ATMEA1

THE PROVEN TECHNOLOGY READY FOR LICENSING AND CONSTRUCTION

Andreas Goebel

ATMEA

President and CEO

Summary

1. **ATMEA – The Company bringing AREVA and MHI capabilities**

2. ATMEA1 – The Reactor
   1. Main features
   2. A proven technology
   3. Top level safety
   4. Ready for licensing

3. ATMEA1 Business perspectives

A Joint Venture between two World Nuclear Leaders

ATMEA1

1 NUCLEAR ISLAND DESIGNED

ATMEA

A JOINT VENTURE
OF 2 WORLD
NUCLEAR LEADERS

AREVA
forward-looking energy

50%

MITSUBISHI
HEAVY INDUSTRIES, LTD.

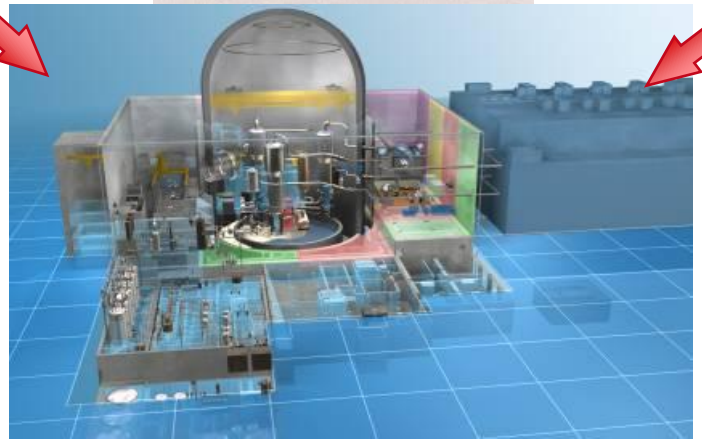
50%

ATMEA1 = Compilation of Nuclear Technology of MHI and AREVA

Integrated design based on proven technology

APWR

ATMEA1



Tomari 3

N4

EPR

KONVOI

Bringing
MHI PWR Construction Experience

Note: Number in ●/● indicates the number of loops in the plant.

① The 24th PWR plant entered commercial operation in Dec. 2009

Bringing AREVA Construction Experience

Track Record:
98 nuclear reactors delivered

4 ongoing EPR™ Construction Projects:


Olkiluoto 3 (Finland)


Flamanville 3 (France)


Taishan 1 (China)


Taishan 2 (China)

Support to Plant Completion:
Engineering, Procurement & Safety Upgrade

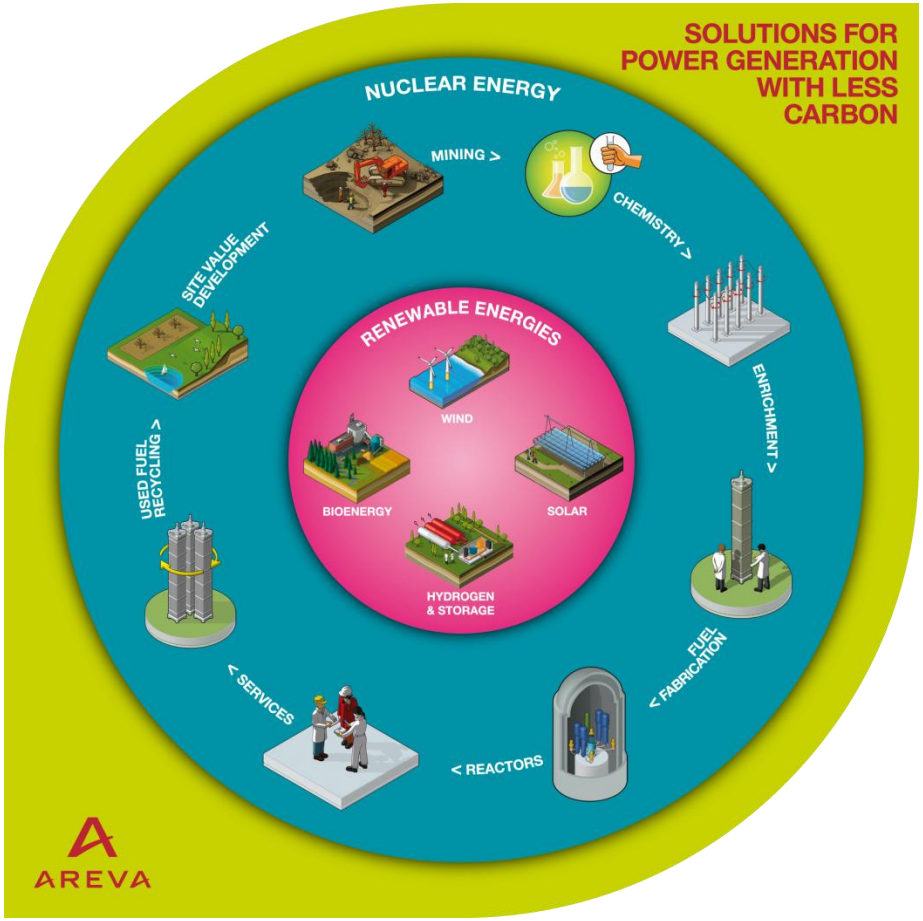

Angra 3 (Brazil)


Bellefonte (U.S.)

Next EPR™ Project:


Hinkley Point (U.K.)

