AREVA and the EPR:  

Meeting the Challenge of the Nuclear Revival

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An integrated offer serving energy professionals

Front End Division

Reactors and Services Division

Back End Division

Transmission & Distribution Division

OTHER SOURCES OF ELECTRIC POWER

Transmission

Distribution
AREVA’s 2030 scenario: construction or life extension of more than 500 GWe of nuclear power

International institutions
- 833: WEO - 2007 Stabilization 450ppm
- 731: WNA - 2007 Upper
- 691: IAEA - 2007 High
- 529: WNA - 2007 Reference
- 525: WEO - 2007 Alternative
- 447: IAEA - 2007 Low
- 438: DOE EIA - 2006
- 415: WEO - 2007 Reference

AREVA
- Scenario

GWe net installed
- Theoretical end of life
- Life extension
- New construction

2006
- 372

2030
- 635
- 344
- 267

2010
- 186

AREVA
Installed nuclear generating capacity set to increase worldwide

Installed nuclear generating capacity - Forecasts (net GWe)

Rising demand and tight market in the front-end

Nuclear plant construction set to accelerate after 2010

- Replacement: ~100 reactors / Additional: ~35-300 reactors

Closed cycle to become the standard in the back-end
AREVA seeks to deploy its 3rd generation reactor

New installed nuclear generating capacity after 2006 by geographic area (2007 - 2030)

GWe Net


Europe 27 + CIS  N. & S. America  Asia  Africa  World
Our goals

We will

- Manage several large projects on an international scale
- Meet new market requirements
- Satisfy demand from our customers

“We expect to deliver 30 to 40 new power plants worldwide by 2020”
... Can it be done?

- 1955: 8 Units, 0.4 GWe
- 1965: 71 Units, 12.5
- 1970: 164 Units, 111.3 GWe
- 1980: 226 Units, 206.9 GWe

Source: www.iaea.org
An integrated manufacturing approach

- Continuous quality deliveries of products and integrated process improvements for existing plants and new build projects

- **Chalon Saint Marcel**
  - 30 years of operations
  - Workshop: 39 000 m²
  - Reactor Pressure Vessels, Steam Generators, Pressurizers, Safety Injection Accumulators

- **JSPM (Jeumont)**
  - Start of operation: 1898
  - Workshop: 13 000 m²
  - Reactor Coolant Pumps and Motors, Control Rod Drive Mechanisms

- **Sfarsteel (Creusot)**
  - Heavy forging and machining
  - Workshops: 85 000 m² (4 sites)

AREVA is building an industry not just plants
An integrated supply approach

Guaranteeing quality, delivery and support
Scope of subcontracted equipment and services that can be localized

- Auxiliary Mechanical Components
- HVAC-Equipment
- Piping
- Civil Works
- Electrical Equipment
- I&C Equipment (partly)
- Site Services and Other Equipment
- Construction and Erection Services
- Engineering Services

for the nuclear island, conventional island and BoP systems

and this concerns not only new build projects, but also backfitting activities to attain life time extension
A global supply chain approach

Insuring resource availability by building industrial supply schemes

- Simulator from Canada
- Main Generator from North Carolina
- Containment Liner from Poland
- Separators/Reheaters from Korea & Indonesia
- Pumps from Brazil
- Services (A/E, QA, Inspection, Erection)
- Components (Forgings & Manufacturing)
- I&C/Electrical
- Fuel Handling
The Renaissance challenge:

Offer a design that incorporates the best of what came before…

...while providing new benefits with the certainty of a proven and evolutionary technology
EPR is an evolutionary Generation III+

Proven PWR platform
- Capitalizes on 87 PWR built
- Capitalizes on major nuclear European players experience (EDF, EON and RWE having 55% of European nuclear fleet)
- Design based on Konvoi and N4
  - 7 units
  - 94 reactors year
- 40 years of operating lifetime

EPR enhanced characteristics
- High power output (1600+ MWe) with small footprint
- Enhanced operational performance
  - Total plant net efficiency (up to 37%)
  - Higher availability
  - Shorter outage
  - Enhanced fuel utilization and flexibility
  - Simplified design
- Enhanced safety
  - Resistant to airplane crash
  - Core melt retention system
  - 4 fold redundancy of safeguard systems
- 60 years of operating lifetime

EPR benefits
- Maximizes the power output per site
- Lowers operating, maintenance and fuel management costs
- Actual design meets current safety requirements and integrates future trends
- Designed to avoid any significant release to the environment

Safe, reliable and proven technology
Improved safety and economic performance
Safe, reliable and outstanding power generation and revenue
Redundant and diverse EPR safety systems

EPR is protected against:

- Multiple failure while providing online maintenance flexibility
  - 4 times redundant safeguard systems
- Common cause failures
  - Safety system diversity:
    - Every system has a diversified back-up
- External hazards through systematic physical separation of the safety systems

Proven evolutionary safety systems deliver high reliability levels
Consequences of a severe accident are limited thanks to both passive and active safety systems

Passive System (Short term)

1. Temporary retention in the reactor pit (gravity and metal gate)
2. Spreading in the large surface dedicated area (metal gate melting and gravity)
3. Flooding and cooling of the spreading area using IRWST (In-containment Refueling Water Storage Tank)

Active System (Long term)

1. Removal of containment heat:
   - Recirculation and coolant heat exchange
   - Containment spray system

No need for significant off-site measures improves Public acceptance
EPR aircraft hazard protection

EPR Designed to withstand impact of:

Large Commercial Jet & Military Aircraft

At various Elevations & From different Sides

Simply, yes, the EPR resists to commercial and military aircraft crashes.
EPR the only Generation III+ under construction

Under Construction

Olkiluoto 3, Finland
Flamanville 3, France

Project Preparation

Taishan 1, China
Calvert Cliffs 3, U.S.

3 years of operating experience by 2015
EPR design currently being licensed by other leading safety authorities

Construction License
- February 2005
- April 2007

Licensing Launched
- Submission December 2007
- Submission June 2007

AREVA supports a shorter licensing process by providing comprehensive reference documents
The in the future … what’s next?

- **USA**
  - DC documents submitted to NRC
  - Heavy Components ordered

- **South Africa**
  - 1. Proposal submitted

- **UK**
  - Generic Design Assessment on-going

- **Baltic Project**
  - in preparation

- **United Arabian Emirates**
  - in preparation
Progress in construction: activities on site
EPR the only Generation III+ under construction: Flamanville 3

First of the new EDF EPR fleet
Generating power and revenue by 2012
Project models for new builds

Nuclear Island

Turnkey projects for complete plants

With partners for the turbine generator part

Nuclear Steam Supply System (NSSS)
# Plants: current projects and tenders

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- **2003:** Contract
- **2005:** Certification & License

- **2005:** Preliminary design
- **End of public debate**
- **Planning 2006-2012**

- Partnership with Constellation: “UNISTAR”
- Licensing process started
- Startup scheduled before 2010

- Tender submitted in February 2005 for 4 EPR reactors
- Official decision expected

- Contracts for duplication of the Ling Ao nuclear plant (2nd Generation)

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Operators and owners benefit from EPR standardization

- With the EPR, you are always part of a fleet
  - Member of the owner / operator group (FROG)

Therefore, you will benefit from:
- Shared experience
- Worldwide availability of spare parts and expertise
- Qualified and proven design

EPR standardization lowers risk by:
- Reducing engineering and construction time and risks
- Reducing operating and maintenance costs
- Enhancing safety
Can the nuclear industry meet that challenge?

Yes we’re already making it happen at AREVA

It is not easy but it can be done ……. 