

AREVA NP

Our experiences with Rosatom

Atomex

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Vice President Offers and Partnerships
Large Projects
AREVA Germany

Budapest 30 November – 01 December, 2015





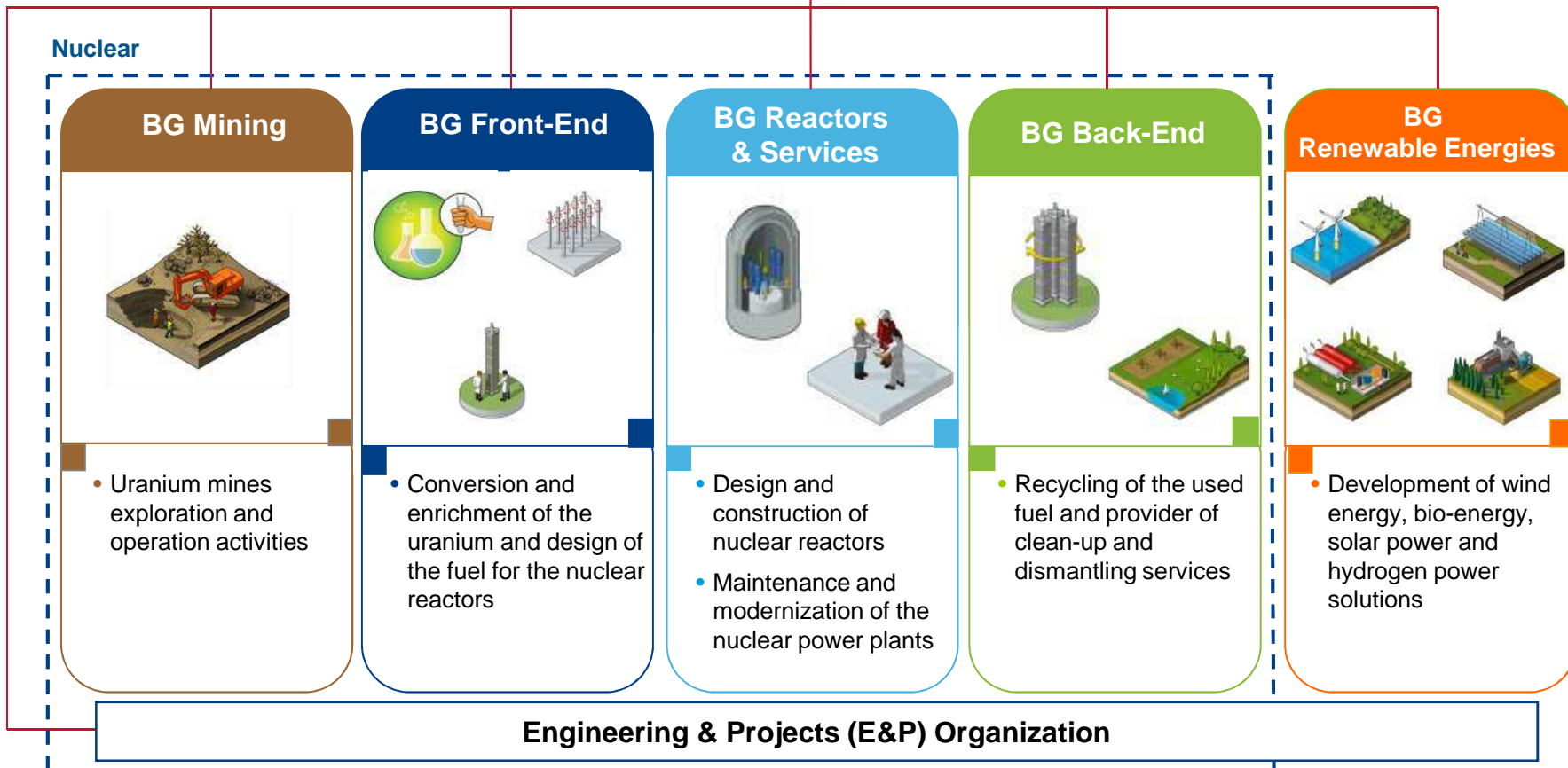
- ▶ **AREVA in Germany**
- ▶ **Our experience with VVER plants**
- ▶ **Competencies at AREVA**
- ▶ **Conclusion**



