

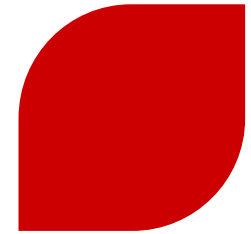
AREVA

forward-looking energy

AREVA TA

AREVA TA, an experienced and reliable partner, ready to accompany you all along your project realization and life cycle

INAC – Recife – Nov 27 2013



1

AREVA TA inside AREVA group

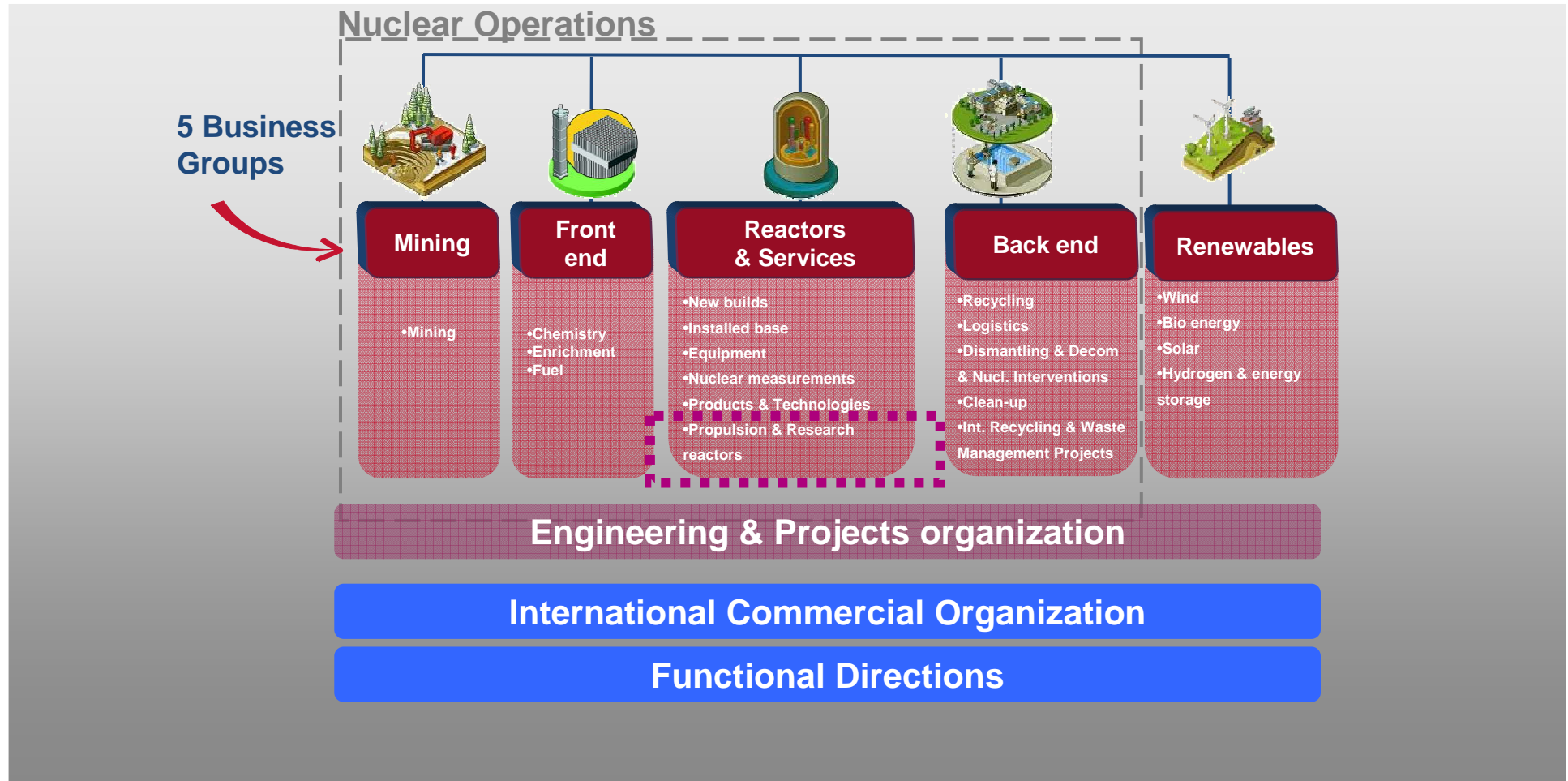
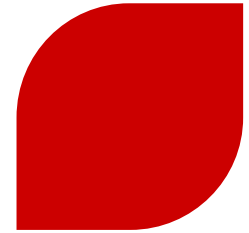
2

