LEON VILJOEN
Chief Executive Officer
ABB ZA

IoT & Expansion in Africa
IoT and expansion in Africa
Leon Viljoen, MD, ABB South and Southern Africa
### ABB: the pioneering technology leader

#### What (Offering)

<table>
<thead>
<tr>
<th>Pioneering technology</th>
<th>Products 58%</th>
<th>Systems 24%</th>
<th>Services &amp; software 18%</th>
</tr>
</thead>
</table>

#### For whom (Customers)

<table>
<thead>
<tr>
<th></th>
<th>Utilities</th>
<th>Industry</th>
<th>Transport &amp; Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>~35% of revenue</td>
<td>~40% of revenue</td>
<td>~25% of revenue</td>
<td></td>
</tr>
</tbody>
</table>

#### Where (Geographies)

<table>
<thead>
<tr>
<th></th>
<th>Asia, Middle East, Africa 38%</th>
<th>Americas 29%</th>
<th>Europe 33%</th>
</tr>
</thead>
<tbody>
<tr>
<td>~$35 bn revenue</td>
<td>~100 countries</td>
<td>~132,000 employees</td>
<td></td>
</tr>
</tbody>
</table>

~40% of revenue

~25% of revenue

~25% of revenue

~35% of revenue

~100 countries

~132,000 employees

~35% of revenue

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~100 countries

~132,000 employees
Progressively building ABB’s reputation

Iconic activities to push the ABB brand and have a visible, global impact
ABB ranks #8 on Fortune Magazine’s list of companies that are “changing the world”

From our record-setting electric vehicle (EV) charging solutions for cars and buses to micro-grids, the integration of solar, wind and other renewable energies into local power systems, our sponsorship of the ABB FIA Formula E Championship series, and more, we are proud to be making a difference to address the needs of our customers and the world.
In the years ahead, essential infrastructure, such as the power grid and the water supply, as well as industry and our transport networks, will increasingly be controlled and operated by autonomous systems.

On the one hand, this will bring tremendous benefits in terms of avoiding outages and shortages, and freeing-up humans from dull, dangerous and degrading work.

On the other, the workforce and society as a whole will have to adapt to a new industrial landscape, where people work alongside robots and machines.

<table>
<thead>
<tr>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanisation, Steam and Water Power</td>
<td>Mass production, Assembly lines, electricity</td>
<td>Computer &amp; Automation</td>
<td>Cyber Physical Systems, networks, AI</td>
</tr>
</tbody>
</table>
Setting a new standard of positioning ABB
ABB and Formula E partner to define roadmap of electric mobility

New “ABB FIA Formula E Championship” brings together global leader in electric vehicle fast charging with world’s first fully electric international motorsport class

Natural fit at the forefront of the latest electrification and digital technologies

Raise awareness of electric vehicles as a realistic and desirable alternative to fossil fuel vehicles
### Why e-mobility is the future

#### Cost

<table>
<thead>
<tr>
<th>Light duty vehicles, transit buses, fleet vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Maintenance</td>
</tr>
<tr>
<td>- Unlike internal combustion engines, electric drive trains have few moving parts.</td>
</tr>
<tr>
<td>- Durability, reliability and low maintenance have been well-tested</td>
</tr>
<tr>
<td>• Fuel</td>
</tr>
<tr>
<td>- Electric Power Research Institute (EPRI) estimates cost of electricity, per mile driving, is one-third less than fuel.</td>
</tr>
<tr>
<td>- Electricity rates are much less volatile than fuel</td>
</tr>
</tbody>
</table>

Combination of fuel and maintenance costs bring the Total cost of ownership (TCO) of EV’s below ICE vehicles, despite the higher purchase price.

### Environmental impact

<table>
<thead>
<tr>
<th>Air quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition to electric drive could improve air quality and reduce petroleum consumption</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reduce greenhouse gas emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrification is the key tool for de-carbonizing transportation</td>
</tr>
<tr>
<td>EV’s get cleaner over time as power supply becomes more sustainable and less carbon-intensive</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Corporations increasingly focused on emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation of CO2 increasing</td>
</tr>
<tr>
<td>Companies are pricing the costs of complying into investments and business decisions</td>
</tr>
</tbody>
</table>
Why e-mobility is the future

Future Technology Enabler

Most manufacturers developing autonomous vehicles opt to use EV’s as a platform:

- EV’s are “drive-by-wire” – easier than mechanical linkages for computers to control. Large batteries make EV’s capable of supporting the power-hungry sensors and control systems needed for autonomous driving.