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AREVA Business Groups

Executive Board
& Committee



Reactors & Services BG Identity Card



▶ Key figures 2014 ▶ (excl. Large Projects)

Order book: € 5,498 million

Sales: € 2,459 million

- France ~ 52 %
- Americas ~ 18 %
- Europe (outside France) ~ 18 %
- Asia-Pacific ~ 12 %

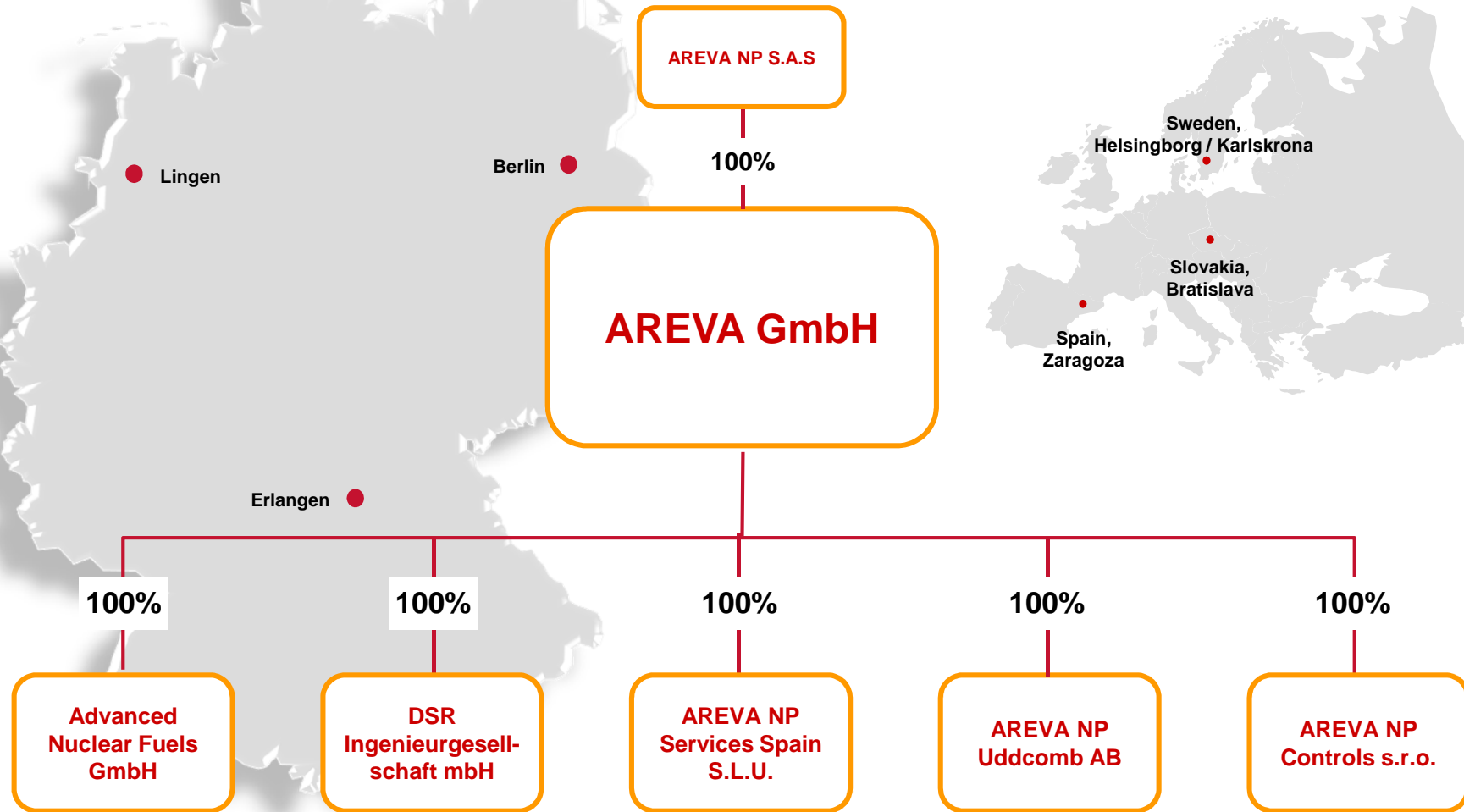
~ 10,000 employees in > 10 countries

- France, Germany, USA, Canada, China, Spain, Sweden,...

