Does Risk Differ with the Deployment of Small Modular Reactor Technology?

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SMR Technology – A New Nuclear Risk Paradigm

*SMR technology will significantly reduce nuclear project financial risk*

With SMR technology, capital employment will go from > $10 B to $3B.

SMR technology also lowers financial risk through:

- Reduced Construction Risk
- Reduced Technology Risk
- Reduced Regulatory Risk
- Reduced Safety Risk
- Reduced Operating Risk
- Reduced Societal Risk
SMR's – Much Less Capital @ Risk

Enterprise and Market Values of Major US Utilities

% of operating capacity from Nuclear

New nuclear units planned or under construction

Remaining Enterprise Value

Market Cap

“Year spent” cost of 2,200 MW traditional nuclear new build: $11-17.6 Bn

Source: Capital IQ; data for 9/23/2015; Platts:NuScale Analysis

Note: SO Southern; EXC Exelon; D Dominion; DUK Duke; PCG PG&E Corp.; EIX Edison Int’l; FE FirstEnergy; ETR Entergy; PPL PPL Corp.; NRG NRG Energy; DTE DTE Energy; AEE Ameren; SCG Scana Corp; DYN Dynegy; CPN Calpine; new nuclear capacity data based on plants shown as in operating status on Nuclear Energy Institute; “Year spent” estimate for traditional nuclear plant based on JP Morgan and other sources

1 As part of a joint venture with Austin Energy and CPS, NRG operates 2 nuclear units at the South Texas plant generating 2.5 GW of capacity
Reduced Construction Risk

SMR’s are simpler to build

- Factory manufacturing of the nuclear components in a controlled environment will replace complex, stick built site construction.
- SMR construction largely left with civil structures.
- Fewer systems to construct
- Accelerated construction periods from >5 years to <3 years.
Reduced Technology Risk

SMR technology, unlike recent first of a kind large light water technologies, involves simple designs of largely commercially tested components.

- Off the shelf, smaller components
- Fewer systems to construct and operate leading to improved reliability.
- Light-water SMRs leverage sixty years of civilian operating experience in fuels, materials, valves and instruments.
Reduced Regulatory Risk

Light water SMR’s have the advantage of being based on technology which has 70 year operating history.

Regulatory hurdles should be less than current large generation III light water reactors:

- Orders of magnitude reduction in core damage frequency.
- Fewer, simpler and smaller structures, systems and components to regulate.
- Less fuel per site, isolated in two or more reactors – limits areal impact of low likelihood releases to the site boundary.
Reduced Operating Risk

Multiple small modules mated to independent steam turbine generators reduces single shaft risk and refueling impacts:

- Shorter, simpler refueling outages can be performed by permanent staff.
- Fewer structures, systems and components to fail.
- Fewer safety-related structures, systems and components to inspect and maintain.
- Forced or planned outages only impact a portion of the plant output.
Reduced Societal Risk

Less fuel / fission products per site isolated within multiple reactors:

- Impact of low likelihood events limited to the site boundary.
- Emergency Planning Zones greatly reduced, limiting impact of planning, drills and testing on local populace.

![Emergency Planning Zones Diagram]

*Note: A 2-mile ring around the plant is identified for evacuation, along with a 5-mile zone downwind of the projected release path.*
So, when we do the math...

**Nuclear Project Finance Risk Today**

(−) Capital Risk

(−) Construction Risk

(−) Technology Risk

(−) Regulatory Risk

(−) Operating Risk

(−) Societal Risk

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