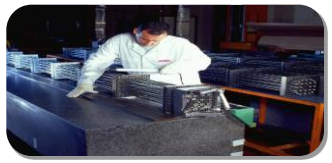
AREVA: Activities for Nuclear Energy



- **Having activities and capabilities in:**
  - **Mining (<300,000 tU delivered)**
  - **Conversion & Enrichment (<40 years experience & <370,000 tU delivered)**
  - **Fuel (135 reactors served & <200,000 assemblies supplied)**
  - **Reactors & Services: R&D, Design, Manufacturing, Procurement, Construction, Operation and Maintenance supports**
  - **Backend & Reprocessing (<27,000 tHM spent fuel treated, <25,000 canisters, <6,900 MOX fuel supplied)**

Bringing AREVA & MHI experience

- **Leveraging AREVA & MHI unique project delivery experience and best practices in Gen III+ reactors**



- **Supporting mining and fuel fabrication**

- **Serving Brazilian industry through localization**

- **Capitalizing on 25 years experience of technology transfer with Brazil**

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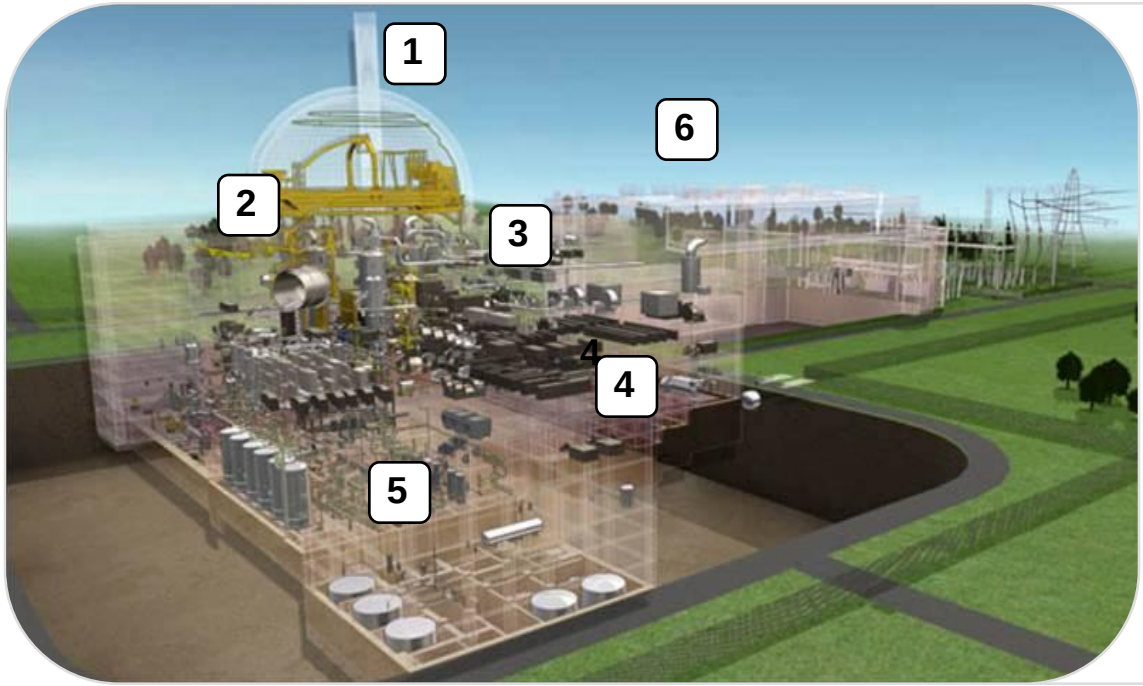
ATMEA1 Reactor Main Features

Reactor Type	3-Loop PWR	Safety System	3 train reliable active system with passive features + 1 diversified safety train
Electrical output	1100 MWe Class (Net)	Severe Accident Management	Core catcher Hydrogen re-combiners
Core	157 Fuel Assemblies	Resists airplane crash	Pre-stressed Concrete Containment Vessel
Steam Pressure	More than 7 MPa	I&C	Full Digital



1. Reactor Building
2. Fuel Building
3. Safeguard Building
4. Emergency Power Building
5. Nuclear Auxiliary Building
6. Turbine Building

ATMEA1: Bringing Benefits

State-of-the-art Safety Design as Generation-III+ NPP

Economy and reliability: Maximize benefits through 60 years operation

Power plant living together with people

Proven design: Use only experienced or fully validated design

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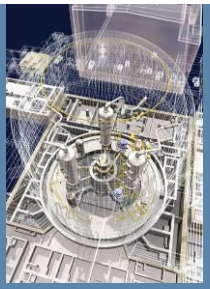
ATMEA1, a fully validated Reactor design



- **The ATMEA1 Reactor is composed of fully-operated, licensed or verified systems and components of AREVA and MHI nuclear power plants. It covers:**
  - **Systems and Structures**
    - **Systems and Components**
    - **Design Integration**
    - **Structures and buildings**
    - **Operation, maintenance and inspection of components**
  - **Manufacturing and Constructability**
  - **Licensing**

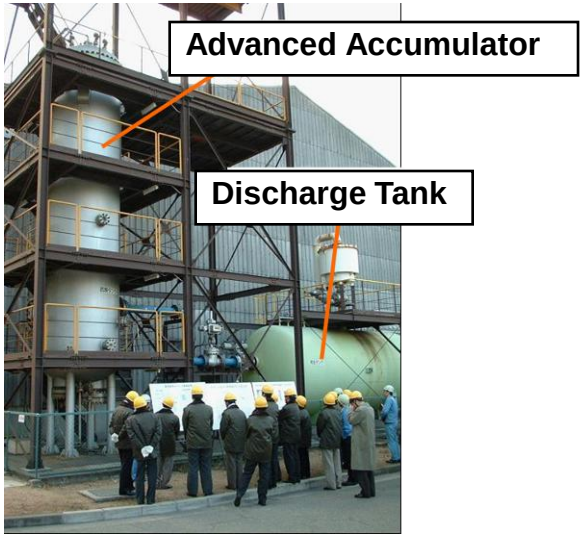
ATMEA1: A Proven Technology
Illustration for components (1/2)

- **ATMEA1 components have tens of years of operating experience in nuclear power plants**

Main ATMEA1 Components	Proven design from
Reactor Pressure Vessel	MHI + AREVA PWRs (more than 40 years, ~130 NPPs)
Fuel Assembly (17x17, 14ft)	N4, Doel-4, Tihange-3 (1985~, 6 NPPs)
Control Rod (B4C-AIC, 14ft)	N4 (1996~, 4 NPPs)
Control Rod Drive Mechanism	KONVOI (1988~, 3 NPPs)
Steam Generator with Economizer	N4 (1996~, 4 NPPs)
Reactor Coolant Pump	N4 (1996~, 4 NPPs)
Pressurizer	MHI + AREVA PWRs (more than 40 years, ~130 NPPs)
Main Coolant Pipe (Forged)	Tomari-3, Civaux-1, 2 (1997~, 3 NPPs)

ATMEA1: A Proven Technology
Illustration for components (2/2)

