



***LINE Commission***

*August 10, 2012*

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*Director Business Development*  
*Generation mPower LLC*

## Formal alliance between B&W and Bechtel

- Joint Venture agreement executed July 14, 2010
- Substantial investment commitments by B&W and Bechtel

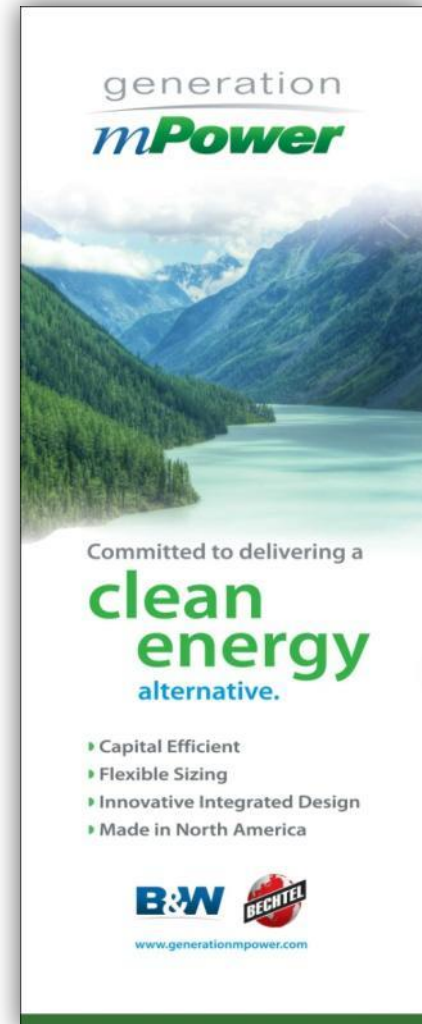
## Recognized and established energy industry leaders

- B&W:
  - 60+ years of nuclear engineering and manufacturing experience
  - Exclusive B&W mPower™ reactor technology
- Bechtel Power:
  - 60+ years of nuclear power industry experience
  - Integrated engineering and project management leadership

## Alliance objectives

- Design, license and deploy first commercially viable Gen III++ SMR
- Improve cost and schedule certainty, with reasonable investment
- Increase accessibility to nuclear power across global energy industry

[www.generationmpower.com](http://www.generationmpower.com)



***A “game changer” for the global energy industry***



**Develop and deploy, by 2020, an SMR that offers:**

- ✓ Lower capital cost
- ✓ Schedule and cost certainty
- ✓ Competitive LCOE pricing

**within the constraints of:**

- Proven: GEN III+, established NRC regulation
- Safe: Robust margins, passive safety
- Practical: Standard fuel, construction and O&M
- Benign: below grade, small footprint, public acceptance



**Traditional 2 Loop PWR NSSS**

**B&W mPower™**  
**Integral Reactor**



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## Integral 530 MWt NSSS module

- Core, CRDMs, SG, Pressurizer and Coolant Pumps
- No penetrations below top of core
- 50-degree superheat in Secondary Loop
- 60-year design life, rail shippable

## Passively safe design philosophy

- Core remains covered during all DBAs
- No active ECCS or safety-related AC power
- Multiple defense-in-depth layers deliver  $\sim 10^{-8}$  CDF

## 4-Year fuel cycle with “standard” PWR fuel

- 69 fuel assemblies with <5%  $^{235}\text{U}$  enrichment
- Burnable poisons, no chemical boron shim in coolant
- Full reactivity control using 69 control rod assemblies



