Presentation for SSEB Industry Associates

US Global Competitiveness in Nuclear Energy
-- could the South lead a revival in Era of “Urban Dominance”? 

Feb. 25, 2019 -- Washington, DC

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IAEA (Sept. 2017) Global Nuclear Capacity to 2050, High/Low

IAEA HIGH Case
Additions: 761 GWe
Retired: 285 GWe

IAEA LOW Case
Additions: 318 GW (must be built)
Retired: 328 GW
Observations on Nuclear Energy Landscape

- Despite Fukushima, Nuclear Energy is a global arena for “Great Power Competition”: +94 GWs underway
- But, US sites are now <5% of New Reactor Build globally
  - USA still operates the largest fleet (98), but it is the oldest fleet
- Massive urbanization in Asia is major driver (+3B people by 2050)
- Nuclear is essential to reduce harmful emissions
  - Especially in Developing Asia to reduce urban air pollution (>millions die)
  - With EVs Nuclear Energy curbs transport emissions. Also Desalination
- USA must engage allies to compete globally
  - Some large elements, forgings cannot be made in USA [Japan, S.Korea]
  - Developing Advanced Reactors sooner will be essential to US position.
  - Rebuilding in N.America and EU is an arena for competition [use NATO]
  - Use existing tools (DOE Loan Program, New Devel Finance Corp. / Ex-Im Bank…)
Preview: Regional Factors for US competitiveness globally

NRC: US Operating Reactors, 2015

U.S. Operating Commercial Nuclear Power Reactors

- Inland Mountain West
- MidEast
- Growing SouthEast

Licensed to Operate (99)
Nuclear Energy stands up to Polar Vortex

US nuclear plants operate through polar vortex
04 February 2019
Exelon has thanked its employees for "braving the cold" to keep its nuclear power plants in Illinois, New Jersey and New York operating at full power as extreme weather conditions hit the USA last week.

CMS: Michigan NatGas Compressor Station Catches Fire – 30 Jan. 2019
Consumers Energy asks GM, Ford, Chrysler to suspend operations at Michigan plants -- turn down thermostats to 65F

https://www.shaledirectories.com/blog/michigan-natgas-compressor-station-catches-fire-explodes/
Southern: Vogtle 3&4 – International Teaming

https://www.georgiapower.com/about-energy/energy-sources/nuclear/gallery/search/recent.cshtml
The key to economic prosperity we are witnessing in the South is a stable, reliable and relatively inexpensive supply of electricity. The role of nuclear power has become more significant because of improved efficiency and life extension at existing reactors and because of the prospect of electricity production at new reactors that could begin to operate within the next decade.

**Building on Southern Strengths for Global Opportunities in Nuclear Energy**

**Growth in Southeast leads the USA**
“Between 1990 and 2000, the region’s population grew by 17%, and eight of the states in the region grew by a greater percentage than the national average of 13.1%. Between 2000 and 2004, the nation grew some 4.3% while the South grew by 5.6%. This trend is expected to continue in the future. With the population of the South representing some 38% of the total U.S. population in 2004, the expected higher growth in the South will be significant.”

**Updating for 2020+:**
- More than 80% of future nuclear construction through 2050 will occur overseas.
- Replacement reactors in USA: 20-40 GWe.
- Southeast suppliers are positioned to export.
- Southern Research Unis bring global reach.
- DOE and DOD sites in the South offer “crown jewels” for first deployment advantages.
- Southern states can respond FIRST with the MOST, in partnership with federal agencies.
# US Regions: Population and Growth

<table>
<thead>
<tr>
<th>Region</th>
<th>2000</th>
<th>2008</th>
<th>2016</th>
<th>Change</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>SATL (MD, VA, WV, NC, SC, GA, FL)</td>
<td>797</td>
<td>942</td>
<td>974</td>
<td>177</td>
<td>22.2%</td>
</tr>
<tr>
<td>ESC (AL, MS, TN, KY)</td>
<td>289</td>
<td>328</td>
<td>328</td>
<td>39</td>
<td>13.5%</td>
</tr>
<tr>
<td>WSC (TX, OK, AR, LA)</td>
<td>489</td>
<td>536</td>
<td>593</td>
<td>104</td>
<td>21.3%</td>
</tr>
<tr>
<td><strong>Subtotal: Southeast</strong></td>
<td>1,575</td>
<td>1,806</td>
<td>1,895</td>
<td>320</td>
<td>20.3%</td>
</tr>
<tr>
<td>ENC (OH, IN, IL, MI, WI)</td>
<td>453</td>
<td>520</td>
<td>513</td>
<td>60</td>
<td>13.2%</td>
</tr>
<tr>
<td>WNC (IA, MN, MO, NB, ND, SD, KS)</td>
<td>240</td>
<td>283</td>
<td>291</td>
<td>51</td>
<td>21.3%</td>
</tr>
<tr>
<td>MidATL (NY, NJ, PA)</td>
<td>308</td>
<td>361</td>
<td>362</td>
<td>54</td>
<td>17.5%</td>
</tr>
<tr>
<td><strong>Subtotal: Industrial MidEast</strong></td>
<td>1,001</td>
<td>1,164</td>
<td>1,166</td>
<td>165</td>
<td>16.5%</td>
</tr>
<tr>
<td><strong>Subtotal: Inland Mountain West</strong></td>
<td>200</td>
<td>257</td>
<td>268</td>
<td>68</td>
<td>34.0%</td>
</tr>
</tbody>
</table>

(Regions include states as specified)

[https://dubsism.wordpress.com/2012/11/20/your-updated-ncaa-conference-re-alignment-risk-map/]
At least 20 reactors can be built at current reactor sites… most stalled due to cheap gas.