- **A few components were developed in order to improve reliability for 60 years or to simplify the system design**
- **All such components have already been fully tested and validated**
- **Most of them have already been manufactured and constructed**



Full scale test of advanced accumulator

Main ATMEA1 Components	Proven design from
Heavy Neutron Reflector	**EPR** **Already licensed / manufactured**
Advanced Accumulator	**APWR** **Full scale tested**

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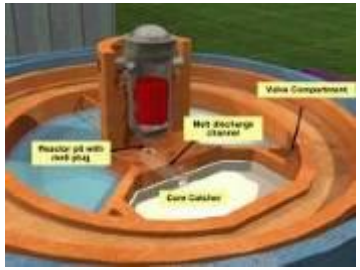
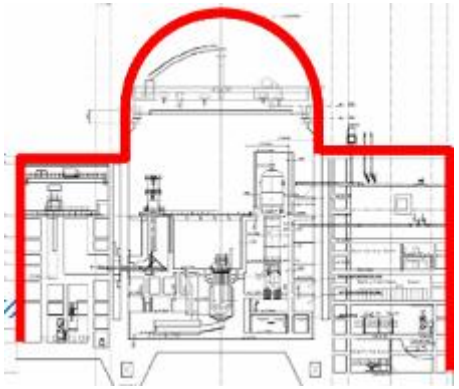
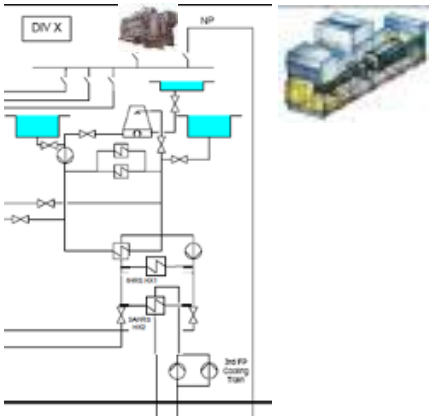
ATMEA1: Top Level Safety GENIII+ Reactor



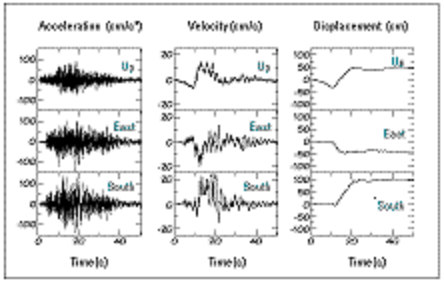
SEVERE ACCIDENT MITIGATION



APC PROTECTION

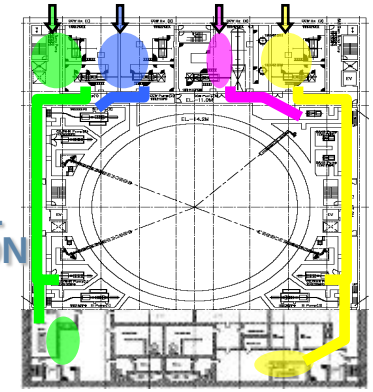


DIVERSITY IN HEAT SINKS & POWER SOURCES (DIVISION X)