Industrial footprint

- > 20 sites worldwide
- 6 AREVA/R&S companies located in China
- 5 Technical Centers in Germany, USA and France

AREVA GmbH – legal structure



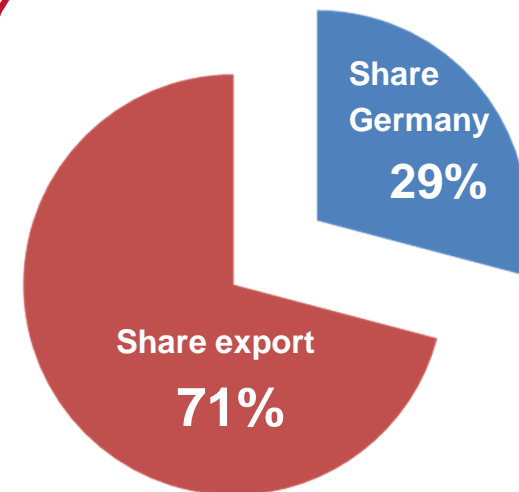
● headquarters

AREVA in Germany: Sales 2014

Sales AREVA GmbH *) in Germany: €1,077 Mio

Strong focus on export:

- ▶ New build contribution already today at 100 % export
- ▶ Installed Base: 79 % export share
- ▶ Fuel business focuses more and more on export: 58 % in 2014



*) IFRS, incl. subsidiaries

AREVA: Business in and out of Germany



- ▶ **Installed Base:** Modernization, Safety Upgrades, Engineering Services, I&C
- ▶ **Fuel:** Pressurized Water Reactors / Boiling Water Reactors, MOX* / ERU* business
- ▶ **New builds:** OL 3, FA 3, TSN 1 & 2; upcoming: Hinkley Point
- ▶ **D&D:** competence center established in Germany while at the same time focusing on projects abroad (UK, Japan)

