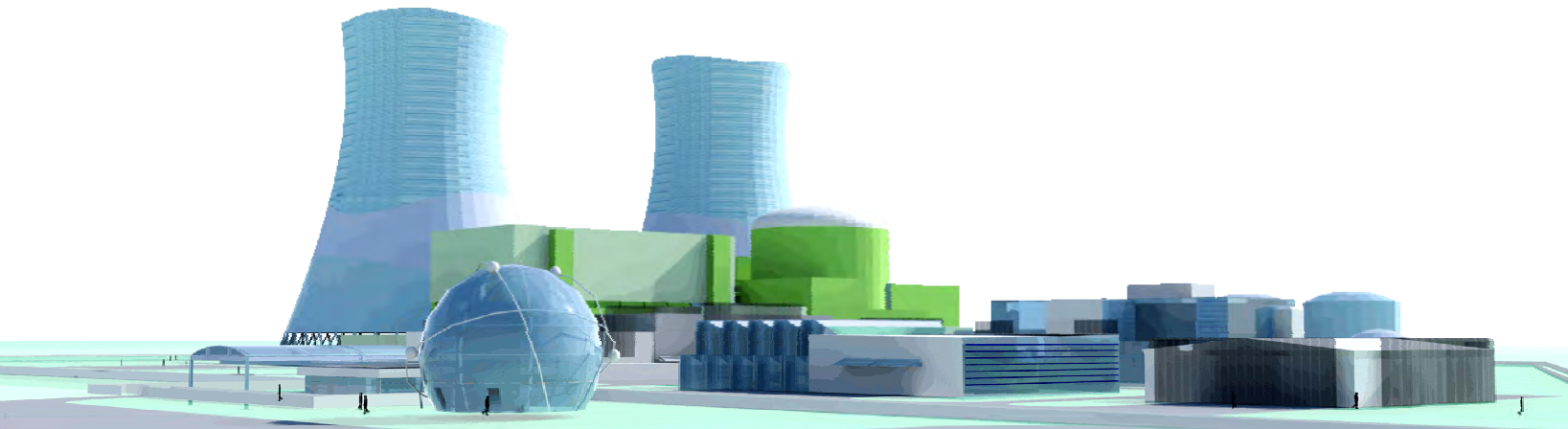




A

AREVA



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Challenges on the Road to the 1st National NPP — A Countdown

Invited Lecture at the International Conference “POWER PLANTS“
Vrnjačka Banja, SERBIA, 26–29 October 2010

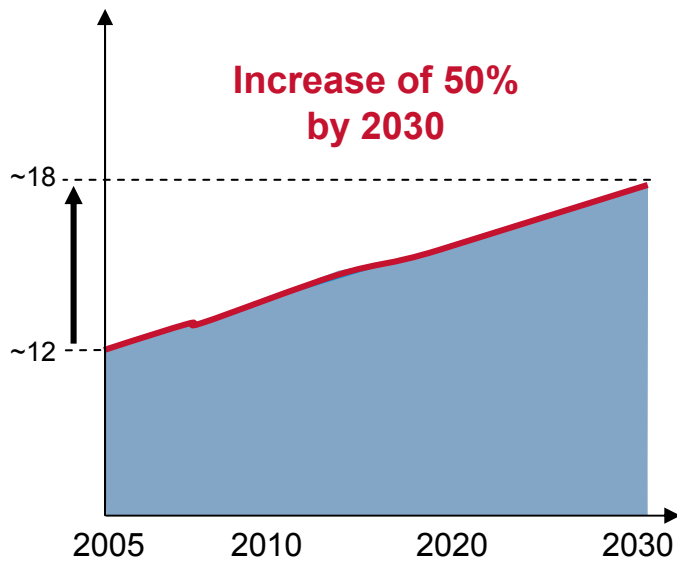


Drivers of Nuclear Development



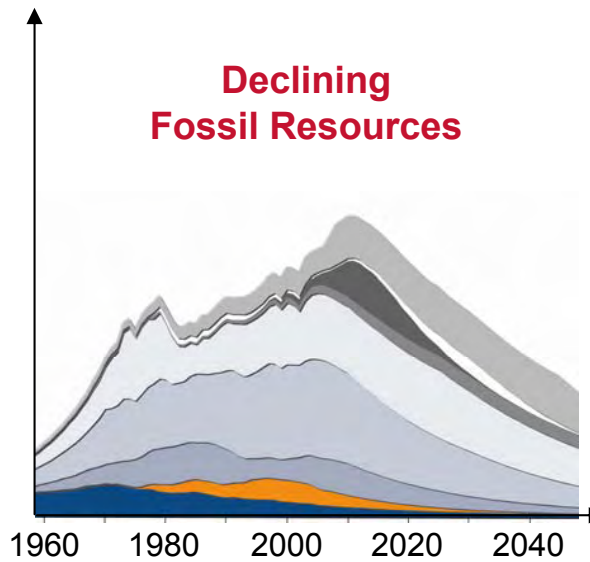
Energy Demand

World energy demand (Gtoe / y)



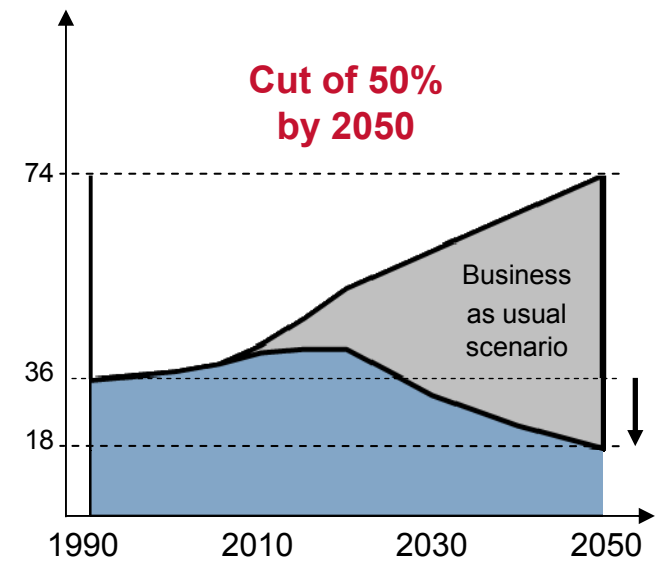
Oil & Gas Availability

Oil and gas world energy supply (Gtoe / y)



GHG Emissions

World GHG emissions (GtCO₂eq / y)



Nuclear has Limited Dependency on Fuel and Carbon Prices



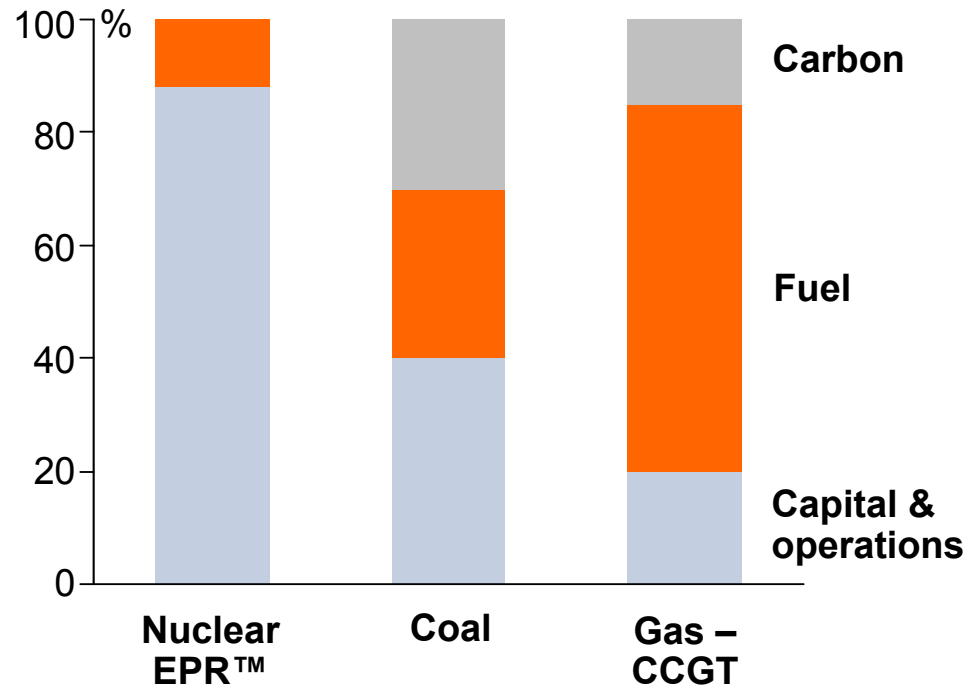
Methodology

- ▶ The production cost (also called Levelised Cost Of Electricity) includes all the expenses related to the power plant from its construction to the operation and final decommissioning. It is the minimum electricity price beyond which a project is profitable
- ▶ The production cost is a common standard in the power industry. It is a relevant indicator to compare the cost of electricity and attractiveness between different technologies with different lifetimes and cost structures