HIGH SEISMIC RESISTANCE

PHYSICAL SEPARATION

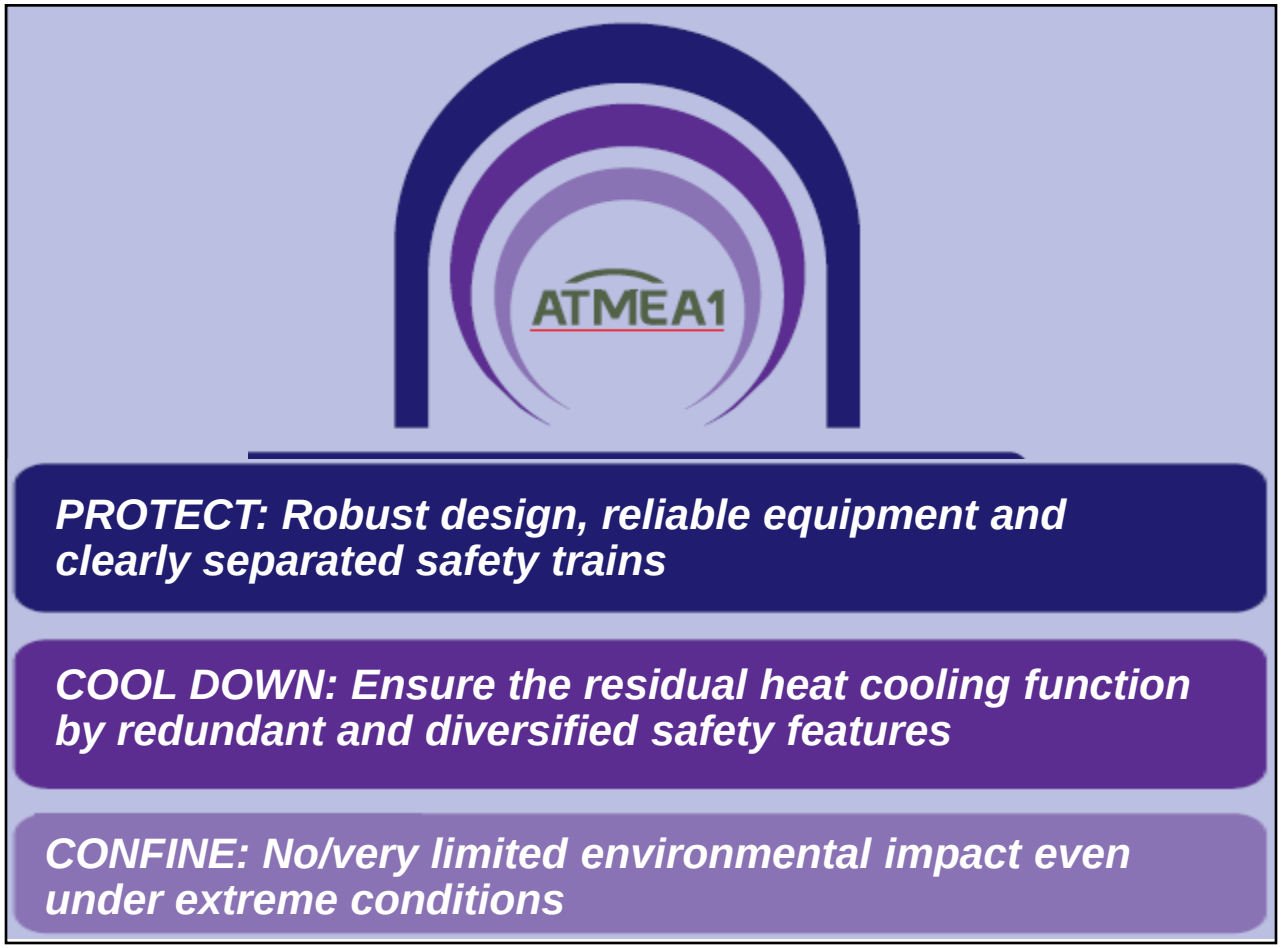


PROVEN DIGITAL I & C

ATMEA1: Top Level Safety GENIII+ Reactor

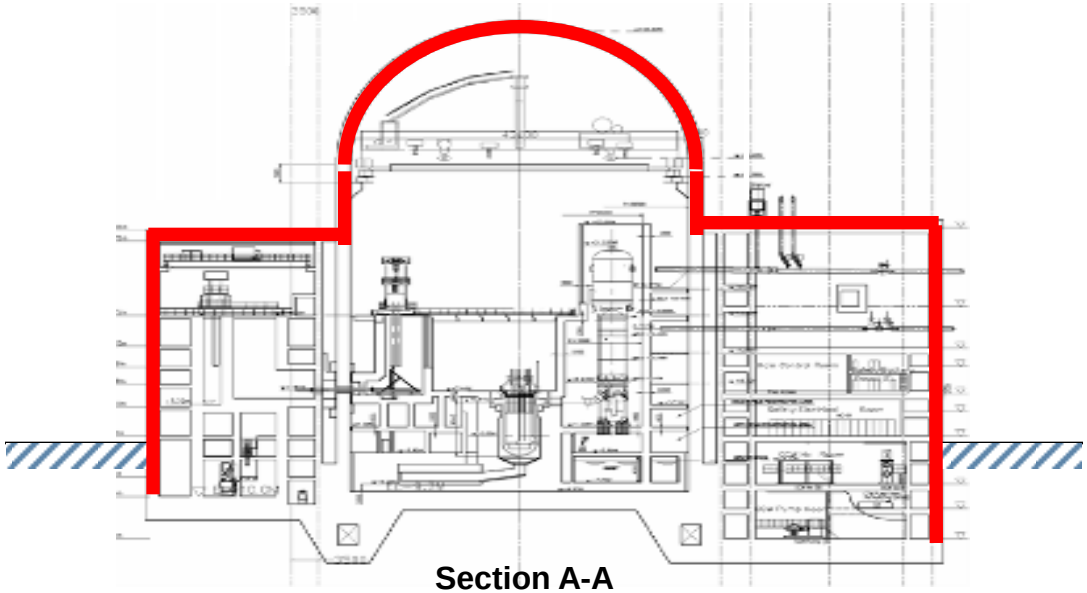
ATMEA1 robust design with its redundant and diversified safety features ensures best-in-class safety

Internal events - External hazards - Internal hazards



Using realistic analyses, incorporate into the design necessary features to ensure that:

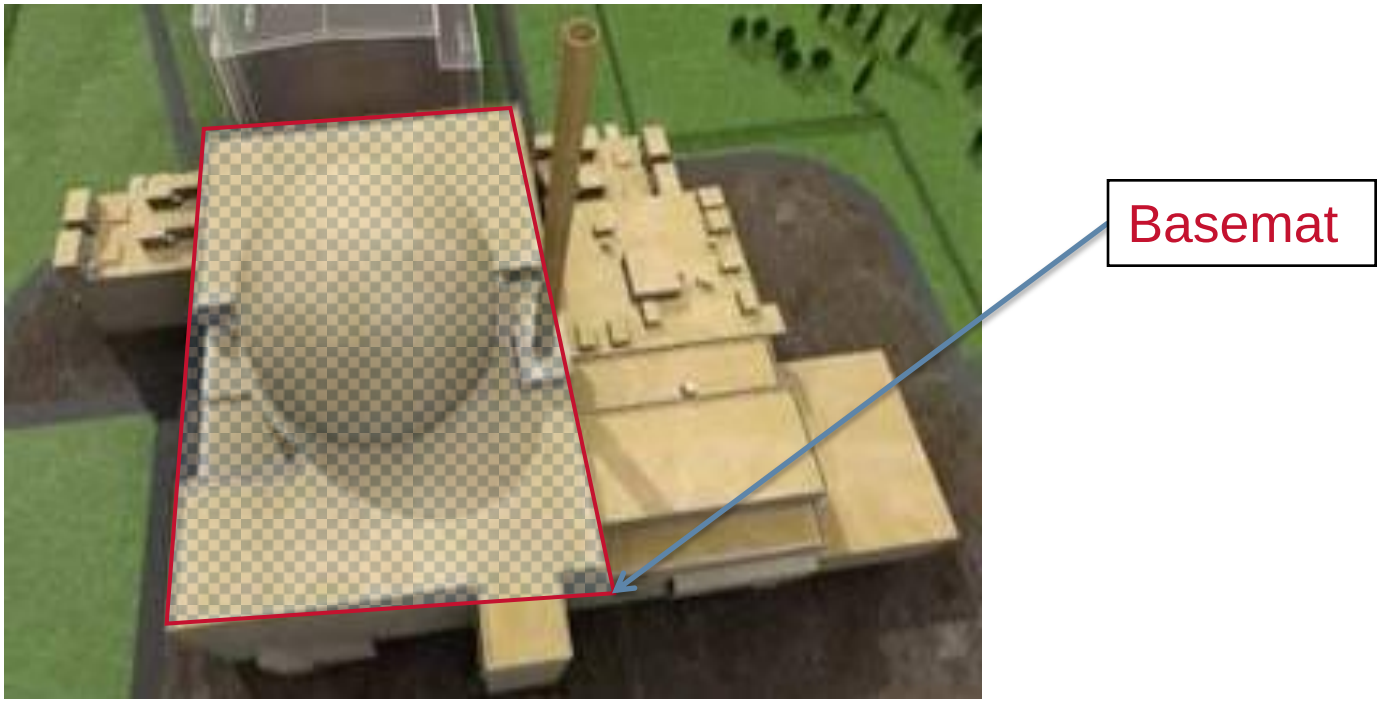
- **The reactor core remains cooled and the containment function is maintained**
- **Spent fuel cooling and spent fuel pool integrity is maintained**
- **No-offsite countermeasures necessary**