* MOX = Mixed uranium and plutonium Oxides

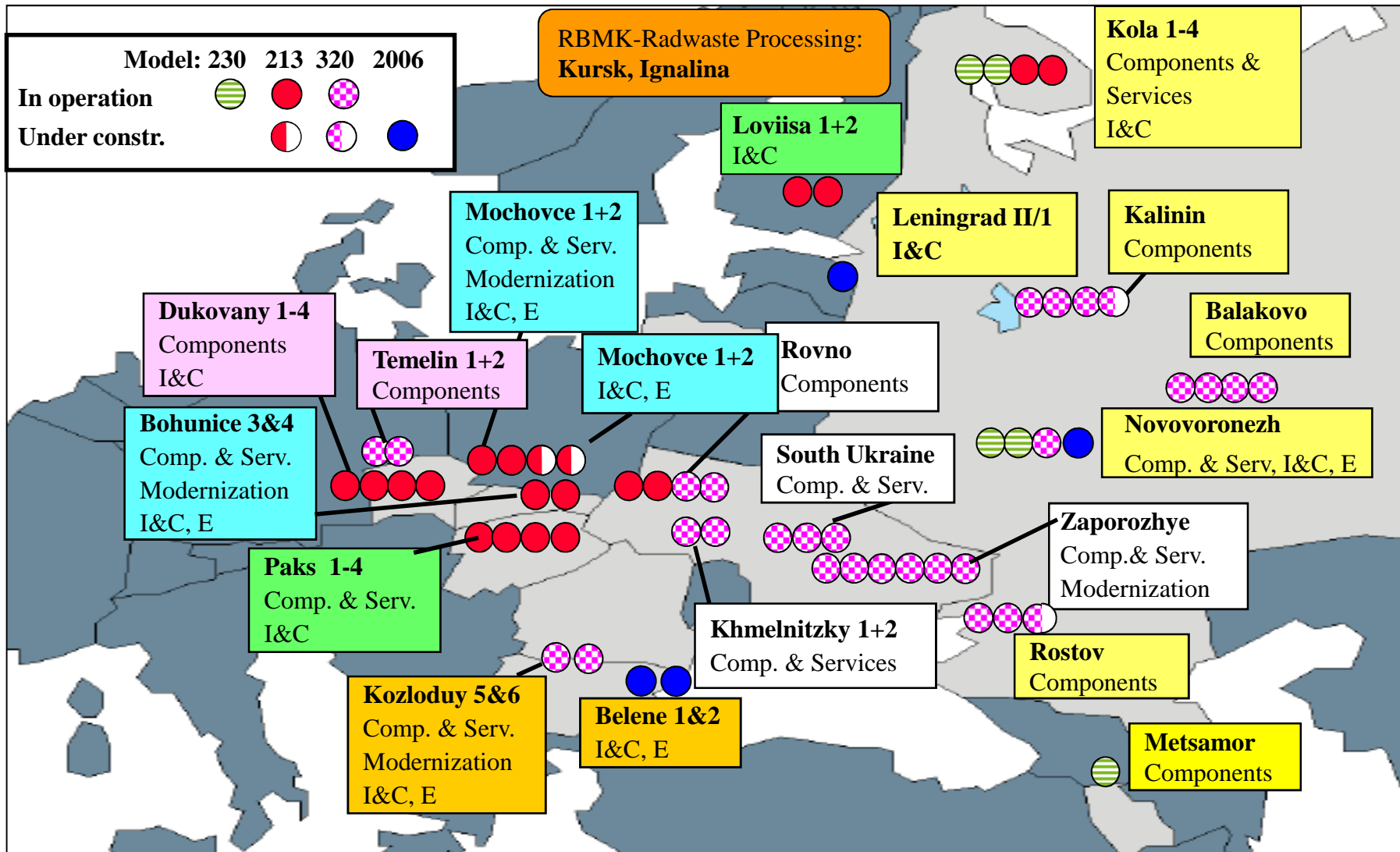
* ERU = Enriched Reprocessed Uranium



- ▶ AREVA in Germany
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Activities in VVER (1991-2015)

Tianwan 1&2
I&C, E



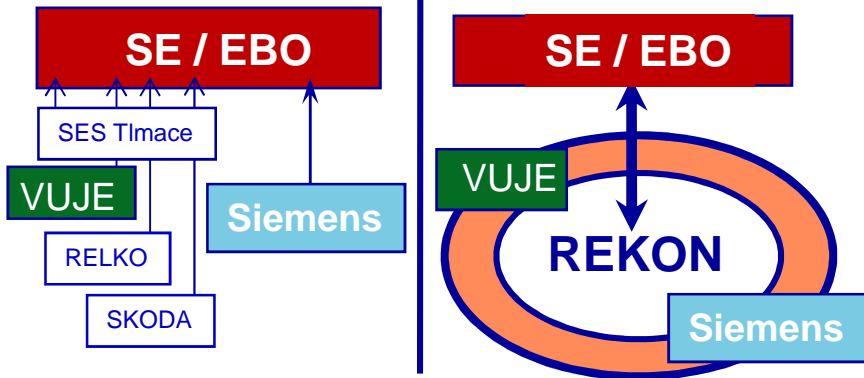
Modernization Projects from 1992 - 2005

EBO V1 Stepwise Reconstruction

in operation since 1979/80 (200 million EURO)

Basic engineering

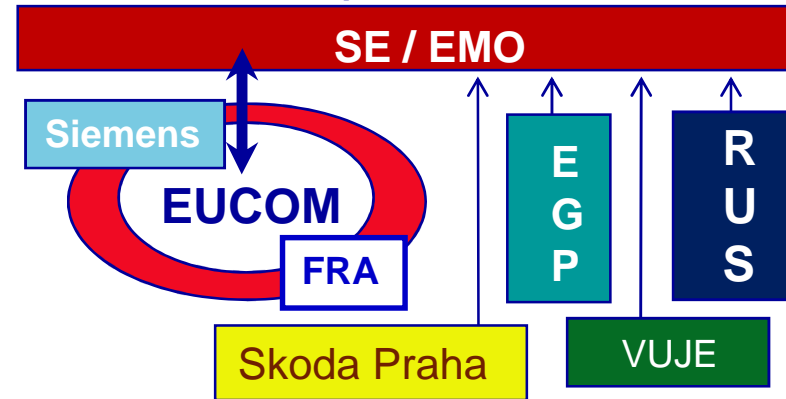
Detailed eng. + implem.