Typical breakdown of production costs

Commissioning in 2020 – base load operations

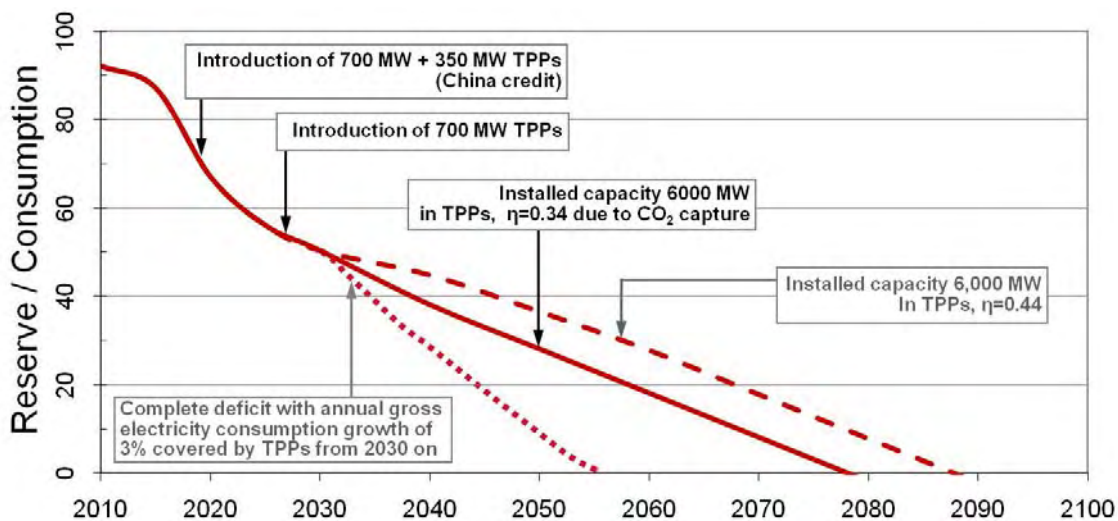
Carbon value 30 €/tCO₂



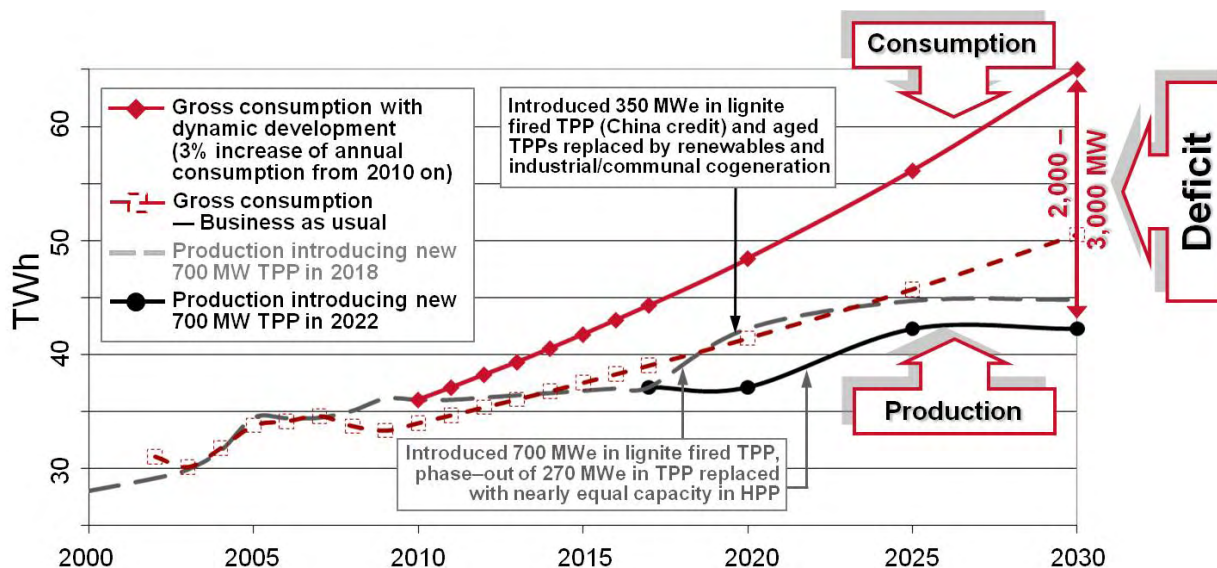
Source: AREVA analysis 2010

Coal Resources & Electricity Outlook

Source: Z. Stosic, V. Stevanovic, "Current Energy Status and Outlook for the Region", Workshop ENERGY MIX AND OUTLOOK OPTIONS FOR SERBIA AND THE REGION, Belgrade, 27–28 September 2010

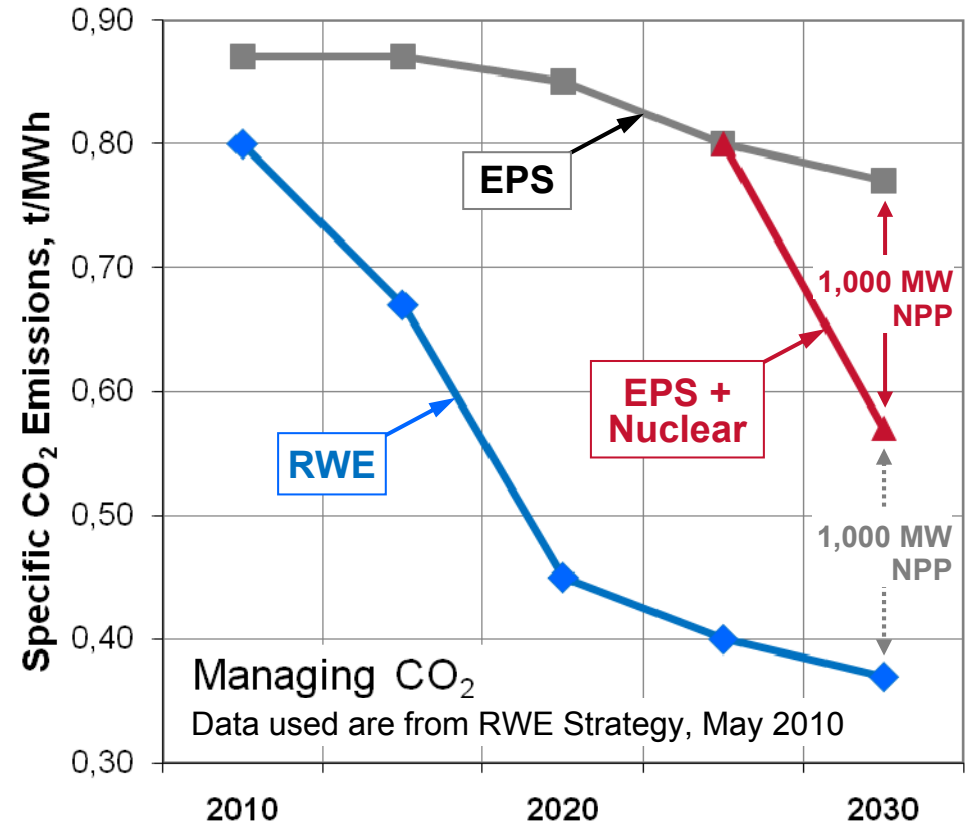
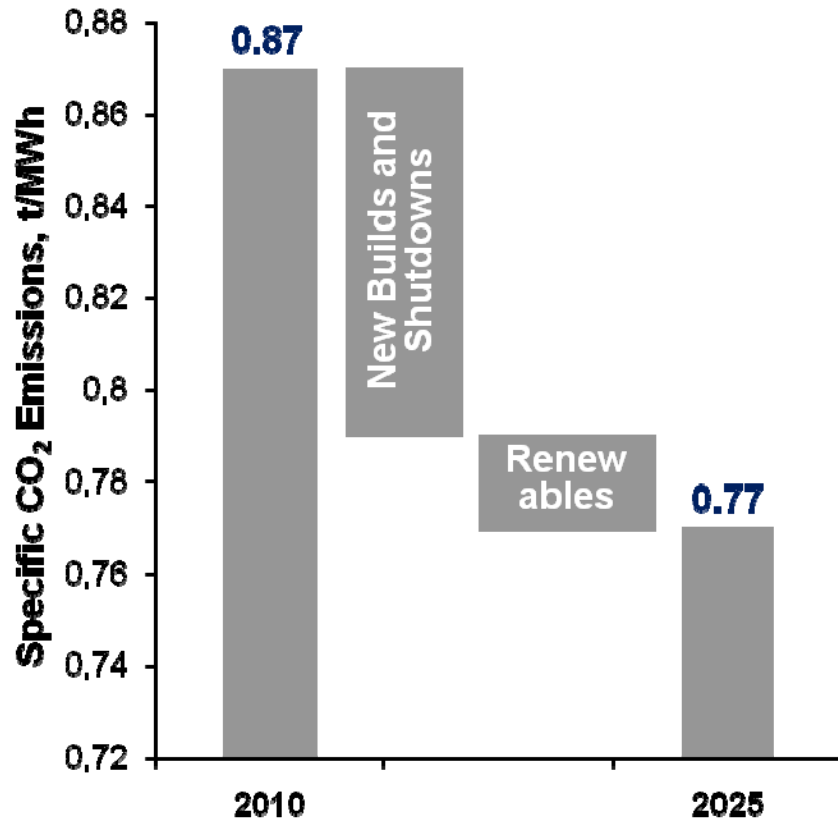


