Trends in NPP construction

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# Reactors under construction

## Number of reactors under construction by region

<table>
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<tr>
<th>Year</th>
<th>America - Latin</th>
<th>America - Northern</th>
<th>Asia - Far East</th>
<th>Asia - Middle East and South</th>
<th>Europe - Central and Eastern</th>
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Reference: IAEA-PRIS
Advanced Construction Approaches

- 3D modeling
- Large cubic content of concrete grouting
- Modularization
- Advanced Welding Technology
Focused on Construction

What’s Demanded

- Planned Construction Time
- Higher Quality
- Within Budget
- Localization and National Involvement

Need to Achieve

- Front-loaded Detailed Construction Eng’g
- Perfect Construction Management
- Data Sharing & Technical Transfer Environment

Full Application of Construction IT
Construction Project Organization using 3D modeling

- 3D model design (using advanced software as auxiliary tools)
- Synchronization design in different place, onsite construction simulation.
- Simulation of significant hoisting plan, simulation of engineering construction progress combining 3D project model,
- Inspection of installed items collision, virtual wandering of installation result
Information system for engineering data management, based on 3D models
Concrete grouting for Taishan 1# Nuclear Island

- Foundation lasts 86 hours, and 9300m³ concrete is poured,

- Record of the largest cubic content of NPP concrete grouting
Technology of reinforcing of the base and ceiling slabs

- Cross laying of the reinforcing carpets
- Carpet fabrication following the stress distribution
- Use of blockouts

Advantages:
- Fast expanding at limited manpower.
- Industrialization of the reinforcing carpets fabrication.
Modular Construction

Civil building module
- Assembled structural steels
- Prefabricated rebar mats,
- Assembled deck slabs, staircases,
- Pre-fabricated steel plate reinforced structures to be filled with concrete after installed as units

Mechanical/electrical module
- Fabricated assembly consisting of structural elements,
- Equipment and other items such as piping, valves, tubing, conduit, cable trays, supports, ducting, access platforms, ladders and stairs.
Composite Module

Composite module of piping/valves and structural steel for torus room
Reduction in Field Work

Composite Module

T-G pedestal deck composite module with T-G anchor bolts, rebar, steel form, conduits
Modularization Construction

- Civil and erection items exist in one module, making the boundary between civil and erection indistinct in module.
Modular Construction

Pros and Cons need to be evaluated based on the job site conditions

**Pros**

- Reduce Schedule (If Module is applied to CP)
- Reduce Field Work and Leveled On-site Manpower
- Increase Productivity and Quality under Factory Environment
- More Safely and efficiently at Ground Level Work
- Reusability of PPM Engineering to the Nth Plants

**Cons**

- Increase Engineering for Module
- Increase Temporary Support Structure
- Early Material Requirements
- Additional Transportation Cost (Large trailer truck, Barge)
- Increase Lifting/Rigging Requirements (Crane, Lifting Jig)
- Inspection of Modular
Automatic Welding Machine

Automatic Welding Machine for RCCV Liner

Automatic Welding for Large Bore Piping

Automatic Welding for Small Bore Piping (CRD piping)
Lessons Learned

- Ensure before starting implementation
  - Inadequate completion of design and engineering work prior to start of construction
- Do not underestimate the importance of proven experience
- Safety requirements clearly should be understood to avoid surprises.
- Difficulties during module fabrication
- Early contacts between Vendor, Customer and Regulator
Questions?