- As fuel economy and emissions requirements increase, EV’s boast lower operating costs and TCO.

- Particularly important for fleet operators who’s vehicles spend every minute they can on the road.

- In the case of ridesharing, the evolution toward autonomous vehicles will create a use case that demands the lower cost profile and higher reliability that EV’s offer.
Public and commercial car charging – use cases
Charging service should match charging application and demand

<table>
<thead>
<tr>
<th>Public and commercial EV Charging</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Home</strong></td>
</tr>
<tr>
<td>4-22 kW (AC)</td>
</tr>
<tr>
<td>4-16 hours</td>
</tr>
<tr>
<td><strong>Work</strong></td>
</tr>
<tr>
<td>20 kW (DC)</td>
</tr>
<tr>
<td>1-3 hours</td>
</tr>
<tr>
<td><strong>Commercial</strong></td>
</tr>
<tr>
<td>50 kW (DC)</td>
</tr>
<tr>
<td>15-60 min</td>
</tr>
<tr>
<td><strong>Highway</strong></td>
</tr>
<tr>
<td>150 to 350kW+(DC)</td>
</tr>
<tr>
<td>5-20 min</td>
</tr>
</tbody>
</table>
Bus & Truck charging
Charging service should match charging application and demand

<table>
<thead>
<tr>
<th>Electric Bus and Truck Charging</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overnight Charging</strong></td>
</tr>
<tr>
<td>50 - 150 kW (DC)</td>
</tr>
<tr>
<td>2-8 hours</td>
</tr>
<tr>
<td><strong>Opportunity Charging</strong></td>
</tr>
<tr>
<td>150 to 600 kW (DC)</td>
</tr>
<tr>
<td>5-15 min</td>
</tr>
</tbody>
</table>
eBus and heavy vehicle charging: 50 kW – 450 kW

Overnight and on-street opportunity charging

- Automated connection system
- High power DC transfer to bus
- Wireless communication to bus
- Based on:
  - EN/IEC 61851-23
  - ISO/IEC 15118 compatible
- Industrial quality power cabinet
- 150kW, 300kW & 450 kW modular
- Redundancy per each 150kW module
- 200-920 VDC
- Galvanic isolation
- Remote management

Charge power
150-450 kW (3-10 min)
## EV Charging Infrastructure

<table>
<thead>
<tr>
<th>Connectivity</th>
<th>Remote diagnostics, payment, building management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Car Charging</strong></td>
<td><strong>Heavy Vehicle Charging</strong></td>
</tr>
<tr>
<td>4-22 kW AC Charger</td>
<td>150kW-600kW with Automated Connection</td>
</tr>
<tr>
<td>24kW DC Wallbox</td>
<td></td>
</tr>
<tr>
<td>50kW All-in-one</td>
<td></td>
</tr>
<tr>
<td>50kW-150kW with sequential charging</td>
<td></td>
</tr>
<tr>
<td>150kW-350kW with liquid cooled cable</td>
<td></td>
</tr>
</tbody>
</table>

### Connectivity
- Compact substations, transformers, switchgear

### Service & maintenance
- Global service, spareparts, maintenance & 3rd party training
Technology for pollution-free e-rickshaws in Jabalpur / India

e-rickshaws charge with solar power through a Smart City Mission pilot

Providing critical technology through solar inverters for solar powered charging stations for e-rickshaws at four locations in Jabalpur.

As the sun hits the solar panels at the charging station, generating the direct current (DC) energy, the ABB inverters convert that power to the alternating current (AC) used in charging the e-rickshaws.

