1. AREVA NP business

2. Nuclear: answering new electricity market challenges
From Areva Group to Areva NP

AREVA NP

- Installed Base
- Components
- Instrumentation & Control
- Engineering & Design Authority
- Large Projects
- FUEL

New Areva

- Mining
- Front End
- Back End

AREVA NP

- Installed Base
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- Large Projects
- FUEL
New NP will be able to secure its long term development with the support of strategic shareholders whilst remaining an autonomous subsidiary.
AREVA NP
Reference supplier in the nuclear sector

- Annual revenue* of ~ 3.1 bn€
- Sales Portfolio of 12 bn€
- ~ 14,000 employees worldwide
- > 58 locations
- A diversified portfolio of customers including worldwide leaders on the energy market
- Capability to provide services to all type of nuclear reactor technology

*Sales revenue contributive to AREVA group - Dec 31, 2016
AREVA NP Worldwide presence

USA
1. Bebeca
2. Charlotte
3. Cranberry
4. Jacksonville
5. Houston
6. Lynchburg
7. Richland
8. Maubeuge
9. Montreuil Juigné
10. Paimboeuf
11. Paris La Défense
12. Pierrelatte
13. Riales
14. Romans-sur-Isère
15. Rungis
16. Saint-Marcé
17. Sully-sur-Loire
18. Ugine
19. Val-de-Reuil

Rest of the world
17. Japan: Tokyo, Tokai, Shimoneseki
18. South Korea: Seoul
19. Czech Republic; Prague
20. Russia; Moscow
21. Ukraine: Kiev
22. Bulgaria: Sofia
23. Slovakia: Bratislava
24. Sweden: Helsingborg
25. Spain: Zaragoza, Tarragona, Madrid
26. South Africa: Cape Town
27. UK: London
28. Finland: Oikaluoto
29. Brazil: Rio de Janeiro
30. Angra dos Reis
31. Canada: Pickering (Ontario)

Germany
1. Berlin
2. Erlangen
3. Karlsruhe
4. Lingen

China
1. Beijing
2. Daya Bay
3. Deyang City
4. Fuging
5. Halian
6. Liaoning
7. Qinshaxi
8. Shangai
9. Taishan
10. Yangjiang
Consolidate our position as OEM NSSS designer & manufacturer

In-service nuclear fleet
- Propose innovative technologies and solutions (fuel, I&C, services)

New builds
- Adapt the offer to serve all potential markets

To satisfy customers and partners

OEM NSSS Designer and Manufacturer

#1 NSSS OEM
#2 Equipment and technology supplier

EPR ATMEA VVER Hualong ABWR,...

OEM: Original Equipment Manufacturer
NSSS: Nuclear Steam Supply System
High-performing people and technologies for safe and competitive nuclear plants worldwide

Values

Future  Performance  Integrity  Passion

Safety
AREVA NP
Missions

SCOPE

Designer and supplier of Nuclear Steam Supply System and nuclear equipment, services and fuel for high levels of safety and performance

Offer innovative solutions and value-adding technologies that help our customers achieve their safety, commercial and societal objectives

Set the standard in terms of commercial and operational excellence, both in manufacturing and in project execution, and ensure a high level of safety

Ensure the professional skills of our employees and uphold their engagement in a demanding and fulfilling work environment
AREVA NP activities

**BUSINESS UNITS**

- **Engineering & Design Authority**
  Development, design and licensing of NSSS and associated services

- **Large Projects**
  Management and execution of nuclear reactor New Build projects

- **Installed Base**
  Maintenance, engineering services for existing nuclear fleets and fleets under construction

- **Fuel**
  Development, design, licensing and fabrication of fuel assemblies and core components for PWR, BWR reactors, and research reactors. Development of zirconium products

- **Components**
  Design and manufacture of heavy and mobile components for nuclear islands

- **Instrumentation & Control (I&C)**
  Design and fabrication of safety I&C systems for the nuclear steam supply system
AREVA NP in 2015-2016
In-service NPPs

FRANCE
- Large-scale modernization with replacement of steam generators and modernization of I&C
- Launch of quality improvement plan in the equipment manufacturing plants

USA
- Contracts for Cyber Security engineering services and expertise
- Forward-Alliance program: Multi-year contract covering scheduled outages and maintenance activities
- Development of new cavitation peening solution to extend power plant service life
- New type of fuel for PWRs (GAIA) and BWRs (ATRIUM™)

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SWITZERLAND
R&D contract for EATF fuel (Enhanced Accident Tolerant Fuel) with Gösgen

UNITED KINGDOM
Contract with EDF for maintenance activities over 10 years for Sizewell B

BELGIUM
Supply and installation of new vessel heads for Tihange 3 / Doel 4 reactors

GERMANY
Outage services contract for E.ON reactors

JAPAN
Supply of passive autocatalytic recombiner (PAR) systems and Filtered Containment Venting Systems for the Japanese fleet

SOUTH KOREA
Safety Alliance program: supply contracts for venting systems for Wolsong1 & 2 power plants

SPAIN
- Refueling Services
- Maintenance & Outage Services
- Long term spare parts supplies
- Digital I&C Solutions
- Emergency Power Supply (EPS)
- Safety Systems (FCVS, …)
- Fuel engineering and component supplies

CHINA
- First delivery of M5™ alloy cladding tubes to CNNC
- Safety Alliance program: contracts for passive autocatalytic recombiner (PAR) systems and venting systems

SOUTH AFRICA
Supply of steam generators for Koeberg reactors

INAC 2017 - AREVA
AREVA NP in 2015-2016
New builds

UK
Hinkley Point C: signature of the contracts for the construction of 2 EPR reactors, led by EDF.

