Development of the Mid-sized Generation III+ PWR
2 world leading nuclear suppliers

Joint venture: ATMEA

- Company name: ATMEA S.A.S.
- Office Location: Paris La Defense
- Establishment: November 2007

- Scope of activities: Development, Marketing & Sales, Construction & Commissioning activities for the 1100 MWe class Generation III+ ATMEA1 Nuclear Island
- The ATMEA company is the exclusive vendor of the ATMEA1 Nuclear Island
- Organization: Subcontract engineering work to both mother companies for the ATMEA1 development activities

The ATMEA1 Reactor: A mid-sized Generation III+ PWR
### ATMEA1 Main Features

<table>
<thead>
<tr>
<th>Reactor Type</th>
<th>3-Loop PWR</th>
<th>Safety System</th>
<th>3-Train reliable active systems with passive features</th>
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</thead>
<tbody>
<tr>
<td>Electrical output</td>
<td>1100 – 1150 MWe (Net)</td>
<td>Severe Accident Management</td>
<td>Core catcher</td>
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<td>Core</td>
<td>157 Fuel Assemblies</td>
<td>Pre-stressed Concrete Containment Vessel</td>
<td>Hydrogen re-combiners</td>
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<tr>
<td>Steam Pressure</td>
<td>More than 7 MPa</td>
<td>Resists airplane crash</td>
<td></td>
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<tr>
<td>I&amp;C</td>
<td>Digital</td>
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1. Reactor Building
2. Fuel Building
3. Safeguard Building
4. Emergency Power Supply Building
5. Nuclear Auxiliary Building
6. Turbine Building
I. Top Level Safety as Generation III+

- Improved redundancy, separation, and diversity
  - 3-division reliable active systems with passive features
  - Redundant and diversified Power Sources
  - Diversified cooling water sources

- Resistance against Internal and External hazards
  - Reinforced buildings to resist against a large commercial airplane crash
  - Leak tightness against flooding
  - High seismic resistance

- Severe accident management
  - Containment integrity is ensured for long term (Core catcher, Hydrogen re-combiners, …)
Top Level Safety as Generation III+
3-Train, Reliable Active Systems with Passive Features
Diverse heat sink

Top Level Safety as Generation III+
Division X - Diversified Heat Sink

3 x 100% trains plus one additional 100% safety diversified train

- Division X provides diversification in emergency power sources, cooling equipment and heat sink

- Division X allows preventive or corrective maintenance of any other train during power operation
Airplane Crash protection objectives

To ensure that:

- No damages occur inside the containment
- The reactor core remains cooled
- Spent fuel cooling and spent fuel pool integrity is maintained

Airplane Crash protection features

ATMEA1 buildings are protected:

- By shielding (thick wall and roof) : RB, FB, SAB
- By segregation : EPS buildings
Top Level Safety as Generation III+
Reactor Building

Steel Liner

Annulus sub-atmospheric and filtered to reduce radioisotope releases

In-Containment Refueling Water Storage Pit (IRWSP)

Airplane Crash protection

Prestressed Concrete Containment Vessel (PCCV)

IRWSP

Core catcher for Severe Accident Mitigation
Long term protection of containment integrity by:

▶ Primary Depressurization
  - Prevention of high pressure core melt and direct containment heating by dedicated primary depressurization system

▶ Core catcher
  - Passively flooded
  - To maintain and cool core debris over a long time even if a severe accident occurs
  - Composed of a heatproof floor structure and cooling water supply equipment

▶ Hydrogen Control System
II. Proven technology

- Composed of fully-operated, licensed, or verified systems and components of AREVA and MHI

- Experience feedback
  - From about 130 nuclear power plants constructed and in operation

- Licensing certainty
  - Review by IAEA, ASN, and CNSC
  - Support for licensing process of the customer’s country
### ATMEA1’s Licensability

The ATMEA1 reactor is licensable all over the world

- Fully comply with US regulations, codes, standards, ICRP requirements and with IAEA Safety Standards
- Incorporate the latest regulatory trends on severe accidents, airplane crash protection .... required in many countries
- French, Japanese, and other regulations, and URD/EUR were considered
- The ATMEA1 reactor is composed of fully-operated, licensed, or verified systems and components of AREVA and MHI

#### Additional actions undertaken by the ATMEA company to demonstrate ATMEA1’s high licensing certainty:

- In 2008, conceptual design was successfully reviewed by a group of IAEA expert
- French Safety Authority ASN, with the support of the French Institute IRSN, has completed the safety options review of the ATMEA1 reactor in November 2011 with positive results
- In February 2011, ATMEA filed an application with CNSC (Canadian Nuclear Safety Commission) for a Pre-Project Design Review of the ATMEA1 reactor technology in Canada
ATMEA assessment results confirmed robustness of the current ATMEA1 design and its adequate grace time as similar Generation III+ evolutionary reactors

- Resistance against external hazards
- Design margin and absence of “cliff-edge” effect
- Long-term containment integrity under severe accident conditions

First lessons learned from Fukushima have validated ATMEA1’s safety approach

No need for modifications in terms of safety options

ASN/IRSN Statement

“ATMEA1’s safety options ensure an appropriate robustness to Fukushima-type extreme events”

ATMEA will make a close follow-up of national and worldwide consensus regarding additional safety dispositions that could be raised in the wake of Fukushima accident
III. Superior Operation Performance

- High thermal efficiency
  - With proven Steam Generator design
  - Maximized electricity generation
  - Less fuel consumption / Less waste generation

- High reactor’s availability
  - With On-Power Maintenance capability, “2-room” concept etc.

- Flexibility for operation
  - Flexible operation cycle (12 – 24 months)
  - Extended load-follow and frequency control capability

- Flexibility for site conditions
  - Adapted to various heat sink conditions
  - High seismic resistance
THE ATMEA1 REACTOR: MID-SIZED GEN III+ PWR

Top Level Safety as Generation III+
Key asset for public acceptance

Proven technology
Reliable construction, licensing & operation

Superior Operation Performance
Economical design for 60 years life