EMO 1+2 Safety Improvements

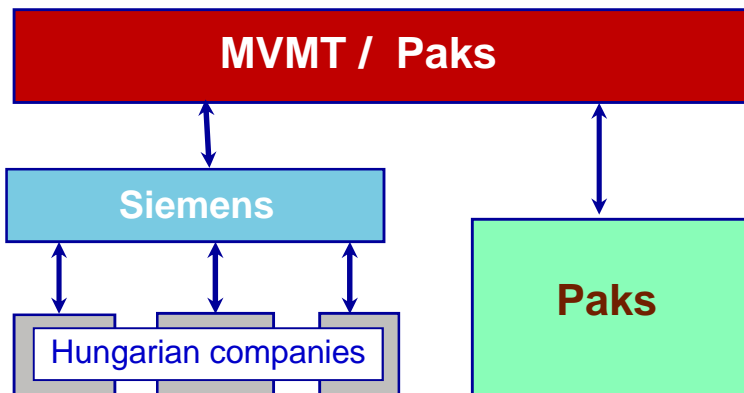
under construction since 1983 (100 million EURO)

50% of improvements to EUCOM



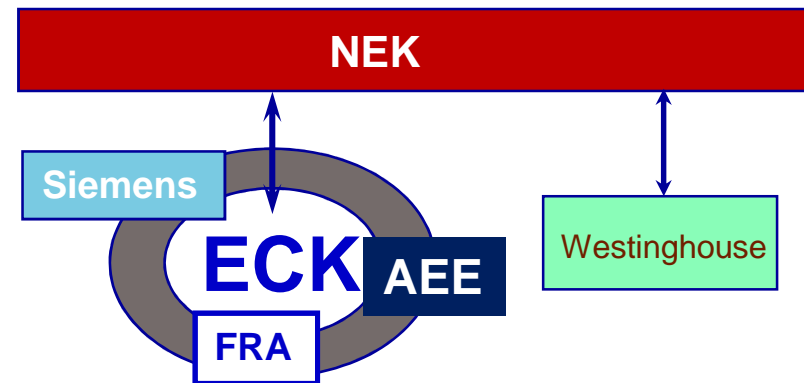
Paks 1-4 New Digital Safety I&C

in operation since 1983/87 (20 million EURO)



Kozloduy 5+6 Upgrade

in operation since 1987/89 (25 million EURO for basic eng. plus 250 million EURO for realization incl. 30% local portion)



NPP Kozloduy 5&6 – Modernization project – Contract Structure

Customer: Kozloduy NPP plc
Supplier: European Consortium Kozloduy (ECK)
(Siemens AG, Framatome SAS, Atomenergoexport)
Overall scope: 42 measures,
60% systems and mechanical components,
40% I&C and Electrical systems

with the following objectives:

- ▶ to provide a 100% financing scheme (Euratom, Rosexim, export loans)
- ▶ to meet the safety requirements of Western Europe and
- ▶ to benefit from experiences of the original designers