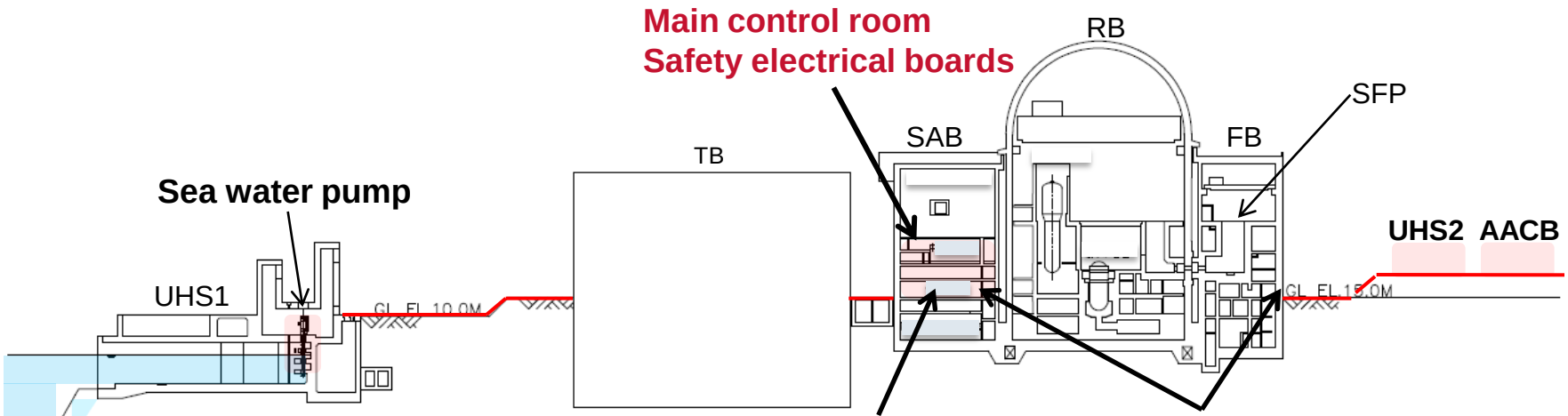
Section A-A

APC shield wall

- Thickened outer walls of buildings against seismic shear forces
- Large rectangular basemat to improve seismic stability
- Functions of reactor and primary system, fuel pool, all safety systems to be kept against seismic events
- Standard conditions: SSE 0.3g with US spectrum (RG 1.60)



- The ground level is set to a sufficient level to avoid consequences from a Tsunami
- Important buildings are protected with water-tight walls and doors
  - Fuel building, Reactor building, Safeguard building
  - Emergency Power sources buildings, AAC building
  - Essential Service Water System route
- Electrical equipment and I&C equipment are located in upper floors



Cool Down
Support Systems

Redundancy, diversity and independency:

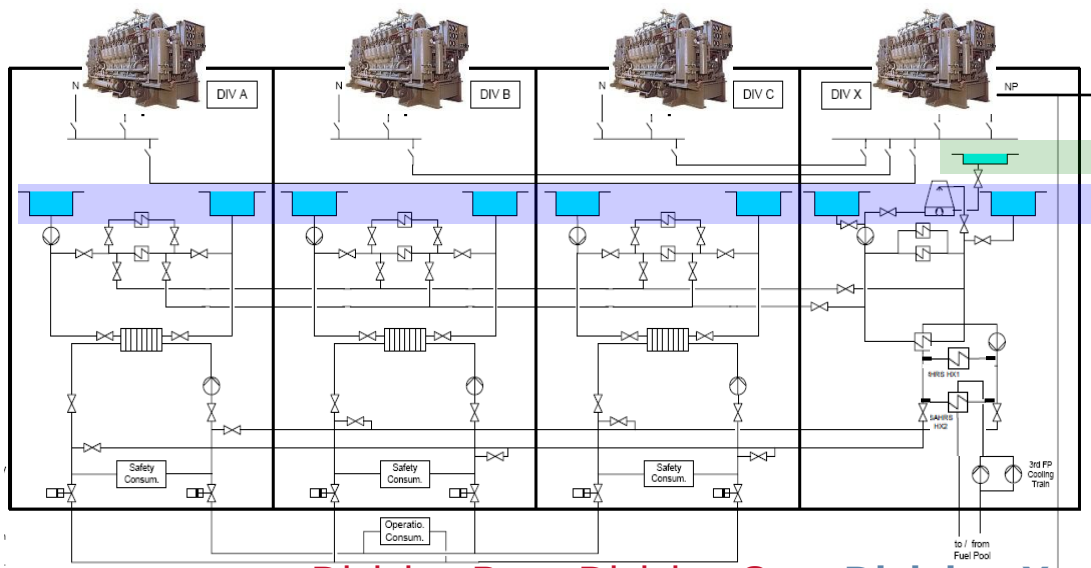
- **3 x 100% trains (cooling chain) + 1 diversified train**
- **Diversified power sources and heat sinks**
  - **4 emergency power sources (EPS) + 1 diversified Alternative AC power (AAC)**
  - **1 ultimate heat sink (UHS1, sea water or river) + 1 diversified heat sink (UHS2, atmosphere)**
- **Clear separation between trains (Divisions)**

