UK NNL* calculated the potential SMR market to be approximately 65-85GW by 2035, 55-75 GW excluding Russia

- This is equivalent to 1100 – 1500 NuScale Power Modules (NPMs)
- At 25% market share, and 10 year deployment timeframe, 28–38 NPM / year
- At 36 NPM / year, approximately 1000 workers dedicated to machining, assembling and testing NPMs

*UK National Nuclear Laboratory “SMR Feasibility Study”, December 2014
SMR Market Potential

Source: BP Statistical View of World Energy 2014
EPA issued its proposed Clean Power Plan to regulate CO2 emissions from existing power plants under section 111(d) of the Clean Air Act.

The CPP issued varying, state-specific targets; rule is not prescriptive about how to meet the targets.

The CPP is tough on coal plants, the largest and highest rate emitters, and many will have to close.

CPP 2022-2029 “glide path” matches well with NuScale first deployment in 2023.

Base load power will have to come from nuclear power, CCGT or renewables + storage.

- Renewables + storage is currently too expensive to be used for base load demand.
- Utilities will resist becoming overly dependent on natural gas as a fuel source.

32% reduction in GHG from affected EGUs is ~100 GW of coal which could be replaced by a combination of renewables, energy efficiency and nuclear.

- 100 GW represents 2000 NuScale Power Modules or 175 570 MWe plants.
- UK NNL forecast for US is 15 GW of SMR deployment by 2035.
## SMR Designs Under Development

<table>
<thead>
<tr>
<th>Technology</th>
<th>PWR</th>
<th>HTR</th>
<th>LMR</th>
<th>Thorium</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
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<tr>
<td><strong>NuScale</strong></td>
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<tr>
<td>mPower</td>
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<tr>
<td>W-SMR</td>
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<tr>
<td>SMR-160 (Holtec)</td>
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<tr>
<td>RADIX</td>
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<tr>
<td>China</td>
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<tr>
<td>ACP-100</td>
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<tr>
<td>NHR200</td>
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<tr>
<td>Russia</td>
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<tr>
<td>VBER-300</td>
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<tr>
<td>KLT-40S</td>
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<td>ABV</td>
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<tr>
<td>BREST-OD-300</td>
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<tr>
<td>RITM-200</td>
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<tr>
<td>India</td>
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<tr>
<td>South Korea</td>
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<td></td>
<td></td>
<td>Toshiba-4S</td>
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<tr>
<td>Argentina</td>
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</tbody>
</table>

### Notes:
- **1:** Technologies viewed as less developed and therefore not a significant threat in 2020-2035 time frame.
- **2:** Countries with indigenous PWR-based SMR technology – assume no sales here.
- **3:** Despite having indigenous programs, track record of interest in US nuclear technology (AP1000) and current discussion both indicate a market open to US SMR technology.

**Bold** indicates programs considered most advanced by UxC.

Source: UxC SMR Market Outlook, March 2013:
Notes: Only programs listed as Under Development, Under Construction, Licensing Stage, or Licensed are shown. The Brazil FBNR is considered to be a “conceptual design” and is not represented here. India has several <200MW plants operating but UxC does not consider these to be modular in design.
DOE Loan Guarantees

- DOE’s ‘Loan Programs Office’ (LPO) has **$12 billion in loan guarantee authority available** for Advanced Nuclear Energy, including:
  - Small modular reactors (i.e. NuScale)
  - New nuclear reactors
  - Capacity upgrades at existing nuclear plants
  - Uranium enrichment facilities
- Application deadlines on a rolling six-month basis (next deadline is September, 2015)
- Separate from the $12 billion in guarantees available, LPO has already guaranteed $8.3 billion for the **Vogtle project – its first advanced nuclear energy deal** – helping to revive **construction of nuclear power plants** in the U.S. and around the world. The Vogtle Project is owned by a diverse group of entities:
  - Georgia Power (*Investor owned*)
  - Oglethorpe Power Corporation (*Cooperative*)
  - Municipal Electric Authority of Georgia (*Joint Action Agency*)
  - Dalton Utilities (*Municipal*)
## Overall EPC Overnight Plant Costs
($1,000,000)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>2014 Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Modules (FOAK Cost plus Fee, Transportation, &amp; Site Assembly)</td>
<td>$ 848</td>
</tr>
<tr>
<td>Home Office Engineering and Support</td>
<td>$ 144</td>
</tr>
<tr>
<td>Site Infrastructure</td>
<td>$ 60</td>
</tr>
<tr>
<td>Nuclear Island (RXB, RWB, MCR)</td>
<td>$ 538</td>
</tr>
<tr>
<td>Turbine Island (2 buildings with 6 turbines each)</td>
<td>$ 350</td>
</tr>
<tr>
<td>Balance of Plant (annex, cooling towers, etc)</td>
<td>$ 225</td>
</tr>
<tr>
<td>Distributables (Temp. Bldgs., Field Staff, Const. Equip., etc.)</td>
<td>$ 545</td>
</tr>
<tr>
<td>Other Costs</td>
<td>$ 185</td>
</tr>
<tr>
<td><strong>Total Overnight Price</strong></td>
<td><strong>$ 2,895</strong></td>
</tr>
</tbody>
</table>

$ 5,078 per kWe net

Note: Delivered costs shown are in 2014 $’s.
~10,000 man hour effort over 6 months.