The lignite resources will be completely exhausted in just 45–75 years if the electricity consumption increase is covered only by lignite-fired TPPs



The capacity deficit will grow to the equivalent of about 1,000–1,500 MWe in 2020 and 2,000–3,000 MWe by 2030 (based on 7,500 h/year)

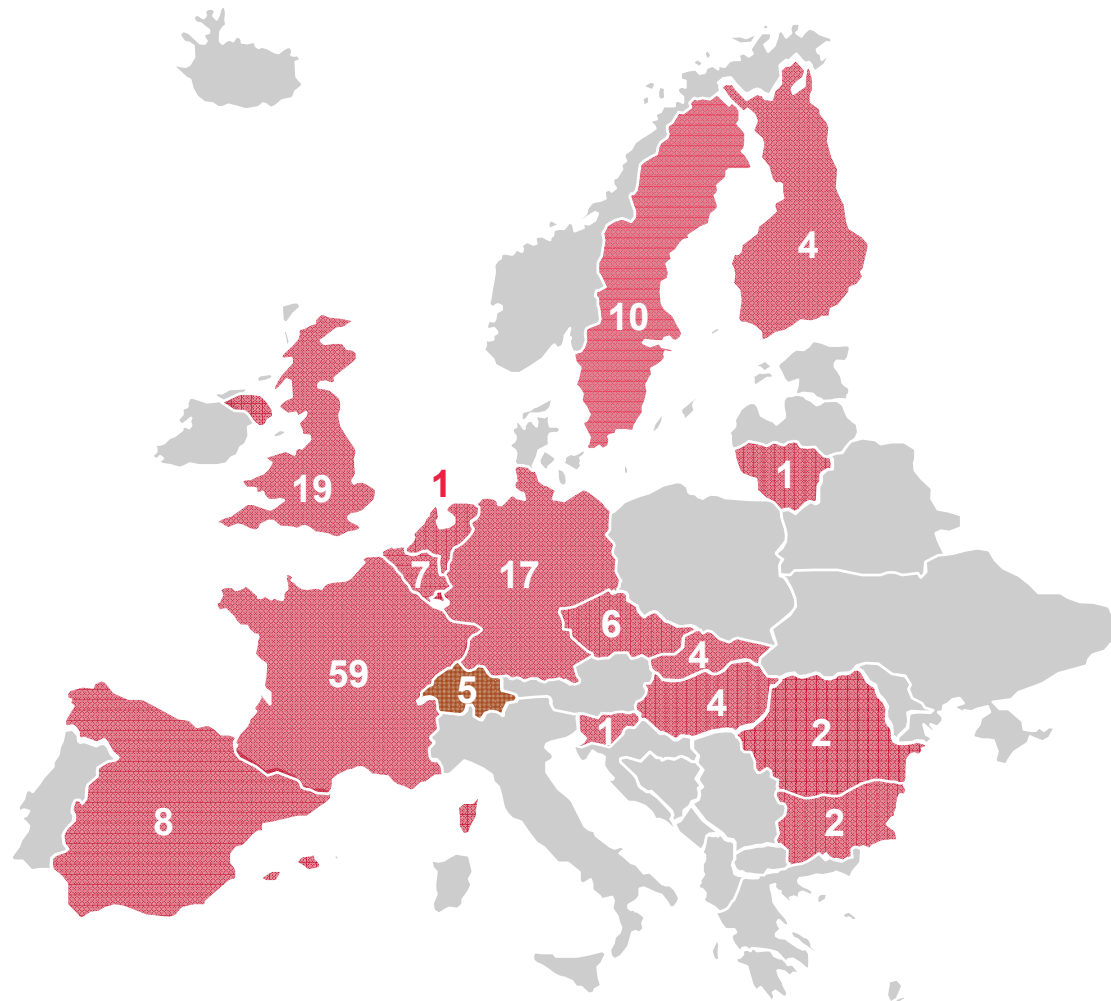
Strategy to Reduce CO₂ Emissions With Nuclear Option



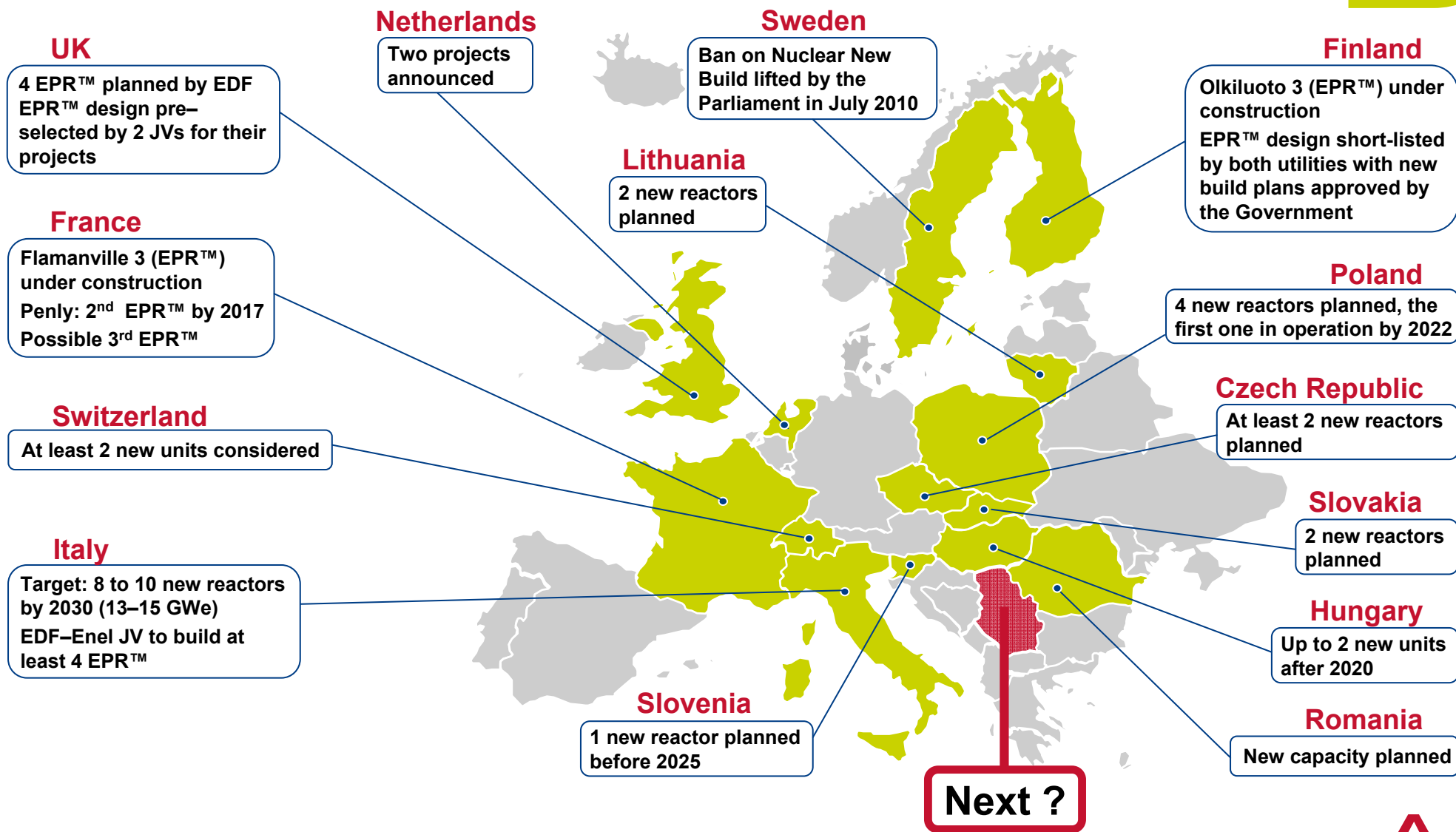
Source: D. Markovic, D. Zivkovic, A. Vlajcic, "Current Status and New Investments of the Electric Power Industry of Serbia", Workshop ENERGY MIX AND OUTLOOK OPTIONS FOR SERBIA AND THE REGION, Belgrade, 27-28 September 2010

Nuclear State of Affairs in Europe

- ▶ In the EU there are 150 operating NPPs...
- ▶ ...in 15 EU member countries plus Switzerland,
- ▶ ...producing ~1/3 of all the electricity in the EU



The European Nuclear Revival





- ▶ **How is it possible to have a NPP in commercial operation in the 202X timeframe**
- ▶ **All necessary steps and procedures are looked at backwards**
- ▶ **Different project scenarios** from vendor, regulator and utility are analysed under consideration of **IAEA requirements**
- ▶ **Project time line**, workforce planning and educational needs are also taken into account