Power supply

Heat sink

Cooling chain

Consumers



Division A Division B Division C Division X

AAC

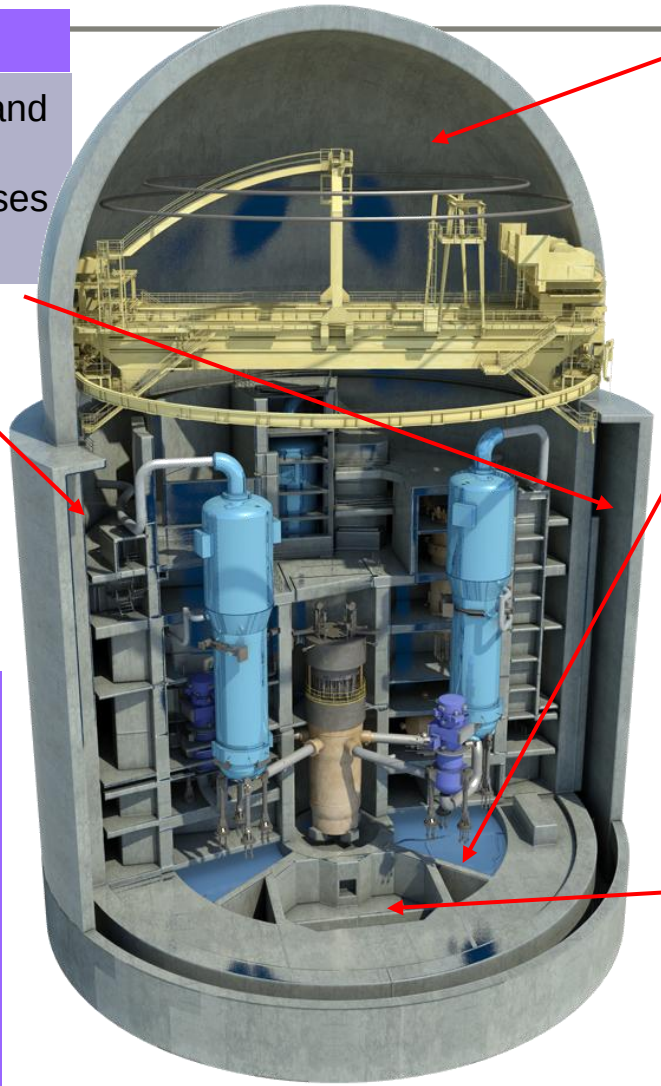
UHS1
Sea water or river

UHS2
E.g. atmosphere through a cell cooler

Confine
Severe Accident Mitigation

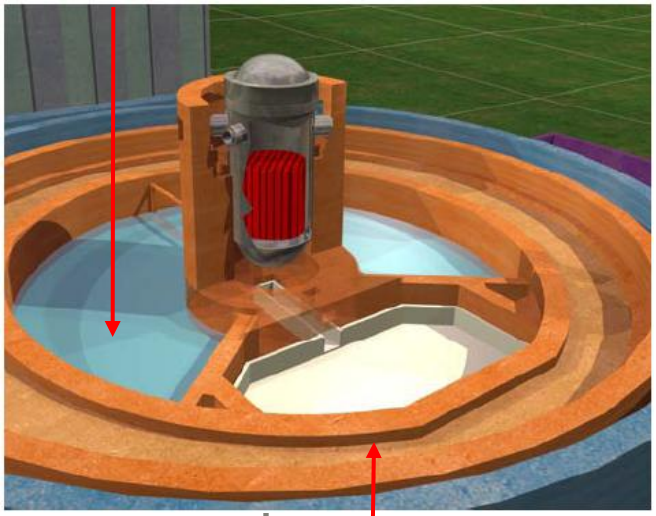
Annulus

Sub-atmospheric and filtered to reduce radioisotope releases



Pre-stressed containment vessel with Steel Liner

In-Containment Refueling Water Storage Pit



Core-catcher

For long-term Severe Accident Mitigation

All potential leakages are prevented or processed and filtered

Extreme External Hazards Response

- **Highly unlikely extreme external events (e.g., extreme seismic events, external flooding, etc.) present challenges to nuclear power plants**

- **ATMEA1 design against extreme external hazards**
  - **Extend protection of necessary "permanently installed equipment" against extreme condition and use them**
    - **AAC, UHS2, Division-X**
  - **Mitigation of radiological consequences in case of a severe accident**
  - **Maintain the plant to a safe shutdown state for 7 days* before offsite means are needed**
- **For each site, the design is defined considering:**
  - **Site plausible hazards**
  - **Site/country specific regulatory requirements, site specificities, emergency capabilities**

* 7 days assumption is to be assessed with site-specificities

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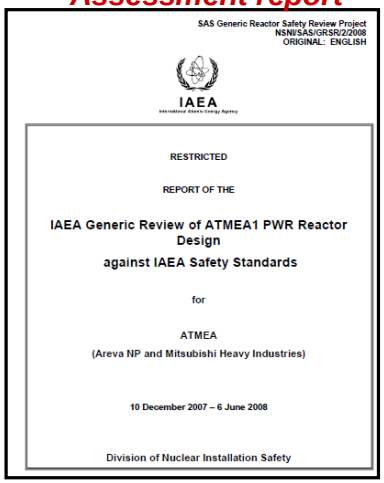
ATMEA1 Ready for Licensing

IAEA Assessment report



SAS Generic Reactor Safety Review Project
NSNI/SAS/GRSR/2/2008
ORIGINAL: ENGLISH

IAEA

RESTRICTED

REPORT OF THE

IAEA Generic Review of ATMEA1 PWR Reactor Design
against IAEA Safety Standards

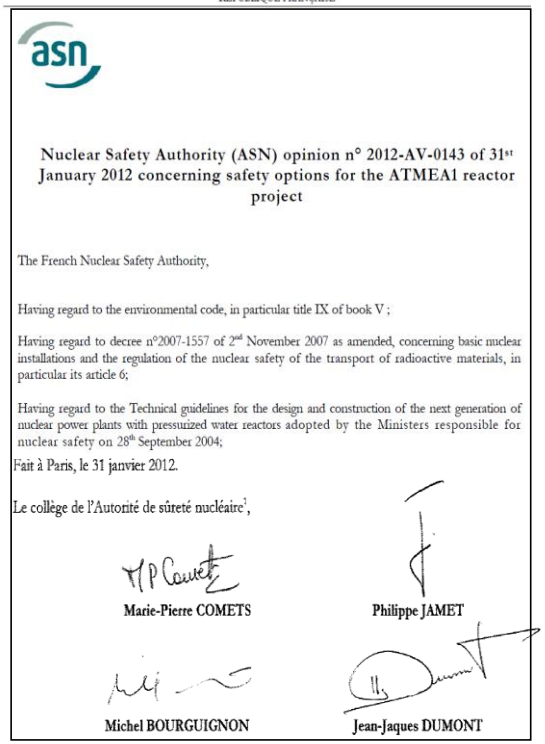
for

ATMEA
(Areva NP and Mitsubishi Heavy Industries)