NUCLEAR CIVIL FOCUS

3

DEVELOPPING COOPERATIONS

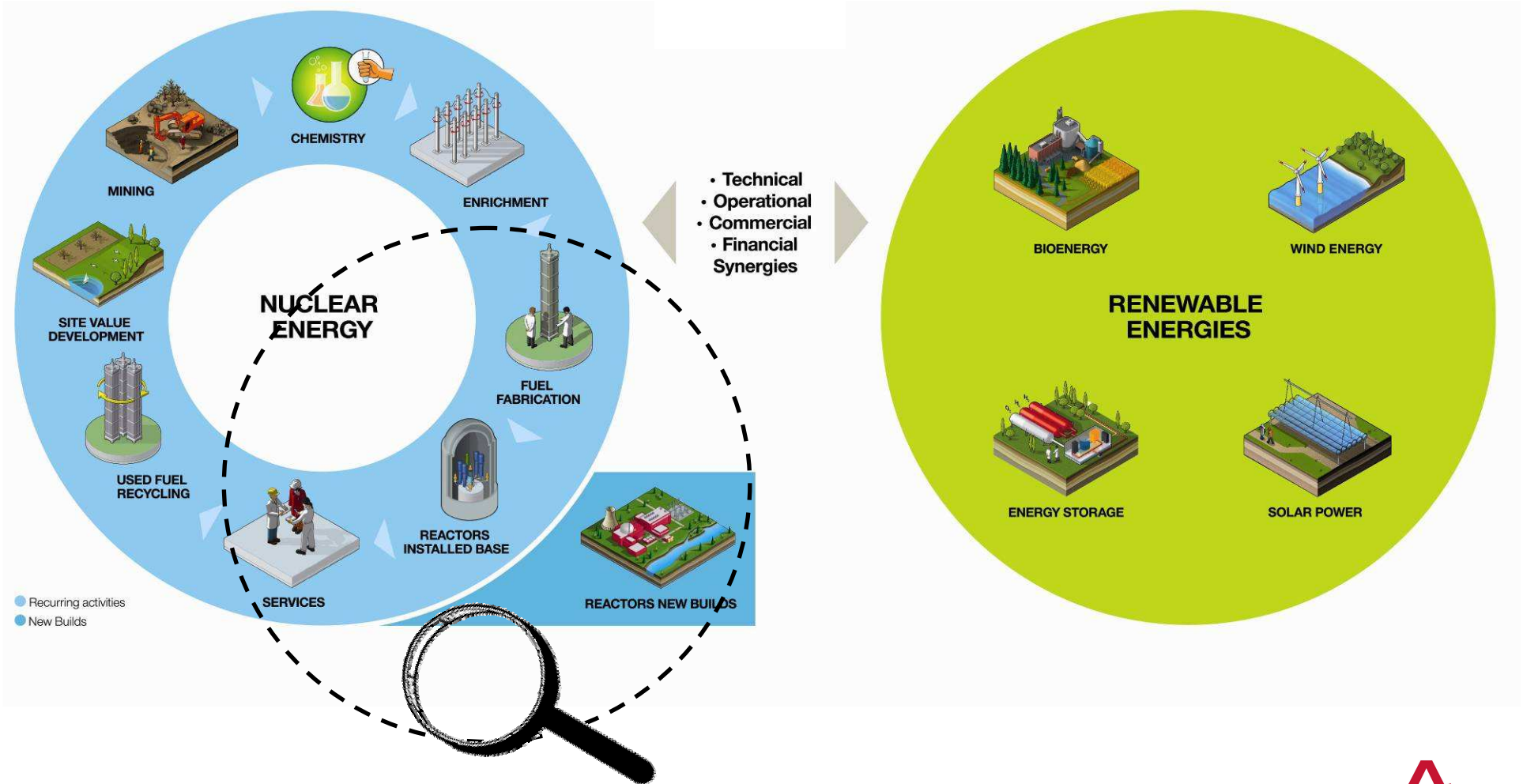
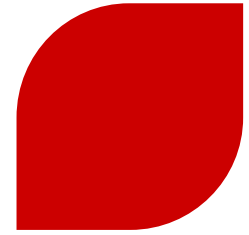
AREVA TA within AREVA Group