Main Risk Factors for Investors in Power Generation

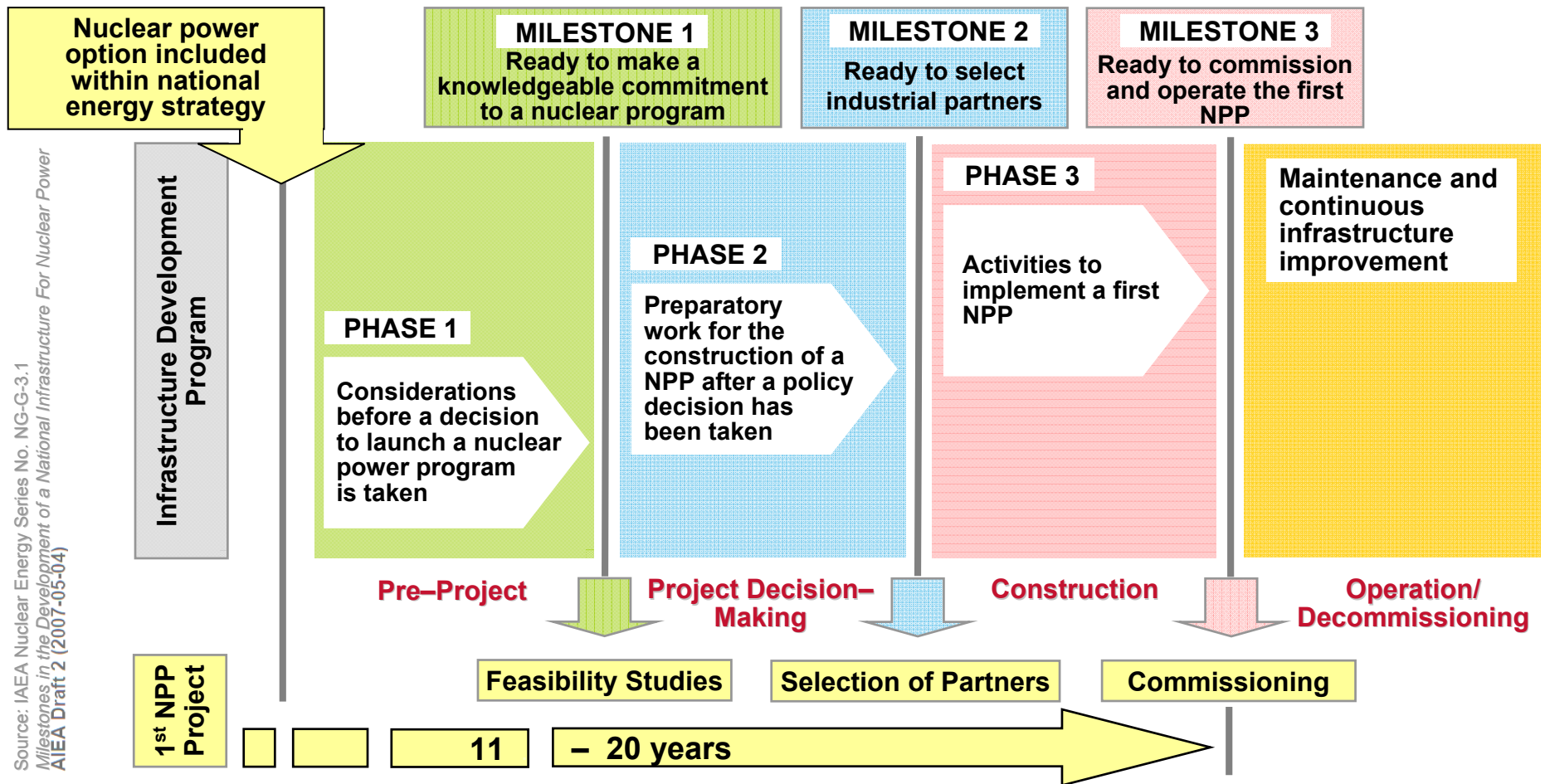


PLANT RISK	MARKET RISK	REGULATORY RISK	POLICY RISK
Construction costs	Fuel costs	Market design	Environmental standards
Lead time	Demand	Regulation of competition	CO ₂ constraints
Operational costs	Competition	Regulation of transmission	Support for specific technologies (renewables, nuclear, carbon dioxide capture and storage)
Availability / Performance	Electricity price	Licensing and approval	Energy efficiency



AREVA can help mitigate most of them to improve Serbia's energy supply and economy in a timely manner

Milestones of Development as Seen from the IAEA



Regulatory Framework



▶ Regulators

- ◆ Regulators should balance their dual role of enabling investments and protecting public interest
- ◆ Transparency, independence, clarity and readability needed

▶ Regulatory efficiency

- ◆ Regulators operate independently from the interests of all stakeholders and have adequate resources and competencies to fulfil their mandates
- ◆ Country develops policy and regulatory approaches in the context of specific and unique national circumstances

▶ Government

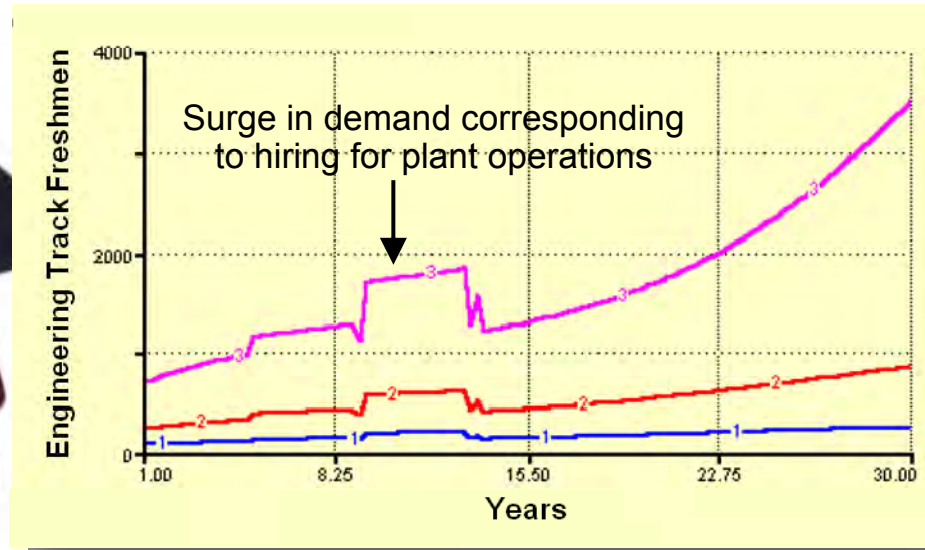
- ◆ Government action is needed to reduce regulatory uncertainty
→ clarify and simplify licensing, acceleration of the new unit approval
- ◆ Responsibility to balance interests should remain with governments rather than investors

Educational Needs

Nuclear New Build is a Significant Endeavour



Workforce Competition



Base entrant level to maintain competition in the workforce

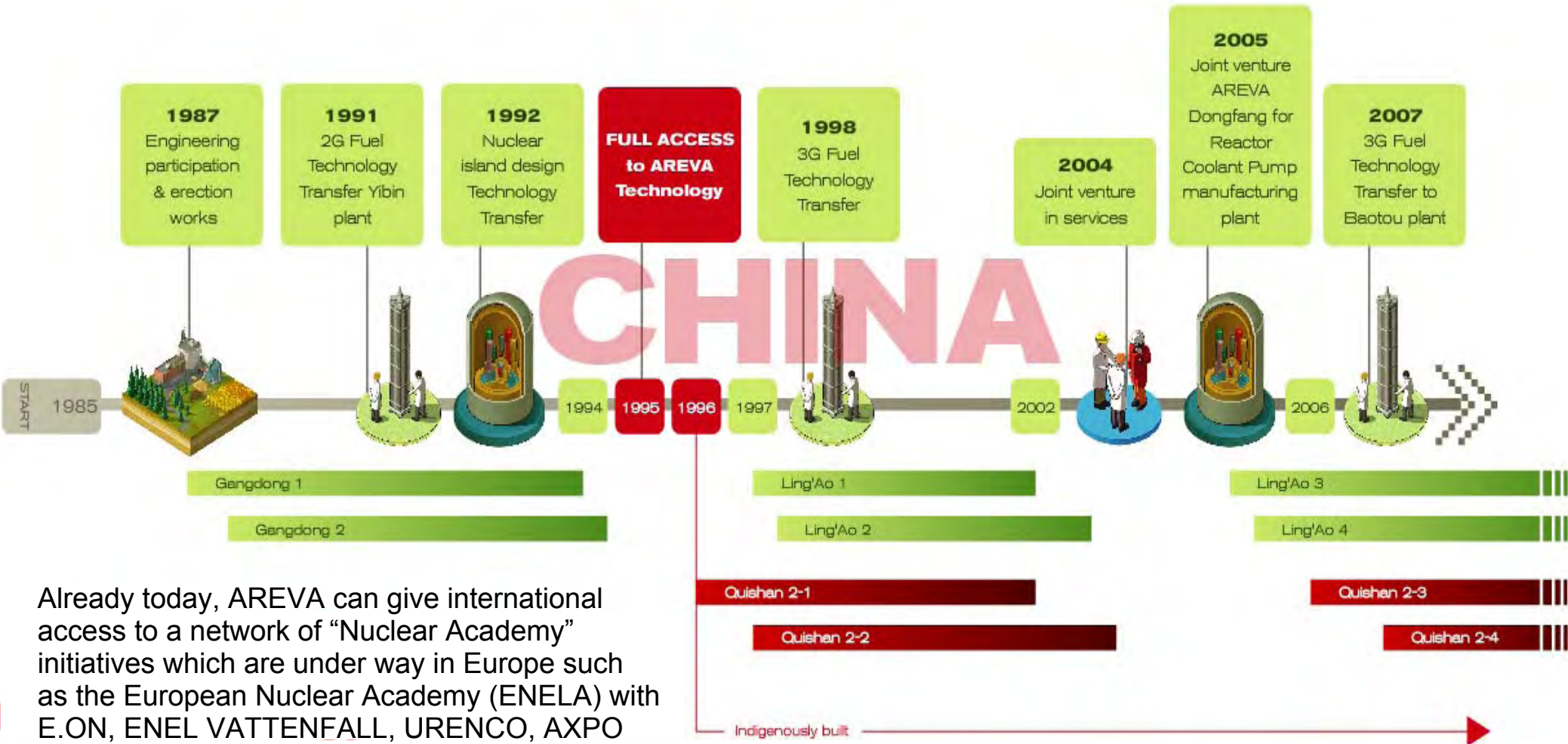
Base entrant level to support nuclear power and related industries