10 December 2007 – 6 June 2008

Division of Nuclear Installation Safety

French Safety Authority (ASN) Assessment



RÉPUBLIQUE FRANÇAISE

asn

Nuclear Safety Authority (ASN) opinion n° 2012-AV-0143 of 31st January 2012 concerning safety options for the ATMEA1 reactor project

The French Nuclear Safety Authority,

Having regard to the environmental code, in particular title IX of book V ;

Having regard to decree n°2007-1557 of 2nd November 2007 as amended, concerning basic nuclear installations and the regulation of the nuclear safety of the transport of radioactive materials, in particular its article 6;

Having regard to the Technical guidelines for the design and construction of the next generation of nuclear power plants with pressurized water reactors adopted by the Ministers responsible for nuclear safety on 28th September 2004;

Fait à Paris, le 31 janvier 2012.

Le collège de l'Autorité de sûreté nucléaire,

Marie-Pierre COMETS — Philippe JAMET

Michel BOURGUIGNON — Jean-Jaques DUMONT

Canadian Safety Authority (CNSC Assessment)

Based on the documentation submitted for the Phase 1 pre-project design review of the ATMEA1 design, CNSC staff concluded that, in general:

ATMEA understands the CNSC regulatory requirements and expectations for the design of new nuclear power plants in Canada.

At an overall level, the ATMEA1 design intent is compliant with the CNSC regulatory requirements and meets the expectations for new nuclear power plants in Canada.

(Excerpt of CNSC's Executive Summary)
(June 2013)

French Safety Authority (ASN) Assessment - Conclusion

- **Safety options and design choices reviewed by the French ASN**
  - **Against its technical guidelines defined for new builds and the French regulation**
  - **The scope covers general PSAR topics except site specific issues**
  - **The review process was the same as the licensing review for a reactor to be built in France**

- **ASN considers:**
  - **The safety options selected for the ATMEA1 Reactor do not warrant any observation**
  - **The design choices adopted for the main equipments of the ATMEA1 Reactor are satisfactory**
  - **Those objectives and the related safety options are in compliance with the French Technical Guidelines**