**Modular ALWR with best of Generation III+ features ... low risk, low cost and passively safe**

## Fully underground

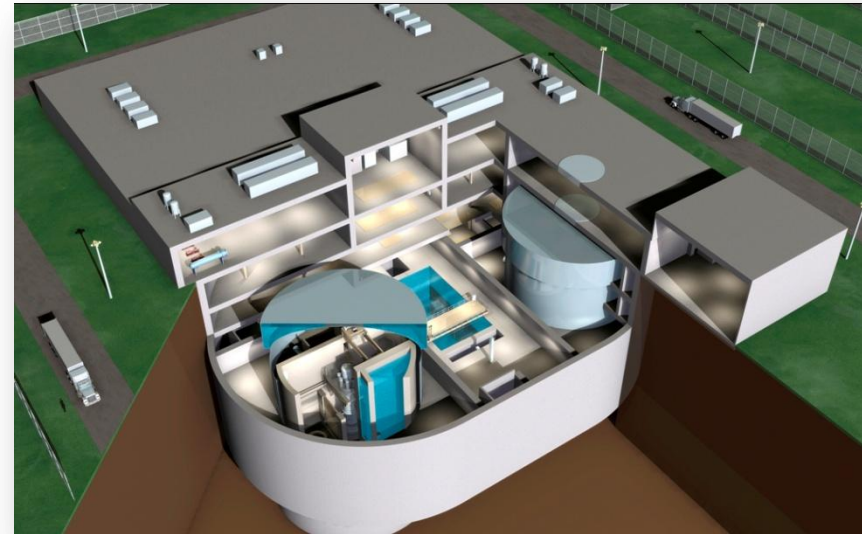
- Protected from external threats
- Enables security-informed architecture
- More efficient seismic design
- Steel containment, with space for O&M activity

## “Passive safety” design

- No safety-related emergency AC power
- 72-hour safety-related control/monitoring battery
- No shared active safety systems between units
- 14-day “coping time” under station blackout
- No containment sprays, sumps or recirculation

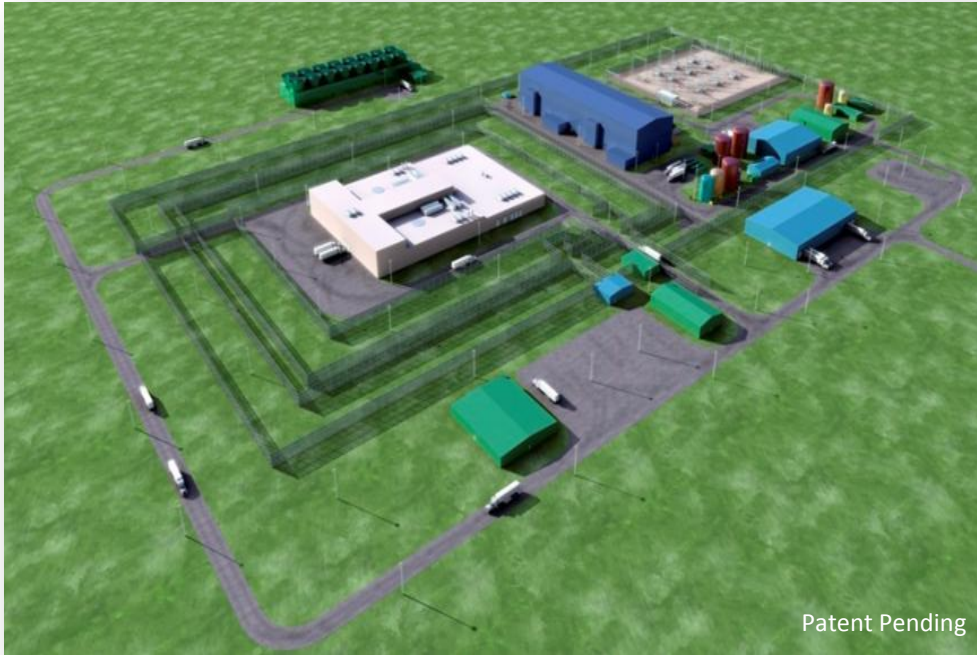
## Enhanced spent fuel pool configuration

- Underground, inside reactor building
- Large heat sink with 30-day “coping time”



*“Simple and robust” architecture lowers cost and risk, enhances licensing*

# “Twin Pack” mPower Plant Site Layout



mPower “Twin Pack” Site Layout  
with Water-Cooled Condenser

- 2 x 180MWe\* units
- Compact <40-acre site footprint\*
- Low profile, separated NI and TI
- All safety-related SSCs below grade
- One-to-one reactor to T/G alignment
- Enhanced security posture
- Optimized for minimum staff and O&M
- Water- or air-cooled condenser option
- Conventional steam cycle components
- Load-following capability
- “Island Mode” operation
- 3-year construction schedule