Base entrant level to maintain nuclear power workforce

- ▶ **Knowledge base**
 - ◆ **Universities** producing qualified engineers
 - ◆ **Research institutions** maintaining (applied) nuclear science
- ▶ **Regulatory body** with clear vision and proper resources
- ▶ **Electrical Utility** with nuclear vision as investor
- ▶ **Technical support organisations** for solving serious issues

Source: S.Scott, Int. Conf. on Human Resource Development for Introducing and Expanding Nuclear Power Programs, 14-18 March 2010, Abu Dhabi, UAE

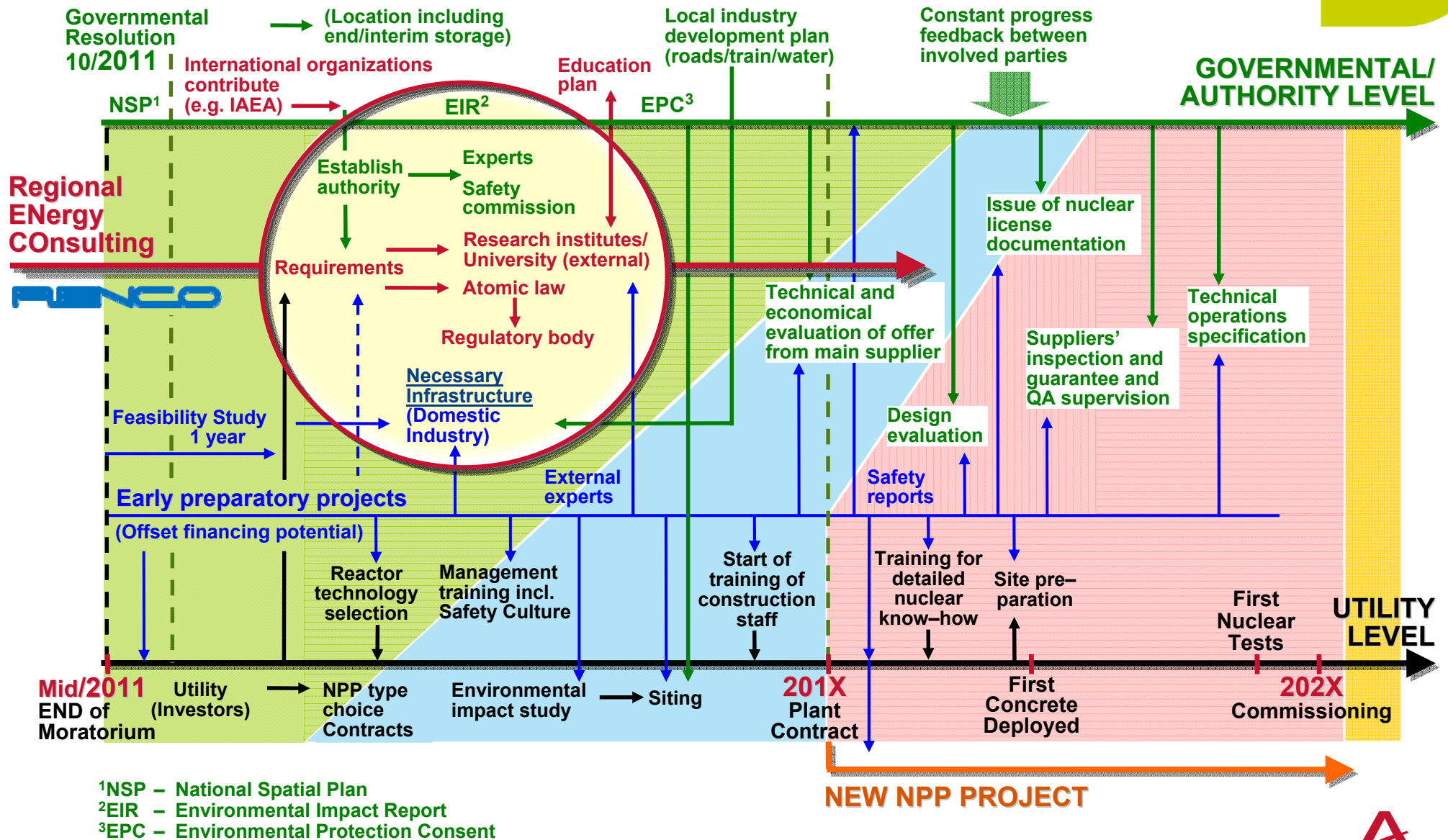
AREVA has a Proven Track-Record of Civil Nuclear Program Deployment Support



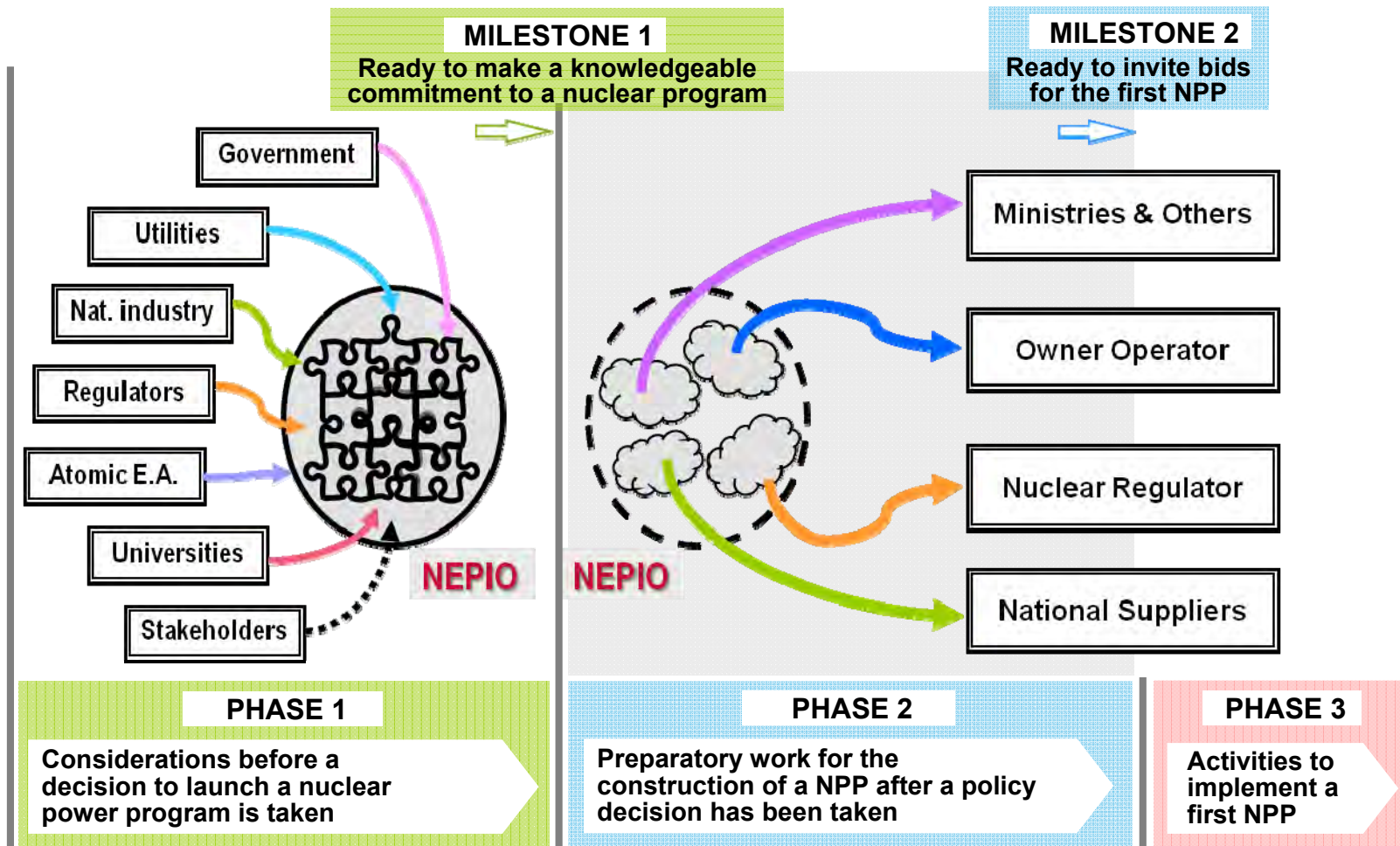
Already today, AREVA can give international access to a network of “Nuclear Academy” initiatives which are under way in Europe such as the European Nuclear Academy (ENELA) with E.ON, ENEL VATTENFALL, URENCO, AXPO