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TA inside AREVA : Several Activities

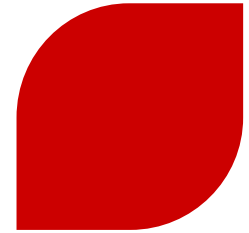


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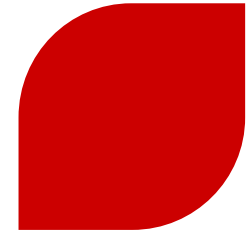
AREVA TA MAIN ACTIVITIES

“Propulsion and Research reactor business unit”



- **Research Reactors innovative facilities. Modular Small & Medium-sized Reactors. Nuclear energy for naval propulsion**
 - Design and build nuclear reactors, fuel facilities, and plants dedicated to radio-isotopes production for medical use
 - Design and manufacture nuclear fuels
 - Operate and maintain nuclear fuel facilities & components
 - Solutions, products & services to optimize operations in reactors & plants, reinforce safety, modernize & improve performance
 - Provide engineering design services for new reactor development
- **Solutions and services to industrial customers and operators of complex systems in energy, industry and transportation sectors**

2012 Key Figures



A wide range of solutions

- Equipment
- Systems
- Services

for

- Defense
- Civil Nuclear

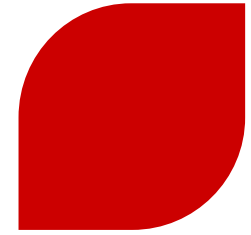
€ 1,103M Backlog

€ 432M Turnover

2,238 Staff
2,114 in France
124 abroad

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1

AREVA TA inside AREVA

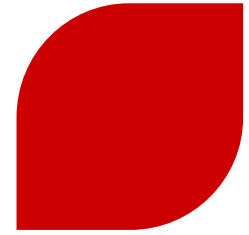
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NUCLEAR CIVIL FOCUS

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DEVELOPING COOPERATIONS

PROVIDING HIGH-VALUE SOLUTIONS FOR NUCLEAR RESEARCH AND MEDICAL APPLICATIONS



FUEL for Research Reactors and **TARGET** for medical application.
WASTE MANAGEMENT solutions for spent fuel



FUEL & TARGET PRODUCTION



RADIOISOTOPE PRODUCTION FACILITIES

RADIOISOTOPE PRODUCTION FACILITIES

Engineering support, design and construction for medical Radioisotope production



RESEARCH REACTORS

RESEARCH REACTORS
Engineering, expertise, installation and commissioning for New Builds and Installed Base



LABORATORIES & RESEARCH CENTERS

LABORATORIES & RESEARCH CENTERS

Design, project management and construction for industry, medicine and research



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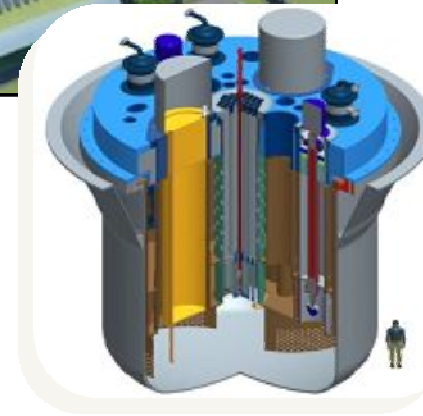
REALIZATIONS AND PROJECTS EXAMPLES



LMT:
Radioisotope
production
facility



FRMII:
research
reactor



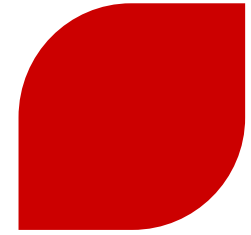
MYRRHA*:
multifunctional
research
infrastructure

AREVA TA

and also Maamora, Osiris, Orphee...