The solar panels are also connected to the state grid to feed in additional power generated through net metering. The inverters come with Wifi connectivity for remote monitoring and centralized billing provisions in the future.
The new Era of Manufacturing

Digitalization is a key enabler for making the factory of the future a reality

### Manufacturing Assets
- Robots
- Motors & Drives
- PLCs
- Sensors
- Manufacturing Machinery
- Control Systems
- Energy Supply
- Energy Storage
- Warehouse & Logistics

### Enabling Technologies
- Automation
- Digital Twin
- Communication
- Next Gen Manufacturing Systems
- Advanced Materials
- Blockchain
- VR/AR
- Additive Manufacturing
- Data Analytics
- Artificial Intelligence
- Cloud/Fog
- Responsive/Predictive Manufacturing
- Cyber Security
- Connected Factories – Vertical Integration
- Digital Supply Chain – Horizontal Integration
- Traceability
- Smart Supply Network
- Blockchain
- VR/AR
- Additive Manufacturing
- Data Analytics
- Artificial Intelligence
- Cloud/Fog
- Responsive/Predictive Manufacturing
- Connected Factories – Vertical Integration
- Digital Supply Chain – Horizontal Integration
- Traceability
- Smart Supply Network

### New Capabilities
- Factory of the Future
The factory of the future is about much more than robots. It is about sensors that connect devices and machines to the internet to monitor their condition and improve the performance of a production line, creating substantial cost savings.

- vertical integration of the supply chain
- fully automated manufacturing processes
- connecting the shop floor to the board room
- creating highly flexible production systems.

Smart, connected factories are the future of manufacturing.
Benefits of Digitalization along the Value Chain
Leveraging Potentials in the Factory of the Future. Today!

**Engineering & Build**
Efficiency & Optimization

**Commissioning**
Faster Issue Resolution & Quicker Start-up

**Operations**
Improved Uptime & Asset Optimization

**Maintenance**
Fleet Visualization & Predictive Scheduling

Proactive, user-friendly Intelligence for better Manufacturing Decisions
+110 years commitment and investment to Africa

Solid installed base, strong, experienced local team across the continent – ready for the next level

~5000 Employees in Africa

Kicked off in South Africa 1907

Restarted 1992

First operation in Egypt 1926

~1.5 billion Orders

Active in ~23 African countries
## ABB presence in Southern Africa

**Offices**

- Angola - since 1994
- Botswana - since 1994
- Democratic Republic of Congo - since 2008
- Kenya - since 1994
- Mauritius - since 1998
- Mozambique - reopened in 2012
- Namibia - since 1990
- Rwanda - since 2011
- South Africa - since 1907
- Tanzania - since 1993
- Uganda - since 2002
- Zambia - since 1950’s
- Zimbabwe - since 1960
Reason for expanding into Southern Africa

Context

Outlook

Energy & 4th Industrial Revolution are transformative for the world

They hold out the prospect of faster development and economic growth in Africa

New technologies offer a rapid and effective means to:
- electrify off-grid communities, improve grid reliability and reduce power transmission losses;
- address the mismatch between regional supply and demand;
- support an economic transformation that encourages entrepreneurship, builds domestic markets, and creates work and career opportunities.
- Making use of renewable energy resources to make a quantum leap in providing access to electricity
Reason for expanding into Southern Africa

Context

**Strengths**

**Most youthful population:** By 2034, working age population is expected to reach 1.1 billion workers, more than either China or India.

**Solid economic fundamentals:** Sub-Saharan growth has held up despite fall in oil and commodities prices: 4.4 percent in 2010-2015, compared with 4.1 percent for the previous decade.

**Continent is rich in natural resources and is especially well endowed with renewable energy sources:**
- Largest solar energy potential - 80% of world’s untapped hydro power
- Largest geothermal potential - Significant wind power potential

**Strengths**

The continent has an expanding **urban middle class** with growing purchasing power:
- Urban populations expected to increase by 24 million per year until 2045, compared with 11 million in India and 9 million in China (UN population).

Africans are **embracing communications and digital technologies** at an increasing pace:
- number of **fixed and mobile phone lines** per 1,000 people increased from 3 in 1990 to 736 in 2014;
- number of **internet users** per 1,000 people increased from 13 in 2005 to 167 in 2015.
Challenges in expanding into Southern Africa

Context

Weaknesses

Political & financing

- Link between Economy and Political stability much stronger than in developed countries
- Corruption and changing / interpretation of laws

Infrastructure:

- Lack of access to electricity (600 million people have no access to electricity – Single biggest obstacle to growth and development)
- Weak industrial base

Skills shortages:

- This also due to a lack of industry and low number of large companies. No Fortune 500 companies in Africa compared to 7 each in Brazil and India with similar GDP and 98 in China. Large Companies at Extreme ends 50% ZA and 20% North Africa

Intra-regional trade costs are highest in developing world and 50 percent higher than in east Asia