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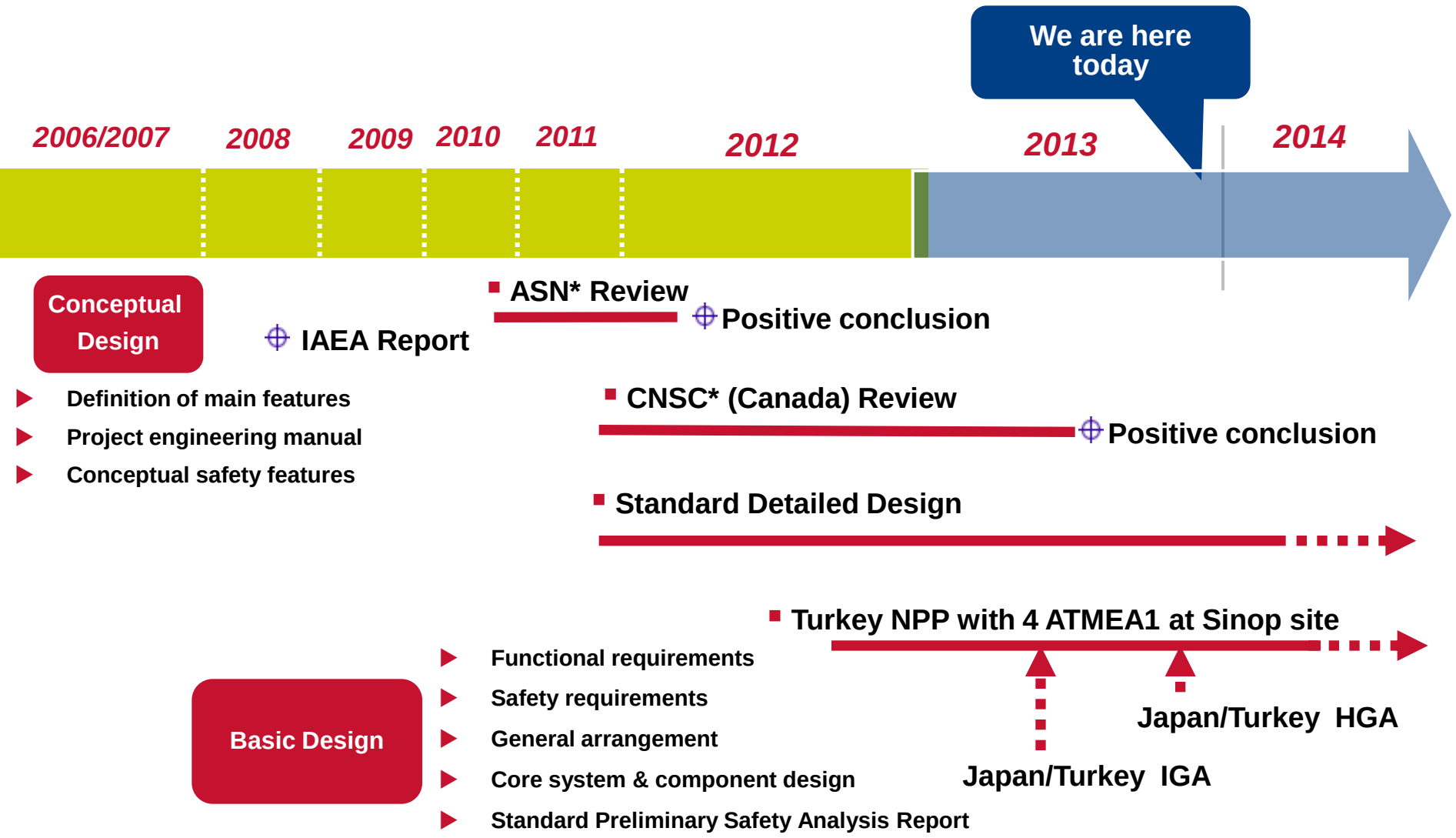
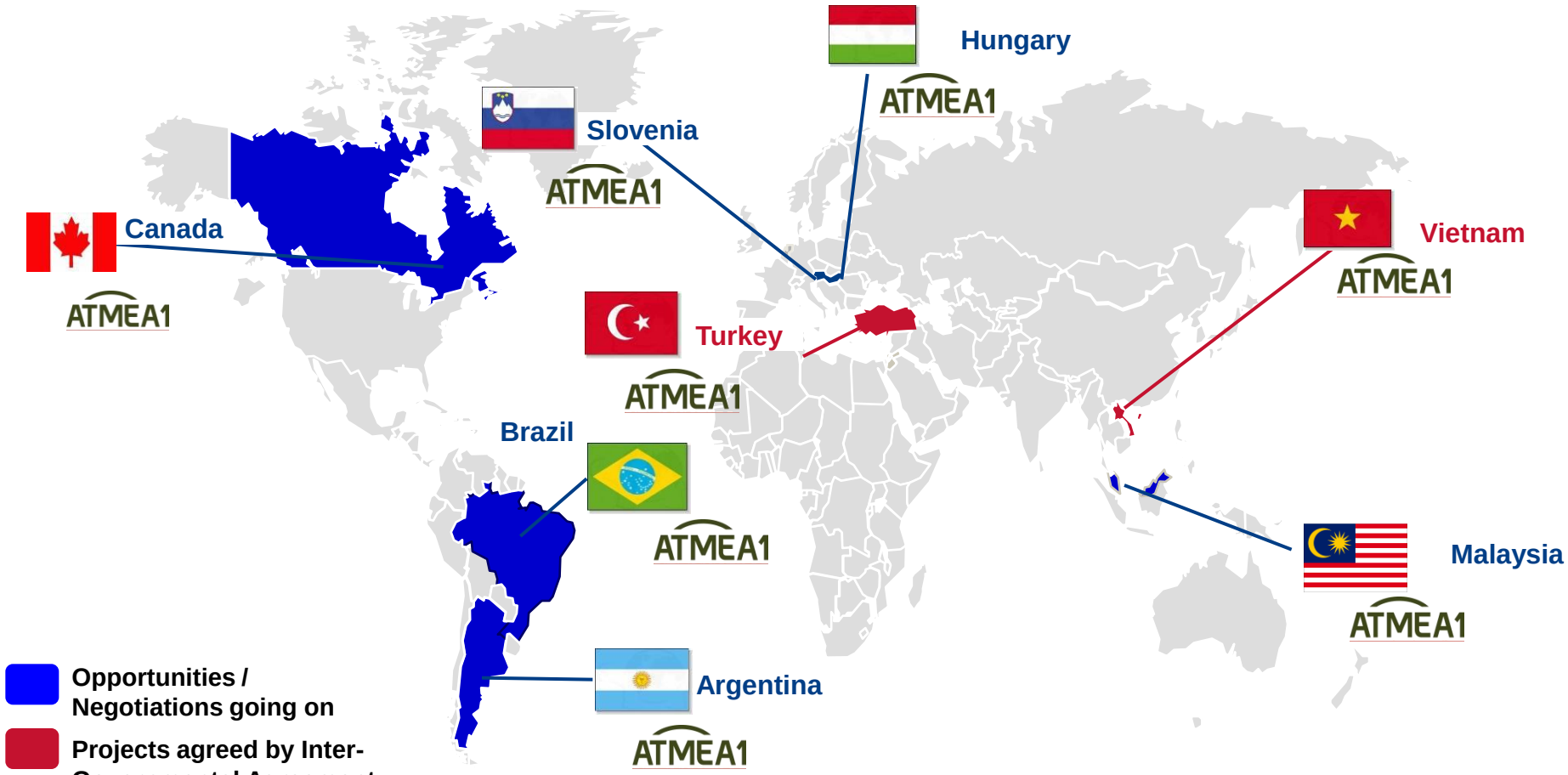
Achievements and Projects



*ASN: French Safety Authority *CNSC: Canadian Nuclear Safety Commission

ATMEA Worldwide Activities

- **The ATMEA1 Reactor is selected in many countries as a potential technology for New Power Plants**

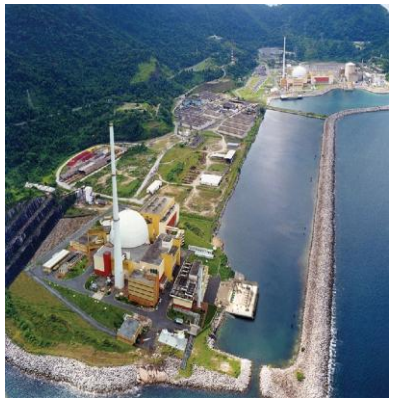


Sinop Project in Turkey Status

- **Government level (Japan and Turkey)**
  - May 3rd, 2013 Inter-Governmental Agreement
  - October 29th, 2013 Host Government Agreement (Framework)
- **Investor level**
  - Consortium : MHI and Itochu (Japan), GDF SUEZ (France), EUAS (Turkey)
- **EPC contractor level**
  - EPC consortium – MHI leadership
- **Technology**
  - ATMEA1 Nuclear Island
- **1st unit commercial operation : 2023**

Why is ATMEA1 best for Brazil ?

- Secure baseload power supply thanks to an advanced Gen 3+ mid-size reactor
- Withstands Fukushima-like accident thanks to highest safety standards
- Proven technology well known in Brazil: same family as ANGRA NPPs
- Access to full support of Japan and France (finance, technology transfer,…)
- Access to MHI and AREVA's 40 years of experience in design and construction
- Benefit of Turkish EPC project return of experience
- Benefit of AREVA involvement in the ANGRA 3 project
  - Strong ties with local suppliers
  - ATMEA1 reactor already includes ANGRA 3 design improvements
    - Additional cooling water tanks
    - Additional power supply system
    - Hydrogen recombiners
    - Aerosol ventilation and filtration system
    - Next generation digital I&C
  - Smooth ATMEA1 licensing in Brazil capitalizing on ANGRA 3



THANK YOU FOR YOUR KIND ATTENTION

ANY QUESTION ?