» AREVA’s experience can be leveraged to the advantage of Serbia

Road Map Serbia

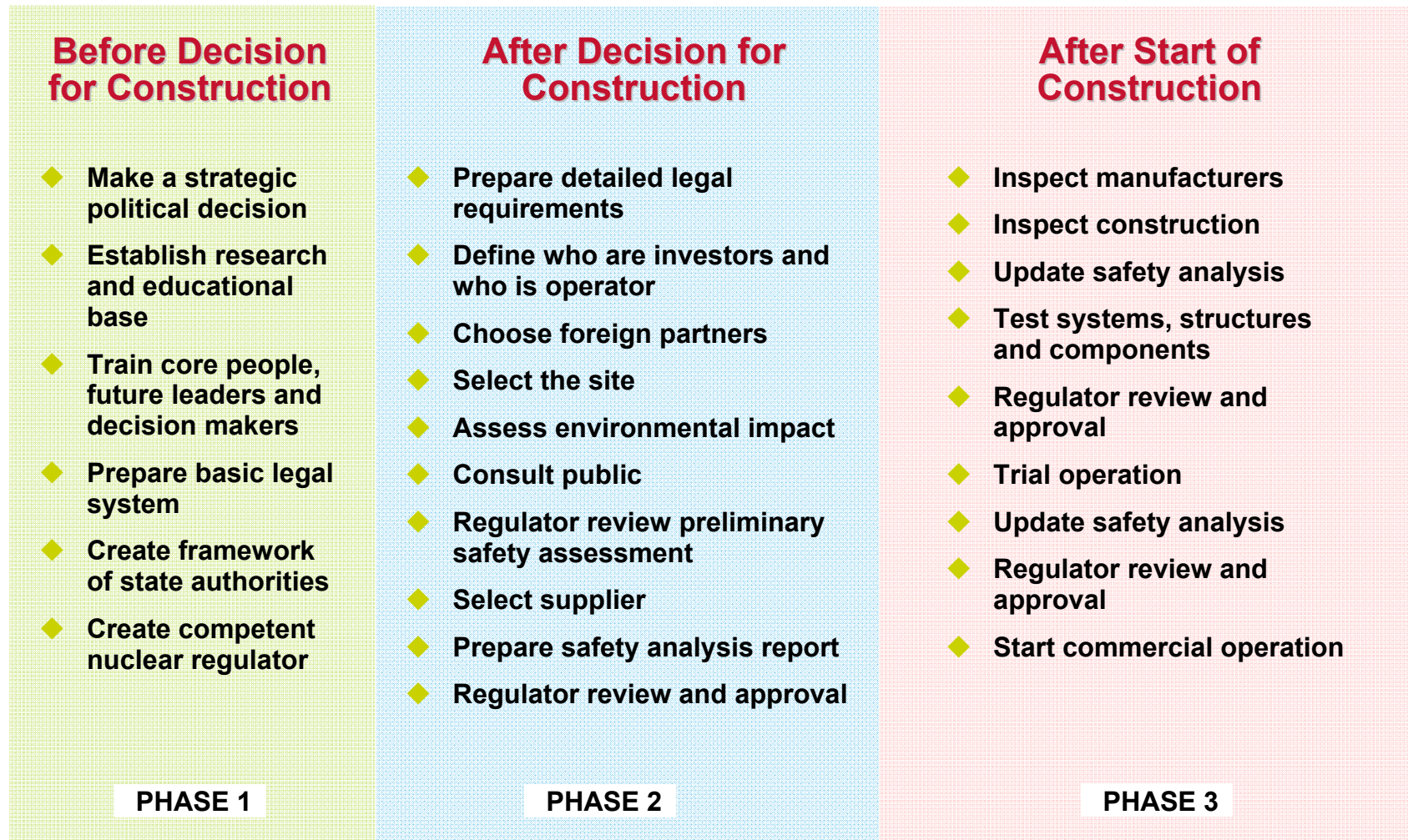


(Nuclear Energy Program Implementing Organisation)

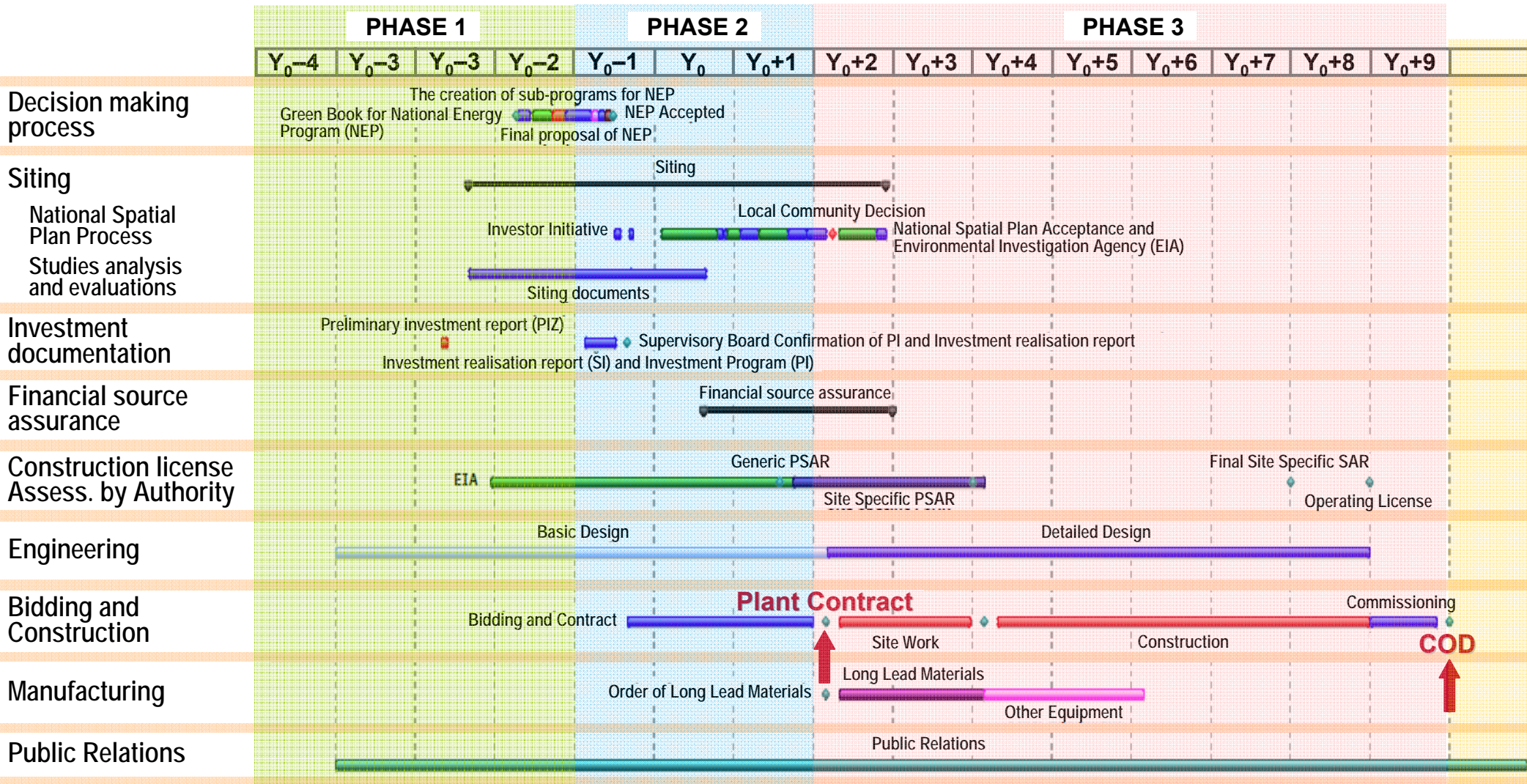


Source:
IAEA Nuclear Energy Series, No. NG-G-3.1, Milestones in the Development of a National Infrastructure for Nuclear Power.
INSAG-22, Nuclear Safety Infrastructure for a National Nuclear Power Programme Supported by the IAEA Fundamental Safety Principles; 2008;
IAEA Nuclear Energy Series, No. NG-T-3.2, Evaluation of the Status of National Nuclear Infrastructure Development.