* With courtesy of SCK-CEN

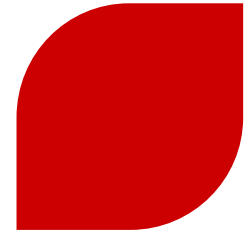
JULES HOROWITZ REACTOR (JHR)



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FUEL & Mo99 TARGETS MANUFACTURING (CERCA)



FLAT PLATES



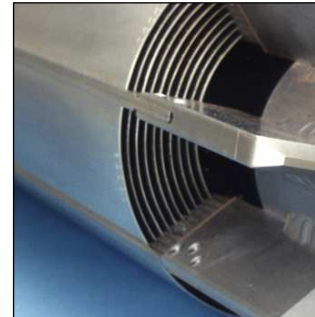
OSIRIS – ORPHEE
– BER II
JMTR – JRR3 –
(SAFARI 1) — OPAL

CURVED PLATES



HFR –MNR -

TUBULAR

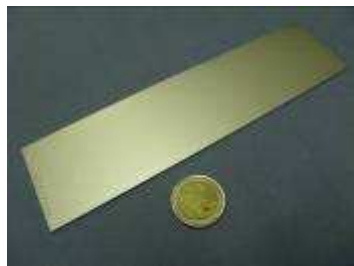


BR2
MARIA

RING-SHAPED



RHF
FRM II



FLAT PLATES DESIGN



TUBULAR DESIGN



U_Zr ROD



TRIGA REACTORS

*Major supplier to research
reactors operators worldwide*

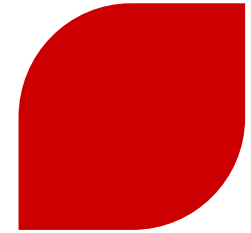
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JULES HOROWITZ REACTOR (JHR)

New Research Facility of CEA (France)



Focus on AREVA roles

- **Basic Design of the installation:**

- Nuclear unit including the reactor, pools, hot cells and workshops.
- Cooling water building housing the normal cooling water circuits.
- Two safeguards buildings each housing the two safeguard trains.

- **EPC Management:**

- Support to CEA for procurement of contract packages
- Contractor supervision and inspection (design & execution studies, in factory, at JHR site during construction/installation and test phases).
- Construction site management & coordination (including site logistics).
- Commissioning management

- **Reactor Block :** Design, procurement, manufacturing, installation/erection, commissioning:

- Reactor Block (“bloc pile”) : main primary components (vessel, primary box), reactor internals, reflector block, control rod drive mechanisms, reactor pool equipment, displacement systems for power ramping experimentations ...
- Primary Circuit (in reactor pool & bunker): material supply (forging DN 600 straight tube, elbow), piping manufacturing, structural steelwork, steel slab...
- Safety Classified components : pumps, exchangers, valves
- I&C : automation systems (protection, safety, operational, interfaces with experimental devices), HMI (accidental, post accidental, operational).

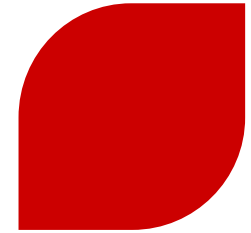


With a total AREVA TA team of about 250 persons

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MYRRHA

Multi purpose lead bismuth reasearch reactor by SCK-CEN (Belgium)



Focus on AREVA roles

- **AREVA led international consortium contracted (Oct 2013) for the FEED phase of Myrrha balance of plant including :**
 - Nuclear system (excl. reactor and accelerator)
 - Safety and Pre-Licensability studies
 - Lead bismuth conditioning system
 - HVAC especially nuclear
 - Cover gas and ventilation
 - I&C
 - Building Architecture and structure studies
 - Electrical systems
 - Radiation analysis and Radio protection
 - Water systems & treatment
 - Contaminated waste hadling
 - Lots description
 - Project management

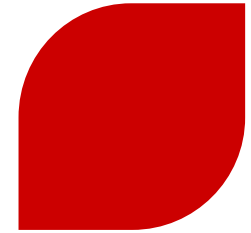


Contract represents ~250000 hours wherof 40% performed by AREVA, in cooperation with Ansaldo Nucleare and Empresarios Agrupados