Detailed equipment lists to individual valves and instruments.

Takeoffs developed for all piping, duct, wire, excavation, civil/structural materials, and architectural items.

Total equipment and commodity input over 14k line items.

All equipment tagged with building, system, unit, and safety classification.

Updated construction plan with estimate input.

84% of equipment pricing based on budgetary quotes.
Module costs estimating cost to fabricate/purchase each individual component.

- Over 75 unique components.
- Cladding, welding, bolting, and gasket material and labor individually estimated.
- Vendor quotes obtained for forgings, valves, instruments, pressurizer heaters.

Machining, fabrication, assembly performed in a dedicated facility.

- Fabrication shop direct/indirect labor informed by a large U.S. nuclear fabricator.
- Monte Carlo analysis performed for contingency to achieve P80 confidence.
Plant Cost Estimate Assumptions

- Generic southeastern USA site.
- Labor hours based on Fluor standard unit rates with productivity adjustments.
- Labor rates based on existing Fluor project.
- Indirect costs based on staffing plan, construction schedule, and temporary facility plan. Bottoms up indirect cost estimate.
- Schedule based on 51 months mobilization to mechanical completion. 28.5 month critical path - first safety concrete to mechanical completion.
- Class 4 estimate per AACE with an expected accuracy range of +35%/-10%.
- Owners cost, estimated at $300 mm, not included in EPC estimate. Estimates for transmission, admin building, licensing, etc. carried in LCOE costs.
NuScale LCOE results of $98-$108/MWhr (2015 $’s)

Key Assumptions:

- Financing is 55% debt (@5.5%) and 45% equity (@10.0%).
- Modeled as a 40 year project life, but the plant is designed for 60 years
- Excludes owner’s costs such as:
  - HR and management infrastructure, central office
  - COLA, permits, NRC and ITAAC inspections, and legal fees
  - Switchyard
  - Owner's project development costs
  - Owner's engineering services (post-COLA)
  - Owner contingency
- Including an estimate of owners costs would add ~ $6/MWhr
Estimated Average US Levelized Cost of New Generation Resources

2019 costs in 2012 $/MWh

NuScale FOAK (12-Pack) LCOE of $100/MWh includes owner’s cost of $5.10/MWh. NuScale NOAK (12-Pack) LCOE of $90/MWh includes Owner’s Cost of $5.10/MWh. For all other technologies, EIA included transmission investment from $1.10/MWh (Advanced Nuclear) to $6.00/MWh (Solar Thermal). NuScale included $1.10/MWh for transmission investment in the FOAK and NOAK LCOE values.

Assumptions for EIA and NuScale (12-Pack):
WACC of 6.5%; 30 yr cost recovery period.


Note: EIA projects 2019 Henry Hub spot natural gas prices of approx. $4.70/mmbtu (2012 Dollars) (Annual Energy Outlook 2014)
LCOE Breakdown

Levelized Cost in 2015 US Dollars

**FOAK with Regulated Utility Financing (IOU)**
- 55% debt at 5.5%, 45% equity at 10%

$108 USD

**FOAK with Municipal Financing**
- 100% debt at 3.5%, no equity

$74 USD

Note: Capital costs reflect the Fluor SE estimate completed in 2014.
Reduced Financial Risks

Enterprise and Market Values of Major US Utilities

$ in Billions

SO  EXC  D  DUK  PCG  EIX  FE  ETR  PPL  NRG  DTE  AEE  SCG  DYN  CPN

Remaining Enterprise Value
Market Cap

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

% of operating capacity from Nuclear

New nuclear units planned or under construction

Source: Capital IQ; data for 1/23/2015; Platts; AlixPartners and 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; nuclear capacity data based on plants shown as on operating status in Platts; “Year spent” estimate for traditional nuclear plant based on JP Morgan and other sources

1 Edison, through Southern California Edison owns the San Onofre, CA nuclear plant. All units have been permanently retired
2 As part of a joint venture with Austin Energy and CPS, NRG operators 4 nuclear units at the South Texas plant generating 2.8 GW of capacity
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The Element of Nu