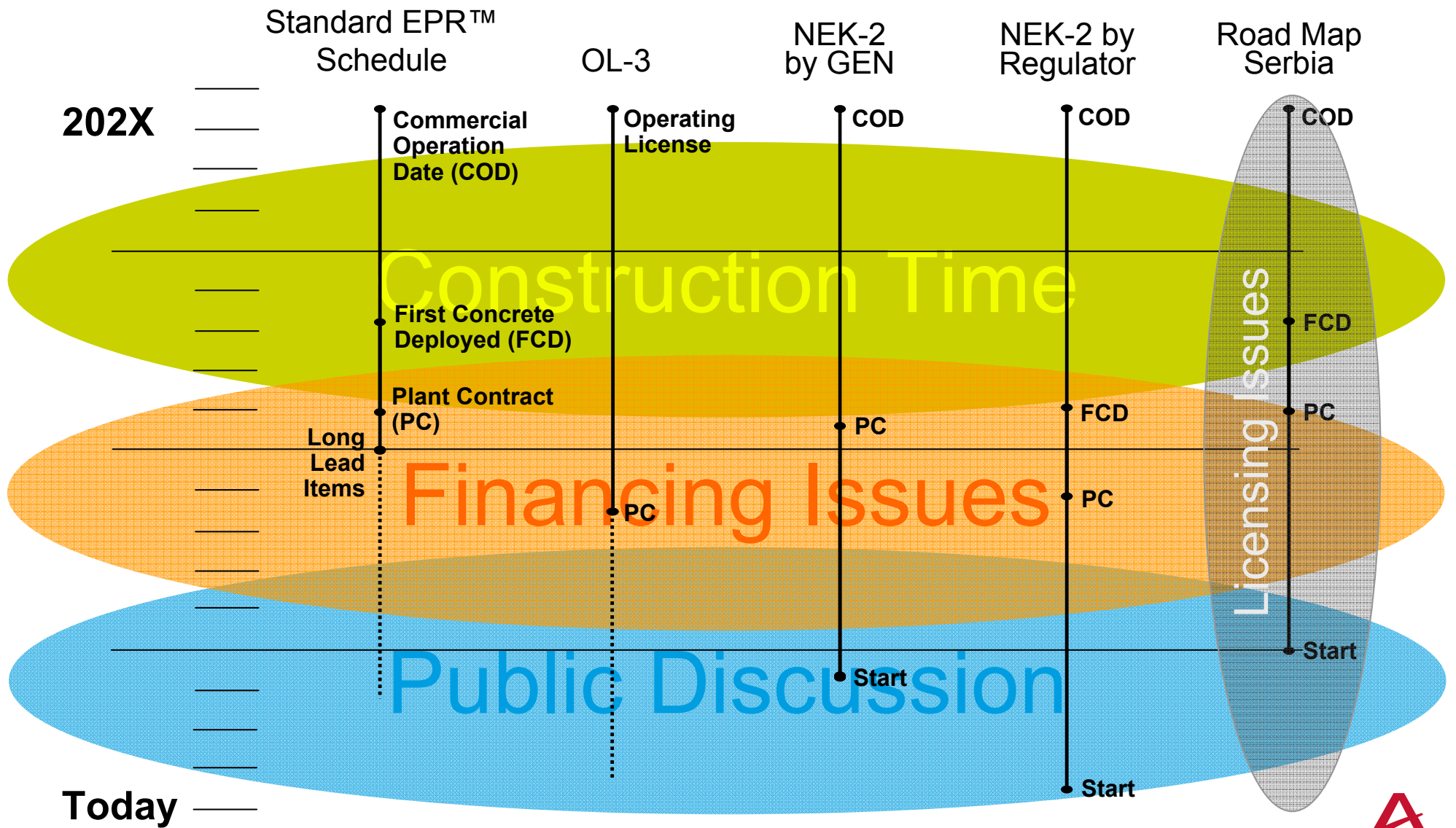
Embarking in Nuclear Power in 25 Steps — Very Simplified Primer



Project Timeline — NEK-2 Example



How Project Delivery Can Go Faster with AREVA Support and Knowledge



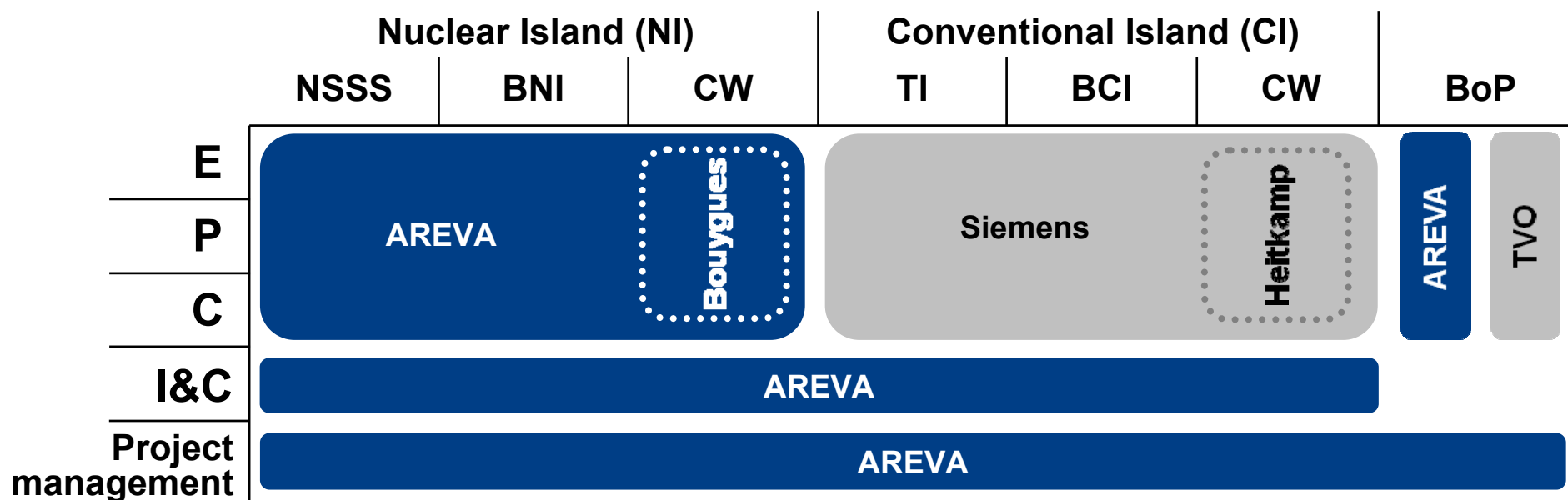
Good Project Delivery Requires Right Industrial Partnership & Industrial Scheme — 1/3

AREVA has field experience in different delivery schemes



OLKILUOTO 3

AREVA is the leader of the consortium and responsible for the NI (EPC) with Bouygues as subcontractor for the CW



■ Scope AREVA

E – Engineering and design
P – Procurement and delivery of equipment
C – Construction

BNI – Balance of NI
BCI – Balance of CI
BoP – Balance of Plant

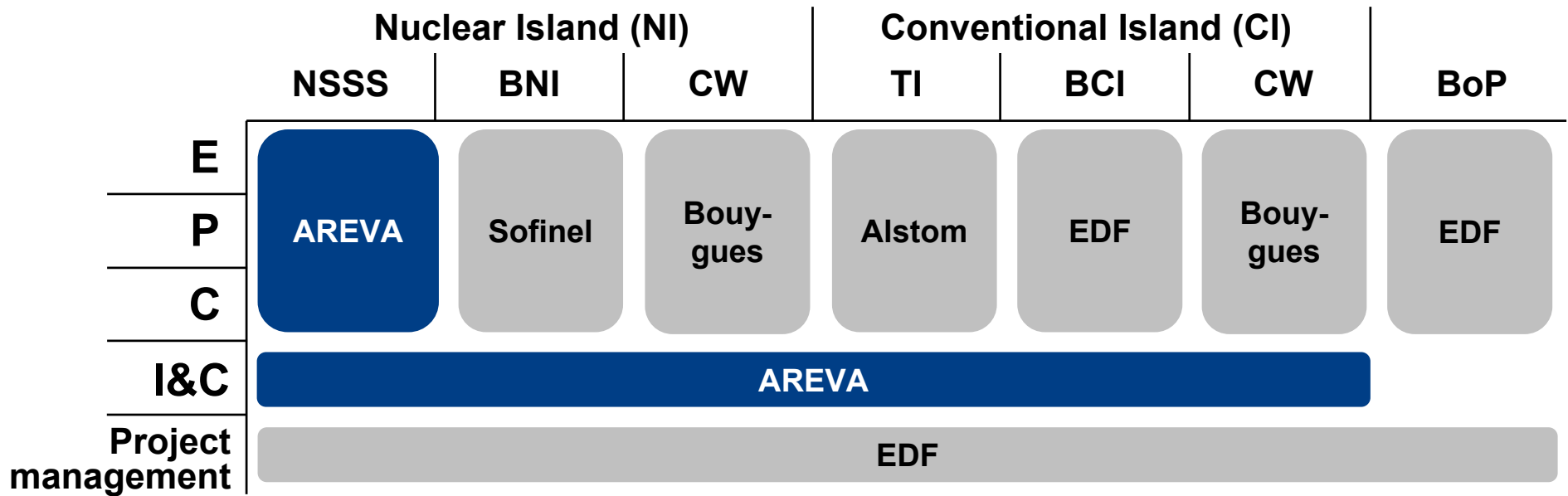
CW – Civil Works
I&C – Instrumentation and Control
NSSS – Nuclear Steam Supply System