AREVA TA

MAAMORA Centre

Nuclear Research Centre of Morocco



Focus on AREVA roles

- **Design studies and turnkey manufacturing based on 14 modules (9 conventional and 5 nuclear) around a TRIGA Mark II reactor :**
 - Overall project management.
 - Front End Engineering Design.
 - Definition of specifications with the customer.
 - Design and construction follow-up of the facilities
 - Supply chain management and localization.
 - Support during start-up and power ramp-up
 - Training program
 - Technical assistance for the setting up of installation procedures and for the maintenance of the installations.
 - Lead responsibility for project management in partnership with a civil engineering group.
 - Integrated project team with various companies
 - Implementation of several nuclear processes: hot cells, liquid effluent treatment evaporator, radioelement fabrication laboratory, NDT cells.
 - Assistance with commissioning, training and onsite in-service support during the first months of operation.

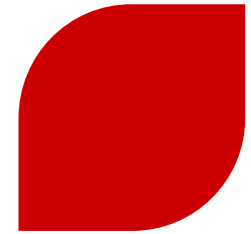


For a total of some 150000 hours of work by AREVA TA

AREVA TA

LMT Laboratoire Maurice Tubiana – France

Laboratory to industrialize & large scale produce medical-grade 212 Pb for new radio-immunotherapy anti-cancer treatments

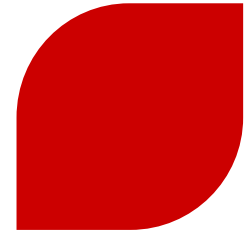


- Lead 212 is a rare metal is used in the development of innovative treatments for certain cancers that do not respond to other conventional methods. As innovation in nuclear medicine is dependent upon the availability of high purity isotopes, the industrial production of the Maurice Tubiana Facility will provide sufficient amounts of high-purity lead 212 for clinical development.
- Lead-212 is being used currently in an AREVA Med Phase 1 clinical trial at the University of Alabama at Birmingham in the United States.



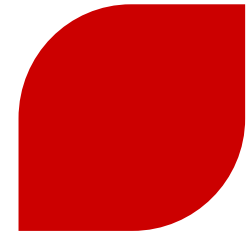
AREVA has inaugurated the Maurice Tubiana Facility located at Bessines-sur-Gartempe, France this Nov 2013- After receiving the administrative authorizations and completing the prerequisite technical testing, this unique facility has started production to extract and purify lead-212 for medical use.

LMT project development



- **AREVA TA roles**

- Project management. Technical coordination and management of interfaces.
- Civil Engineering.
- Chemical process.
- Electricity and detection systems (fire detection, physical protection, etc.).
- Chemical process.
- Nuclear Ventilation (taking into account pharmaceutical constraints)
- Mechanical devices (particularly a shielded glovebox).
- Calculation of radiation protection shieldings.
- Definition of radiological zoning, selection and integration of radiation protection monitoring equipment.
- Pipe and vessel assemblies, weldings, etc.
- Nuclear and industrial safety.



1

AREVA TA inside AREVA

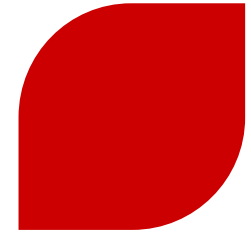
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DEVELOPPING COOPERATIONS

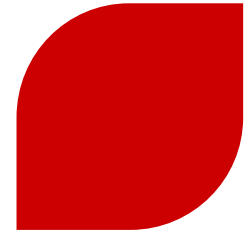
Assembling best competences for each RR project



- **Partnership/teaming : to secure access to best available competences and general know hows, both locally and overall:**
 - AREVA TA open to discuss best suited alternatives
 - With fundamental principles in mind : ensure that overall system view is present, interfaces managed and critical issues fully addressed

Example of Myrrha FEED : Ansaldo, Empresarios Agrupados and AREVA working together

Developping competences at the occasion of each RR project



- **Research Reactors play a critical role in the development and stability of nuclear competences in a given country/part of the world**
- **AREVA choice : by making his large experience available, go beyond a mere supplier/customer relation and disseminate the benefit of belonging to the « Research Reactor community »**

40 years

of experience in design, construction, commissioning, operation, refurbishing of research and test reactors to guarantee occupational safety for men, availability for equipment and environmental care.

All these requirements make **AREVA TA** the long-term partner for your project.



MUITO OBRIGADO

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AREVA TA

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