Industrial Strategy to identify priorities in energy mix policies in Africa as a result of joint discussions about local needs and resources

François-Xavier Dubois
Head of Power Generation Projects West & Central Africa
Brussels | October 23rd, 2017
A passion for Africa since 1976

- 1st metro line in Algeria, Algeria
- Tarfaya wind park, Morocco (Maroc)
- Safety of 23 sites of the 1st communication operator, Burkina Faso
- Extension and modernization of the crushing and transport of cement (projet Technord), Guinea Conakry
- OMVG – Grid supervision system (SCADA EMS), Senegal, Gambia, Guinea, Guinea-Bissau
- Water pump station in Accra, Ghana
- Sucrivoire – New biomass cogeneration steam turbine, Côte d’Ivoire
- Management and operation of the national grid, Cameroon
- 1st metro line in Algeria, Algeria
Top priorities in the African Region

Strengthening the Economy

Developing jobs and skills

Improving Quality of Life

Sustaining the Environment
The evolution towards Industrie 4.0

**Mechanics**
- **First Industrial Revolution**
  - Based on the introduction of mechanical production equipment driven by water and steam power
  - 1784: First mechanical loom

**Electro-Mechanics**
- **Second Industrial Revolution**
  - Based on mass production achieved by division of labor concept and the use of electrical energy (electrification)
  - 1870: First conveyor belt, Cincinnati slaughterhouse, 1908: Ford T-Model

**Automation / IT**
- **Third Industrial Revolution**
  - Based on the use of electronics and IT to further automate production (electronics/automation)
  - 1969: First programmable logic controller (PLC) Modicon 084

**Industry 4.0**
- **Fourth Industrial (R)Evolution**
  - … driven by Digitalization, Integration and enhanced Flexibility
  - 1982/1991

Time:
- 1775
- 1800
- 1866
- 1900
- 1948
- 2000
- 2025
Siemens brings solutions to Industry’s challenges of tomorrow: Electrification – Automatization – Digitalization

**Digitalization**
- Added value for our customers are more and more through softwares and advanced digital platforms
- Innovation through data management is becoming one of the fociusses of Industry
- We want to be part of tomorrow’s digital world

**Automatization**
- Siemens is already world leader in automatization
- We have been successful for years in automizing our customers processes
- Our intention is to grow and maintain this position

**Electrification**
- Siemens roots are in electrification – we are leader in that domain
- Siemens covers the whole electrification chain: from the fuels extraction and handling to the production and transport of the electricity to the customers.
- We capitalize on our large installed base and create added value for our customers through innovation and optimized services
Electricity changes lives

Electrification
Electrification vision for the African Region

Long term vision: renewable energy mix for Africa

Today’s challenge: leave heavy fuels and increase rural electrification

Solution: sustainable energy transition
Energy transition & Industrialization through flexible, reliable and sustainable electricity - Fossil Contribution

- **Industrial Combined Cycles**
- **Sustainable biomass**
- **Cogeneration**
- **Fast power (SGT-A45)**
Industrial power plants for a sustainable energy mix:

- Lowest emissions of fossil fuel generation solutions
- Reliability & availability (~99,5% & >97%)
- Efficient power generation up to 58.5% CC net
- High exhaust gas temperature for excellent steam-raising capability. >90% CHP efficiency
- **EconoFlex™:**
  - Flexible combined cycle power plant
  - Perfectly suited as back-up to renewable power sources in the grid
  - 10-minute start, frequent starts and stops, fast load-following
  - Fast: Open Cycle electrical production after 8 months
Industrial & rural electrification through biomass power for central, decentralized and even off-grid power generation
### SGT-A45 TR Mobile Unit