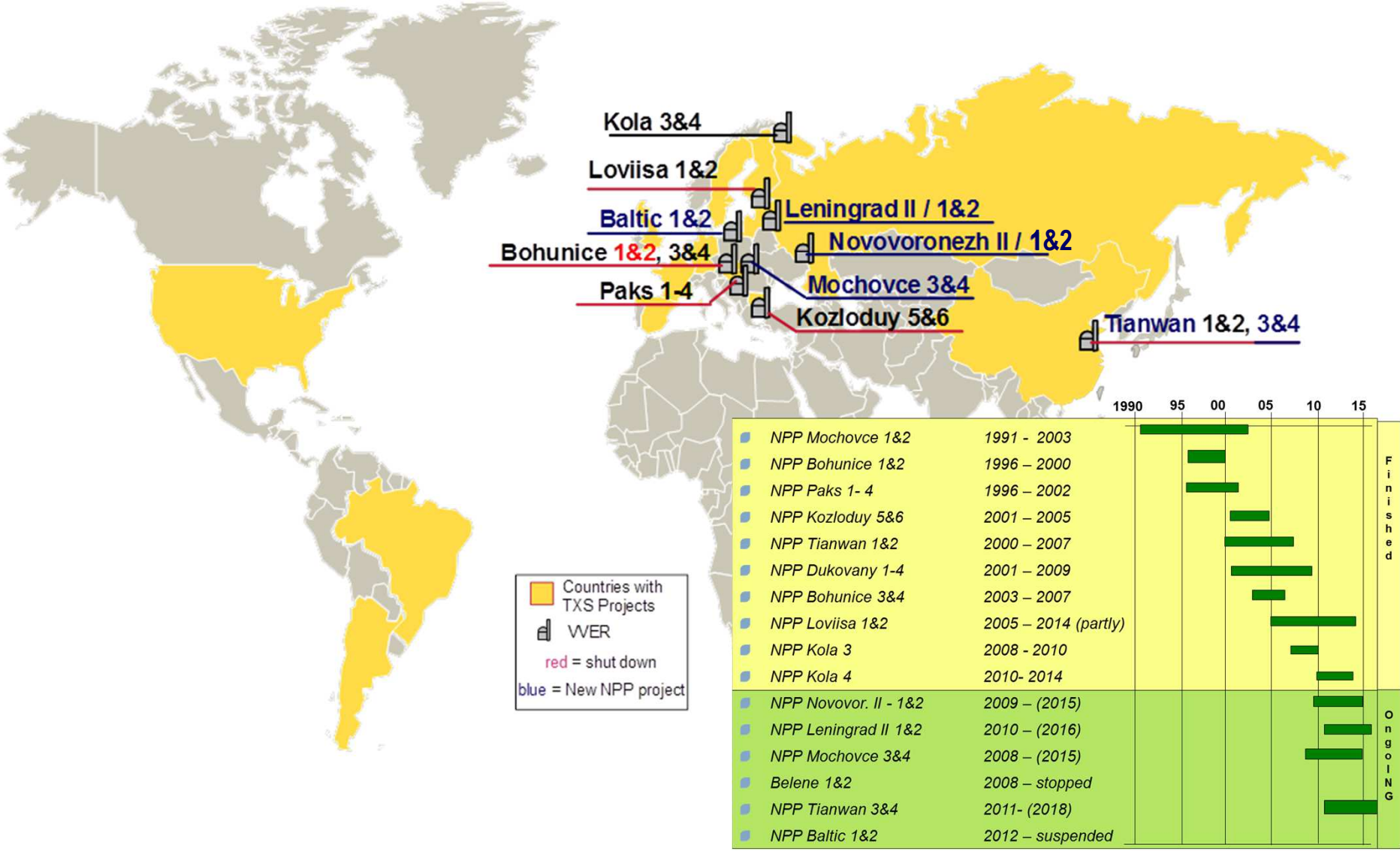
Bulgaria, Kozloduy Unit 5&6 (2001-2006)

- ◆ **Safety I&C**
 - TXS-Coolant overpressure protection system (COP)
 - Electronic for RPV level measurement
- ◆ **Non-safety I&C**
 - TXP for water treatment facility
- ◆ **Radiation monitoring**
- ◆ **Improvement of emergency power supply and electrical systems**
 - Additional DG for important unit consumers (2 x 5,4 MW)
 - Modernization of I&C (TXS) and electrical equipment of emergency DG (6 delivered, 1 DG commissioned)
 - New generator & transformer protection
 - New transformer temperature control
 - New fault recording equipment
 - New protection relays for 6 KV switchgears
 - Partly new MV and LV-switchgears for auxiliary power supply
- ◆ **Improvement of fire detection and fighting systems**
- ◆ **Installation of new diagnostic systems in reactor building**



**VVER
320**

TELEPERM® XS Projects with focus on VVERs



Ongoing Projects in VVER plants



▶ **China: Tianwan 3+4, I&C and EDG for VVER 1000**

- ◆ Customer CNNC / JNPC
- ◆ NI Designer: Atomstroyexport; CI Designer: CNPE (subsidiary of CNNC)
- ◆ Duration: 2011 – 2018
- ◆ Scope: I&C 140 TXS Cabinets, Electrical Systems, Field Equipment, H2-Monitoringsystem;
- ◆ Consortium with Siemens / SPPA

▶ **Russia Fleet: Safety-I&C in VVER domestic with partner VNIIAES**

- ◆ New Build Project Novovoronezh II-1 12/2009 – 12/2014
- ◆ New Build Project Leningrad II-1 07/2010 – 12/2014
- ◆ Modernization on KOLA 3+4 01/2011 – 08/2014
- ◆ New Build Project Baltic 1&2: (U2 susp.) 07/2012 – 12/2015
- ◆ New Build Project Leningrad II-2 03/2014 – 06/2016
- ◆ New Build Project Novovoronezh II-2 06/2014 – 09/2016