\*with water-cooled condenser

***Security-informed plant design contains O&M costs***

**[View animation of mPower “Twin Pack”](#)**



# Protection against “Fukushima-type” Events

Events and Threats	mPower Design Features
Earthquakes And Floods	<ul style="list-style-type: none"> <li>• <b>Seismic attenuation:</b> Deeply embedded reactor building dissipates energy, limits motion</li> <li>• <b>“Water-tight”:</b> Separated, waterproof reactor compartments address unexpected events</li> </ul>
Loss of Offsite Power	<ul style="list-style-type: none"> <li>• <b>Passively safe:</b> AC power, offsite or onsite, not required for design basis safety functions</li> <li>• <b>Defense-in-depth:</b> 2 back-up 2.50MWe diesel generators for grid-independent AC power</li> </ul>
Station Blackout	<ul style="list-style-type: none"> <li>• <b>3-day batteries:</b> Safety-related DC power supports all accident mitigation for 72 hours</li> <li>• <b>APU back-up:</b> Auxiliary Power Units inside reactor building recharge battery system</li> <li>• <b>Long-duration “station keeping”:</b> Space allocated for 7+-day battery supply for plant monitoring/control</li> </ul>
Emergency Core Cooling	<ul style="list-style-type: none"> <li>• <b>Gravity, not pumps:</b> Natural circulation decay heat removal; water source in containment</li> <li>• <b>Robust margins:</b> Core heat rate (11.5kW/m) and small core (530MWt) limit energy</li> <li>• <b>Slow accidents:</b> Maximum break small compared to reactor inventory (<math>4.7 \times 10^{-5} \text{m}^2/\text{m}^3</math>)</li> </ul>
Containment Integrity and Ultimate Heat Sink	<ul style="list-style-type: none"> <li>• <b>Passive hydrogen recombiners:</b> Prevention of explosions without need for power supply</li> <li>• <b>Internal cooling source:</b> Ultimate heat sink inside underground shielded reactor building</li> <li>• <b>Extended performance window:</b> Up to 14 days without need for external intervention</li> </ul>
Spent Fuel Pool Integrity and Cooling	<ul style="list-style-type: none"> <li>• <b>Protected structure:</b> Underground, inside reactor service building, located on basemat</li> <li>• <b>Large heat sink:</b> 30+ days before boiling and uncovering of fuel with 20 years of spent fuel</li> </ul>

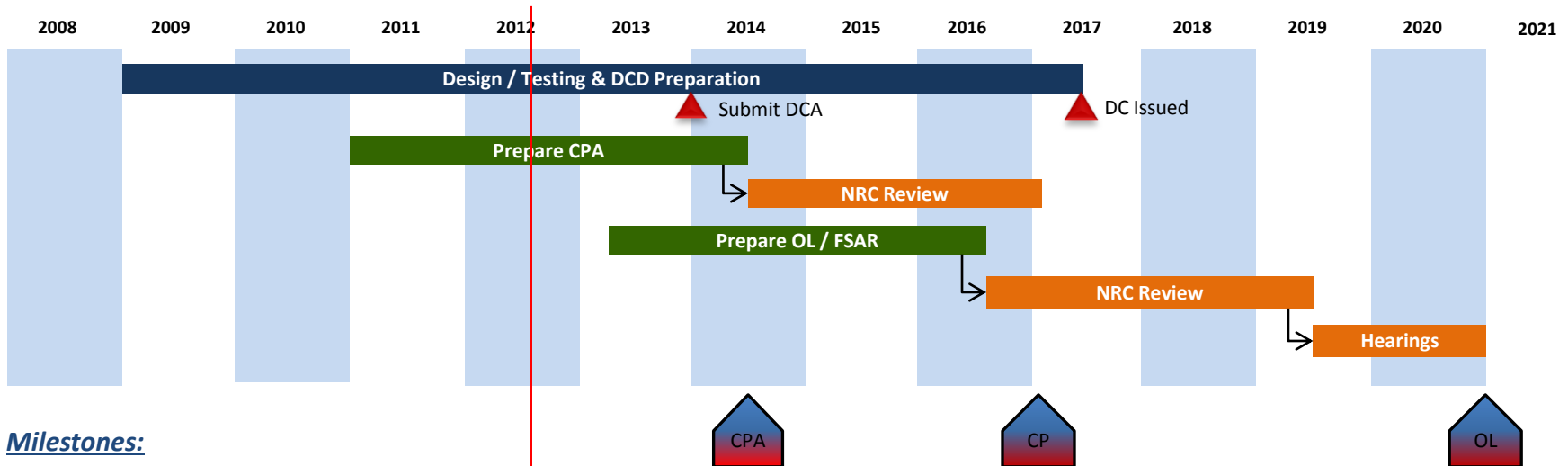
*Multi-layer defense ... mitigates extreme beyond-design basis challenges*