**Fast Power. Superior Performance. Trusted technology.**

<table>
<thead>
<tr>
<th>Fast Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ 2-weeks installation (3 months from NTP to power)</td>
</tr>
<tr>
<td>✓ Mobile by road, air or sea</td>
</tr>
<tr>
<td>✓ Minimal site interfaces and preparation</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Cost-effective power solution</th>
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</thead>
<tbody>
<tr>
<td>✓ 44 MW&lt;sub&gt;e&lt;/sub&gt; (ISO) with outstanding power density</td>
</tr>
<tr>
<td>✓ CAPEX savings with fewer units ($/kW)</td>
</tr>
<tr>
<td>✓ Performance optimized for hot climates</td>
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<table>
<thead>
<tr>
<th>Superior value in operation</th>
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<tbody>
<tr>
<td>✓ OPEX savings with high fuel efficiency</td>
</tr>
<tr>
<td>✓ Liquid and gas fuel with same service interval</td>
</tr>
<tr>
<td>✓ Proven turbomachinery in industrial package</td>
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<thead>
<tr>
<th>Flexible, dependable technology</th>
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<tbody>
<tr>
<td>✓ 50 Hz or 60 Hz</td>
</tr>
<tr>
<td>✓ Emissions as low as 25 vppm NOx</td>
</tr>
<tr>
<td>✓ Fast start (&lt; 8 mins) and no “hot lock-out”</td>
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</table>
Off-grid Hybrid Power Plants
The Solution to Maximize Renewable Energy

Distributed generation sources

Energy automation and management

Digitalization

Biomass power

Existing gensets (back-up)

Storage

Wind

Solar
Digitalization changes everything
Digitalization Changes Everything, Everywhere
The pace of technological advances is fueling digital transformation

### The cost of key technologies is falling

<table>
<thead>
<tr>
<th>Technology</th>
<th>2007 Cost</th>
<th>2013 Cost</th>
<th>2014 Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRONES</td>
<td>$100,000</td>
<td>$700</td>
<td></td>
</tr>
<tr>
<td>3D PRINTING</td>
<td>$40,000</td>
<td></td>
<td>$100</td>
</tr>
<tr>
<td>INDUSTRIAL ROBOTS</td>
<td>$550,000</td>
<td></td>
<td>$20,000</td>
</tr>
<tr>
<td>SENSORS</td>
<td>$30,000</td>
<td></td>
<td>$80</td>
</tr>
<tr>
<td>SMART PHONES</td>
<td>$449</td>
<td></td>
<td>$10</td>
</tr>
</tbody>
</table>

Source: Accenture Technology Vision 2015

### Implications of Moore’s Law

![Graph showing transistor density and cost of technology over time](image-url)

- **Cost of technology**
  - The cost of technology is decreasing exponentially.
  - Cost per unit is significantly lower in 2013 compared to 2007.

- **Transistor density**
  - Transistor count has increased dramatically over time.
  - Source: Leading Technology Research Vendor
Siemens addressing these challenges using digital technologies – Building on Electrification – Automation – Digitalization

Digitalization

Siemens Digital Services

Siemens Software

MindSphere

Automation

Digitally enhanced Electrification and Automation

Electrification

1) MindSphere – The cloud-based, open IoT operating system
MindSphere – the cloud-based, open operating system for the Internet of Things from Siemens

MindApps
Asset transparency and analytical insights into machines, plants, fleets and systems

MindSphere
Various cloud infrastructures:
Public, private or on-premise

MindConnect
Secure plug-and-play connection of Siemens and third-party products
Essential market requirements – Throughout all industries

Security

Speed  Flexibility  Quality  Efficiency
MindSphere
The Industrial Internet of Things

It’s not about technology,
It’s about a Mindset!
• **Gaz availability** is expected to increase in the future

• **Energy transition** through small size combined cycle with highest efficiency to support industrial development

• Decentral and even off-grid **biomass** as part of the energy mix

• **Digitalization** creates opportunities for industrial development, off-grid power generation and **Hybrid Mix**
Our Mission

Develop Siemens in Africa, for Africa and with Africa!