▶ **Slovakia: Mochovce 3&4, I&C for VVER 440**

- ◆ Customer Slovenske Elektrarne
- ◆ Duration: 2010 – 2017
- ◆ Scope: I&C 200 TXS Cabinets, Power Suply
- ◆ Consortium with Siemens

* DCS Distributed Control System

Our experience with VVER plants

- ▶ **We have been working, supplying and cooperating under various contractual schemes for different VVER plants**
 - ◆ Bohunice, Mochovce, Paks, Kozloduy, Tianwan, NPP 2006 (NW-II, LNPP-II)

- ▶ **We may provide staff with**
 - ◆ Competences at VVER plants related to Engineering, Procurement, Construction, After sales service
 - ◆ Ability to create Synergies between Russian and Western Technology.
 - ◆ Knowing Russian culture and language

- ▶ **Who also participated in the International Framework, e.g.:**
 - ◆ IAEA program for safety review of VVER, others
 - ◆ EU - TACIS/PHARE other support programs:
 - SAR, NDT, diagnostic, r/a waste treatment, on-site assistance, training centre Ukraine

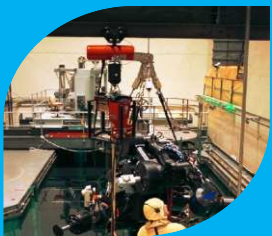


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Installed Base Business Division

A comprehensive portfolio

Recurring Activities



- Outage Services
- Non Destructive Examinations
- Special repairs

Modernization



- Lifetime Extension studies
- Power uprates
- I&C, electrical systems
- Heavy and mobile components replacement
- Safety improvement solutions

New plants equipment



- I&C
- Electrical systems
- Containment systems
- Diagnosis & monitoring



AREVA
Forward Alliance



AREVA
Safety Alliance



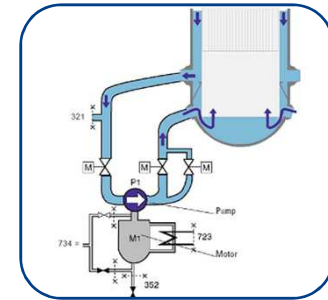
AREVA
Value Alliance



Our New Plants Equipment

Which is already licensed in Finland, UK, France

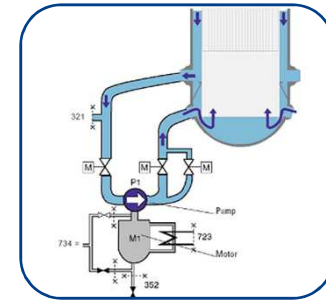
- ▶ **Emergency power supplies**
- ▶ **Waste treatment systems**
- ▶ **Containment Products**
- ▶ **Diagnose and Monitoring**
- ▶ **Reactor Coolant Pumps**
- ▶ **Suppliers qualification**
- ▶ **Equipment qualification**
- ▶ **Safety and non safety I&C**
- ▶ **Core & field instrumentation / radiation monitoring**



Other support for New Build Plants

- ▶ **Electrical systems**
- ▶ **Licensing & safety studies**
- ▶ **Consulting for new nuclear codes requirements**
- ▶ **Design support, e.g.**
 - ◆ **for APC,**
 - ◆ **seismic,**
 - ◆ **cooling in dessert,**
 - ◆ **HVAC**

in accordance to requested codes and standards



From Design to Commissioning

**Design & construction
of nuclear facilities**



**Upgrade, modernization &
dismantling
of existing facilities**



**Technical support to R&D
of nuclear facilities**



**Installation and
Commissioning Support
of systems and nuclear facilities**



AREVA – Competence in Nuclear Code Application

AREVA actively maintains its KTA involvement

AREVA holds and maintains various certificates, providing relevant code knowledge



» Where ever we perform we adapt to the nuclear codes and regulations
These are part of AREVA's expertise portfolio





- ▶ AREVA in Germany
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Summary

What do we have:

- ▶ Operations with Rosatom affiliates for more than 20 years
- ▶ Significant VVER know-how and references in Russia and abroad
- ▶ Personnel is fluent in Russian language

**Last time focus was more on the I&C,
but we see additional cooperation areas.**

What we can contribute to make your projects even more successful:

- ▶ Engineering competencies, know-how and products, esp. BNI, I&C and electrical systems
- ▶ Available supply chain in many countries
- ▶ Country-specific licensing know-how

And many others ...