## Lead Plant (TVA Clinch River): 10CFR50

- First U.S. site-specific SMR license application
- 10CFR50 license approach lowers FOAK risk
  - Targeting mid-2014 CPA submittal by TVA
  - Enables design changes in construction
- CP is opportunity to identify NRC issues early
- Manage regulatory risk with early engagement

## Subsequent Plants: 10CFR52 with DC/COLA

- Gain DCD efficiency by leveraging PSAR work
- Submit DCA during 4Q13
- Target Design Certification by NRC in 2017
- Resolve all known FOAK issues before filing DCA
  - 24 topical & technical reports planned pre-DCA
  - Continue aggressive pre-DCA NRC engagement



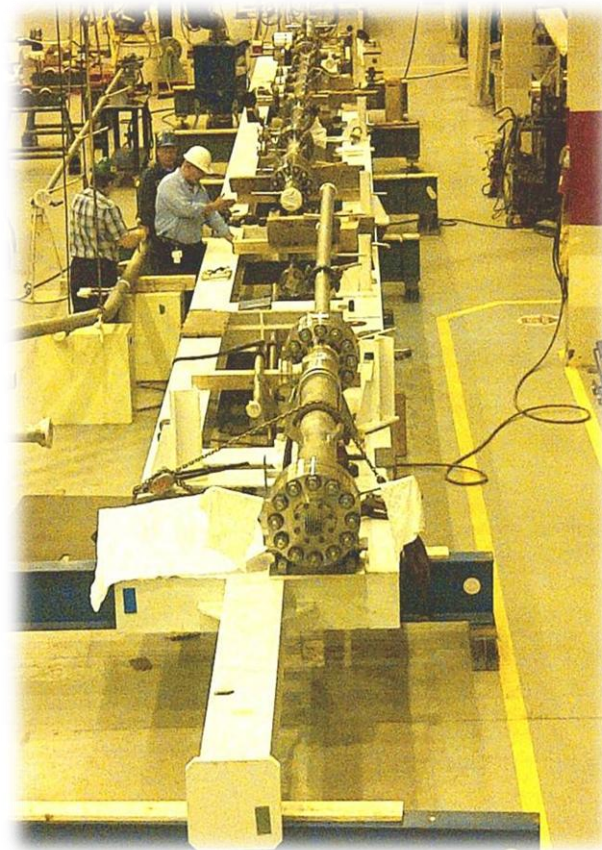
Milestones:

## Component Prototyping

- Reactor Coolant Pump
- Control Rod Drive Mechanisms
- Fuel Mechanical Testing
- CRDM/Fuel Integrated Test
- Fuel Critical Heat Flux
- Emergency Condenser

## Integrated Systems Testing

- Heat Transfer Phenomena
- Steam Generator Performance
- LOCA Response
- Pressurizer Performance
- Reactor Control



***Dedicated mPower facility ... backbone of \$100M testing program***

- World's first commercially viable Gen III+ SMR
- Proven, practical LWR technology
- Simple, passively-safe design
- NSSS factory-built in North America
- Licensing within current LWR framework
- Schedule and cost certainty
- Lower capital cost / competitive LCOE
- Broad industry support
- Deployment and project-related work underway
- Increased nuclear accessibility worldwide
- **Re-establish US nuclear competency**



*Deliver on the promise of a new clean energy option*

generation

*mPower*