FRANCE
Flamanville 3: introducing RPV internals into the reactor building, delivery of the reactor vessel head to the site and completion of mechanical assembly work on the reactor coolant system.

TURKEY
ATMEA1: completion of the detailed generic Basic Design

BRAZIL
Angra 3: equipment supply, engineering services, I&C.

CHINA
• Taishan 1: cold-run tests with RPV closed and then open successfully carried out
• Taishan 2: introduction of all steam generators into the reactor building and completion of primary loop welding work

FINLAND
Olkiluoto 3: on-site delivery of operational I&C TXP cabinets, completion of their on-site testing, and start of commissioning tests on reactor

INDIA
Jaitapur: contract with NPCIL for basic design studies for an EPR
AREVA NP in Latin America
Strong history and partnerships

AREVA NP IN LATIN AMERICA

➢ A 40 years presence in South America;
  ▪ Commercial Office in Rio de Janeiro;
  ▪ Operational presence on sites: Atucha and Angra.
➢ OEM for ANGRA 2, ANGRA 3, ATUCHA 1 & 2;
➢ Angra 3: Engineering and Equipment Supply

INSTALLED BASE AND I&C

➢ Support to the construction and commissioning of the NPPS;
➢ Services expertise for all types of reactors all along;
  ▪ ANGRA 1 & 2, Atucha 1&2, Embalse, :
    • Specialized engineering;
    • Maintenance expertise;
    • Outage services.

FUEL

➢ Components supply
➢ Manufacturing support
➢ Design of Angra 2 fuel in collaboration with INB.

AREVA NP
**AREVA NP**

Involvement in Angra 3 Project

Present Industrial scheme and role

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### ELETRONUCLEAR

**Overall Project Management and Supervisory Site Management**

<table>
<thead>
<tr>
<th>Design</th>
<th>Supplies</th>
<th>Civil Works</th>
<th>Erection</th>
<th>Commissioning</th>
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<td><img src="#" alt="AREVA" /></td>
</tr>
</tbody>
</table>

1. Erection Supervision by AREVA
2. Erection Supervision by Siemens AG

Siemens AG as subcontractor of AREVA

BMEC Brazilian Main Erection Company
1. AREVA NP business

2. Nuclear: answering new electricity market challenges
2016: Energy Mix: Installed Capacity

- Hydraulic: 60%
- Biomass: 9%
- Carvão: 2%
- EOL: 7%
- Gás Natural: 8%
- Oléo: 3%
- PCH: 4%
- Photovoltaic: 0%
- Nuclear: 2%
- Importada: 5%
- Diesel: 1%
- Gás Natural: 8%

Source: PDE 2026
Brazil: Hydro to Thermal Transition

Brazil Storage Capacity (%) – Since 2008

Brazil’s Electricity Generation (MWh) Mix:
Growth of fossil and expensive Thermal

2012
- Hydro: 19%
- Thermal: 77%
- Renewable: 3%
- Nuclear: 1%

2013
- Hydro: 24%
- Thermal: 71%
- Renewable: 3%
- Nuclear: 2%

2014
- Hydro: 26%
- Thermal: 68%
- Renewable: 3%
- Nuclear: 3%

2015
- Hydro: 30%
- Thermal: 62%
- Renewable: 3%
- Nuclear: 6%

2016
- Hydro: 25%
- Thermal: 66%
- Renewable: 7%
- Nuclear: 2%

Source: ONS

Brazil’s Electricity Generation (MWh) Mix:
Growth of fossil and expensive Thermal

- Hydro: 3%
- Thermal: 97%
- Renewable: 0%
- Nuclear: 0%

INAC 2017 - AREVA
Brazil’s electricity demand forecasts

2005  2016  2021  2026
430    516    609    741

Source: PDE 2026 - MME / EPE

Brazil’s electricity consumption will grow 44% until 2026, according PDE. Additional 65 MW capacity in 10 years!
Participations of the Production Sources in the Energy Mix Evolutions

Source: PDE 2026
Nuclear power allows security of the grid by covering baseload needs

Typical daily electricity production in France

Key facts

- Nuclear energy provides stable and predictable electricity production, on a large scale
- Nuclear capacities allow to cover baseload needs
  - Nuclear energy does not depend upon regular fuel supply or climate conditions, and has an excellent plant availability factor
  - Once reloaded, a nuclear plant can run non stop up to 24 months before outage for reload
  - Modern nuclear power plants have short outage durations

Source: RTE 2015
2017: Energy Mix
Energy Generation as of 19/10/2017

**Hydro**: 65%
**Thermal**: 23%
**Eolica**: 8%
**Nuclear**: 3%
**Solar**: 1%

Source: ONS
In opposition to other renewable energy sources, nuclear does not depend on weather and register a much higher capacity factor that could compensate hydropower seasonality in Brazil;

- Compared to Solar and Wind, nuclear technologies use very few land and can be installed next to consumption centers.
... Environmentally Friendly

- **COP 21 agreement**
  Limit increases in global average temperature to 2°C until 2100

- **Brazil Engagement**
  43% reduction in 2030 vs 2005

**Brazil Emissions in 2015**
1.6 Billions tons of CO2e

**Brazil’s Target in 2030**
1.15 Billions tons of CO2eq

- More than a environmental necessity, controlling CO2 emissions will also be an economic one with the implementation of the CO2 tax regulation
Global and Local challenges for the electricity sector

- Security of supply
- Affordable prices
- Diversity
- Distributed Generation
- Low CO2 emissions
- Fosters Industrial and Social development
Thank you for your attention!

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