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Backup: **Technology**

VVER References (1)

► TELEPERM®XS I&C

Since late 1990ies, AREVA is a reference supplier of the following I&C equipment for VVER NPPs:

■ Reactor safety and I&C systems for NPPs in Europe and China:

- Mochovce 3&4 and Bohunice 3&4, Slovakia
- Loviisa 1&2, Finland
- Paks 1-4, Hungary
- Tianwan 1&2, China

■ AREVA is the only supplier of safety I&C equipment for NPPs with VVER reactors of AES-2006 design:

- Leningrad NPP-2
- Novovoronezh NPP-2
- Baltic NPP
- Kola NPP (units 3&4)

VVER References (2)

► **PAR – Passive hydrogen removal systems**

Excellent performance of PAR systems is confirmed by over 15 years of their application at NPPs with Russian-design reactors:

■ **Europe**

- Dukovany 1-4, Temelin 1&2 (Czech Republic)
- Kozloduy 3-6 (Bulgaria)
- Paks 1-4 (Hungary)
- Mochovce 1&4 and Bohunice 3&4 (Slovakia)
- Rovno (Ukraine)

■ **Russia and China**

- Kalinin and Rostov (Russia)
- Tianwan 1&2 (China)

► Monitoring and diagnostic equipment

- AREVA offers unique monitoring and diagnostic technologies for the basic reactor components. Systems developed by AREVA are applied worldwide, including VVER NPPs:
- Valve diagnostic systems (ADAM and SIPLUG):
 - Smolensk and Balakovo, Russia
 - Zaporozhie, Ukraine
- Vibration monitoring system (SÜS):
 - Novovoronezh, Kola and Balakovo, Russia
 - Mochovce and Bohunice, Slovakia
 - Dukovany, Czech Republic
- Loose parts monitoring system (LPMS/KÜS):
 - Novovoronezh, Kola and Balakovo, Russia
 - Mochovce and Bohunice, Slovakia
 - Dukovany, Czech Republic
 - Kozloduy, Bulgaria
- Leakage monitoring system (FLÜS):
 - Kalinin, Kola and Novovoronezh, Russia
 - Mochovce and Bohunice, Slovakia
 - Kozloduy, Bulgaria
- Fatigue monitoring system (FAMOS)
 - Kalinin, Russia
 - Mochovce, Slovakia
 - Kozloduy, Bulgaria

VVER References (4)

► NDT equipment

Since early 1980ie, AREVA supplies various non-destructive testing systems both to NPPs and to reactor manufacturer plants:

Country, NPP	Ultrasonic testing	Eddy-current testing	SG manipulators, etc.
Loviisa, Finland	◆	◆	◆
Paks, Hungary	◆	◆	◆
Dukovany, Czech Republic	◆	◆	◆
Vitcovice, Czech Republic			◆
Bohunice, Slovakia	◆		◆
Tianwan, China		◆	◆
Rovno, Ukraine	◆	◆	◆
Kola, Russia	◆	◆	◆
ZIO, Russia		◆	◆
Novovoronezh, Russia	◆		◆
Balakovo, Russia	◆	◆	◆

Backup: VVER Reference / проекты ВВЭР (6)

NPP Belene 2007- (canceled)

- ▶ **Main Contractor Atomstroyexport**
- ▶ **Sub-supplier AREVA with Siemens (~25%)**

◆ Safety and operational I&C

- Reactor Protection System (RTS, ESFAS)
- Reactor Limitation System
- Reactor Control System (ARM)
- Post Accident Monitoring System
- Passive Heat Removal Activation
- Plant Process Instrumentation
- Main and Emergency Control rooms
- Full Scale Simulator

◆ Auxiliary & emergency power supply

- MV-switchgears (6 kV)
- LV-switchgears (400 V)
- Uninterruptable power supply (batteries, inverters, converters)
- Power supply cables and I&C cables
- High frequency monitoring system
- Generator & transformer protection, generator excitation

◆ Heating-Ventilation-Air Conditioning / Hydrogen Recombiners