Good Project Delivery Requires Right Industrial Partnership & Industrial Scheme — 2/3



FLAMANVILLE 3

AREVA provides the NSSS (EPC) and the I&C



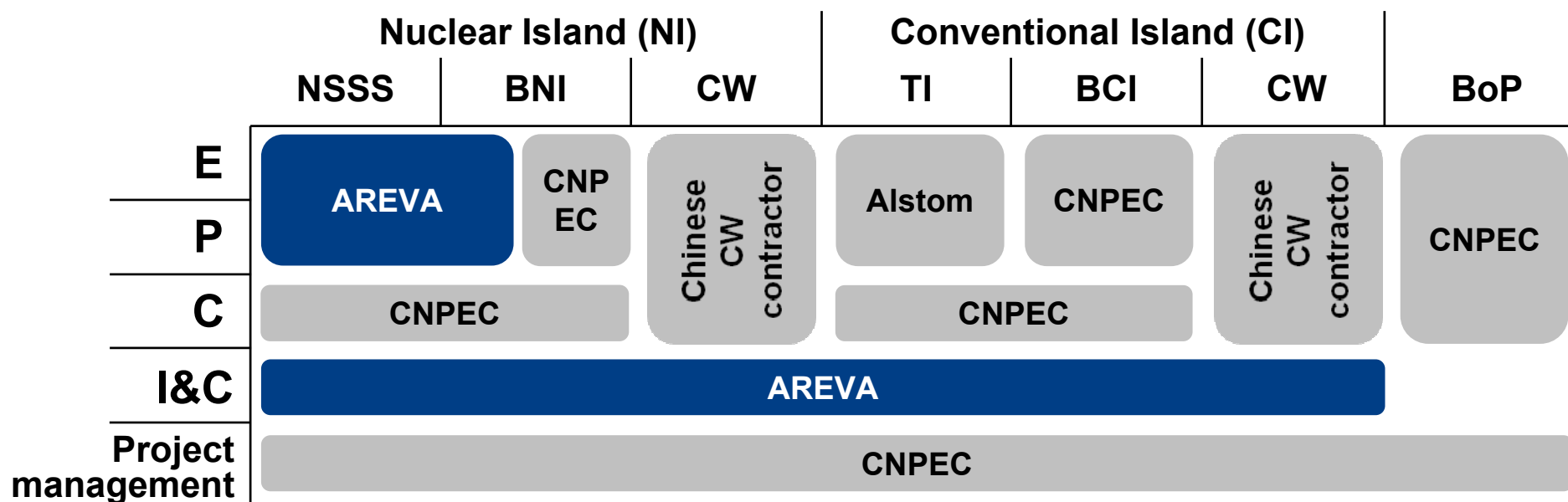
 Scope AREVA

Good Project Delivery Requires Right Industrial Partnership & Industrial Scheme — 3/3



TAISHAN 1&2

AREVA is member of the consortium supplying the NI (EP)



 Scope AREVA

>> AREVA has experience in and has the flexibility and potential partners to adopt the most appropriate scheme for project execution

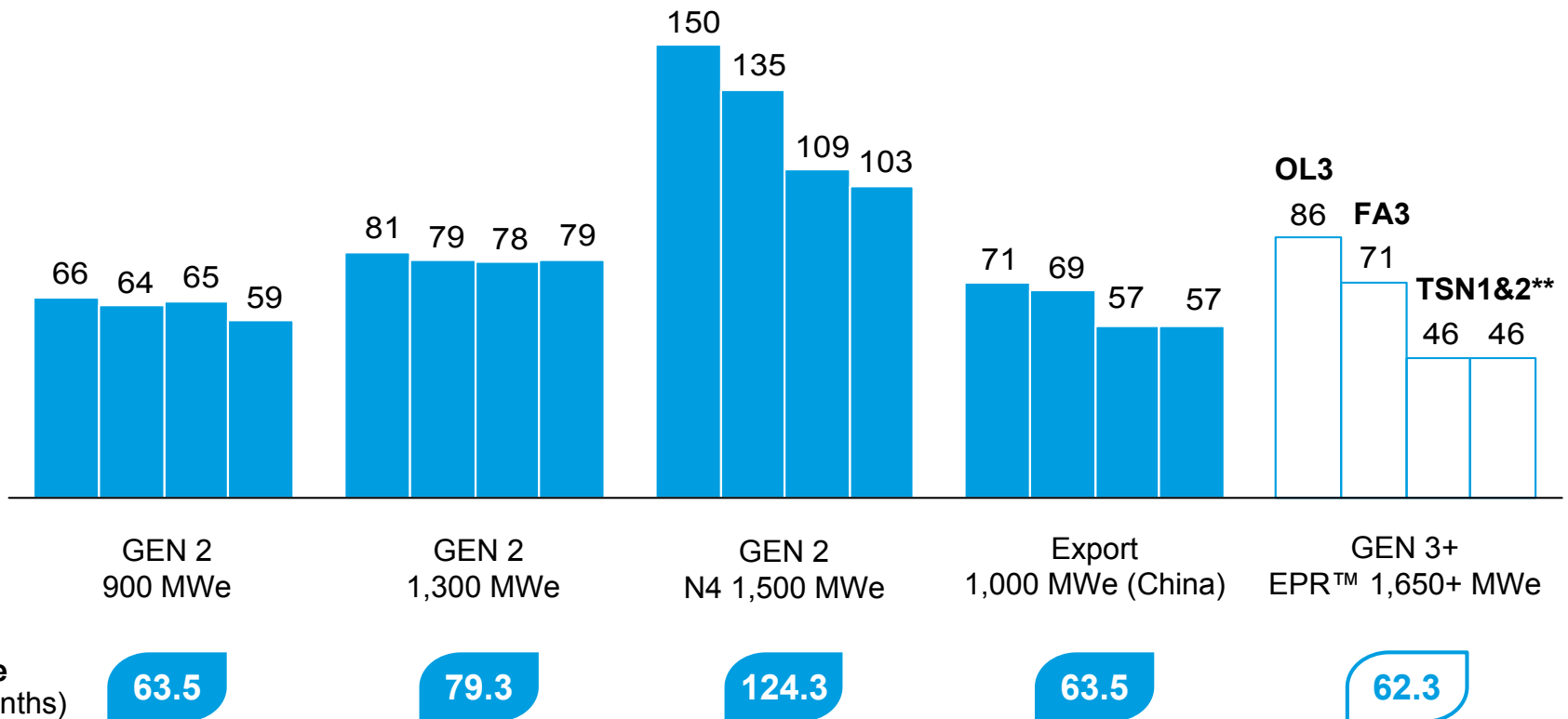
AREVA is Gathering Unique Construction Experience and Improving EPR™ Delivery Time



Time between 1st concrete and nuclear operation (# of months)*

* Based on the first four units in the reactor series

** Source CGNPC



- ▶ **“The coal reserves currently supplying the TPPs in Serbia will last at most for about 50 years” – Energy Minister Škundrić (28.09.2010)**
- ▶ **In 2025 Serbia will reach an electricity production deficit up to 2,400 MW and up to 3,000 MW in 2030**
- ▶ **“After dropping the Law on Banning nuclear energy, Serbia has to consider building NPPs to meet the increasing demand for electricity” – Energy Minister Škundrić (28.09.2010)**
- ▶ **Furthermore late in 2009 a cooperation of Serbia with the IAEA NEPIO department was already started**
- ▶ **With AREVA’s support and know-how, NPP project scenarios show it is possible to have a Serbian NPP in commercial operation in the 202X timeframe, but time is short**
- ▶ **All necessary early work measures and activities including education have to be approached in due time and every local and foreign supporting organisation should be taken into account seriously in order to keep the schedule**
- ▶ **The countdown for the 1st Serbian NPP is already ticking today!**

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Thank you
for your
attention!

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