangement for 2x1MW and 4x1MW
- Inverter LV5-1511-SLR arrangement for 2x1.1MW and 4x1.1MW
- Medium Voltage step-up transformers (Pad mounted) available on 35kVAC
- Array Re-combiner internal to inverter 100-400A rated fuses, up to 10 circuits per inverter
- Skid Base – steel base with optional auxiliary AC distribution panel for SCADA and tracker systems
- IEC and UL standards
- Ideal utility PV power plant system



Challenges Tackled



Progress Path

Manufacturing

- From **0 to 40+** shop floor employees qualified to execute any process step **for each shift**
- SENAI Young Apprenticeship program partnership: **10+ employees were hired**
- Increased **30% the factory demand** (YoY) in the past 2 years
- Manufacturing line time: **improved 30%+** from the first unit



Progress Path

External Supply Chain

- Complys with 60%+ of local content (**FINAME Code for both Inverters and Stations**)
- Qualification of **50 local suppliers**
- Adapting additional **30** international suppliers for **Brazilian requirements**



Progress Path

Engineering

- **25 Engineers** and support functions qualified
- **20 Field Services Engineers** qualified and ready to support services demand
- **2 GE Renewables Services Centers** qualified to assist Solar demand (Piauí and Pernambuco)
- IEC, NBR certifications obtained **specific for Brazilian product**
- **Benchmarking** with Center of Excellence (Berlin, Germany)



Progress Path

Investments

- New factory
- LV5 Localization
- LV5 Inverter Manufacturing
- Certification and Benchmarking
- LV5 Skid Manufacturing

Total Investment of 31M USD and growing...



Progress Path

Extended Scope

- FINAME code obtained for GE Grid Solutions **SVC solution**
- **Capacitor Banks** manufacturing capacity developed and **FINAME Code** obtained (GE Grid Solutions)



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A photograph of two young children, a boy and a girl, interacting with a glowing blue energy display in a museum. The display is a vertical cylinder with a map of South America and other glowing patterns. The boy is on the left, looking at the display, and the girl is on the right, also looking at the display. A white horizontal line with a square on the left and a diamond on the right is overlaid on the image, with the text "Let's turn the world on" centered below it.

Let's turn the world on





Code of Ethics & Quality Commitment



Our Code of Conduct



THE SPIRIT

3 Key Questions

To Ask Whenever You Are Unsure

01

How would this decision look to others?

02

Am I willing to be held accountable for this decision?

03

Is this consistent with GE's Code of Conduct?

Remember:
Act if you see an issue.
Ask if you're not sure.



See more online at:
integrity.ge.com



THE
SPIRIT &
THE
LETTER
simple reference



integrity.ge.com



Zero Defect Mindset