**US COLs Applied for, 2009 – SouthEast dominant**

**Table 1: COL applications received by the NRC**

<table>
<thead>
<tr>
<th>Company</th>
<th>Sr. Unsec.</th>
<th>Reactor Design</th>
<th>Proposed New Reactor</th>
<th>Activity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ameren</td>
<td>MO</td>
<td>Baa3</td>
<td>US EPR</td>
<td>Low</td>
</tr>
<tr>
<td>Constellation</td>
<td>MD</td>
<td>Baa3</td>
<td>US EPR</td>
<td>High</td>
</tr>
<tr>
<td>Constellation</td>
<td>NY</td>
<td>Baa3</td>
<td>US EPR</td>
<td>High</td>
</tr>
<tr>
<td>Dominion</td>
<td>VA</td>
<td>Baa2</td>
<td>ESBWR</td>
<td>Low</td>
</tr>
<tr>
<td>DTE Energy</td>
<td>MI</td>
<td>Baa1</td>
<td>ESBWR</td>
<td>Low</td>
</tr>
<tr>
<td>Duke Energy</td>
<td>SC</td>
<td>Baa2</td>
<td>AP 1000</td>
<td>Medium</td>
</tr>
<tr>
<td>Energy Future Holdings</td>
<td>TX</td>
<td>B3 CFR</td>
<td>US APWR</td>
<td>Low</td>
</tr>
<tr>
<td>Entergy</td>
<td>MS</td>
<td>Baa3</td>
<td>ESBWR</td>
<td>Low</td>
</tr>
<tr>
<td>Entergy</td>
<td>LA</td>
<td>Baa3</td>
<td>ESBWR</td>
<td>Low</td>
</tr>
<tr>
<td>Exelon</td>
<td>TX</td>
<td>Baa1</td>
<td>ESBWR</td>
<td>Low</td>
</tr>
<tr>
<td>NRG Energy</td>
<td>TX</td>
<td>B3 CFR</td>
<td>ABWR</td>
<td>High</td>
</tr>
<tr>
<td>PPL</td>
<td>PA</td>
<td>Baa2</td>
<td>US EPR</td>
<td>Medium</td>
</tr>
<tr>
<td>Progress</td>
<td>FL</td>
<td>Baa2</td>
<td>AP 1000</td>
<td>Medium</td>
</tr>
<tr>
<td>Progress</td>
<td>NC</td>
<td>Baa2</td>
<td>AP 1000</td>
<td>Low</td>
</tr>
<tr>
<td>SCANA</td>
<td>SC</td>
<td>Baa1</td>
<td>AP 1000</td>
<td>High</td>
</tr>
<tr>
<td>Southern</td>
<td>GA</td>
<td>A3</td>
<td>AP 1000</td>
<td>High</td>
</tr>
<tr>
<td>TVA</td>
<td>AL</td>
<td>Aaa</td>
<td>AP 1000</td>
<td>Low</td>
</tr>
</tbody>
</table>

Energy Northwest (WA); UMPS (UT)  
**ME:** Industrial MidEast  
**SE:** Growing SouthEast
Nuclear Energy gains Bipartisan Support

Senate Vote 87-4 (Feb. 2016)

FACT SHEET: Obama Administration Announces Actions to Ensure that Nuclear Energy Remains a Vibrant Component of the United States’ Clean Energy Strategy

In advance of COP 21

As detailed in the Climate Action Plan, President Obama is committed to using every appropriate tool to combat climate change. Nuclear power, which in 2014 generated about 60 percent of carbon-free electricity in the United States, continues to play a major role in efforts to reduce carbon emissions from the power sector. As America leads the global transition to a low-carbon economy, the continued development of new and advanced nuclear technologies along with support for currently operating nuclear power plants is an important component of our clean energy strategy. Investing in the safe and secure development of nuclear power also helps advance other vital policy objectives in the national interest, such as maintaining economic competitiveness and job creation, as well as enhancing nuclear nonproliferation efforts, nuclear safety and security, and energy security.

Senate Joins House in Supporting Innovation in Advanced Reactors

- Bill encourages public-private partnerships on advanced nuclear R&D
- Opens national laboratory sites to private nuclear projects
- Legislation added as amendment to comprehensive energy bill

Feb. 4, 2016—The U.S. Senate’s significant support for nuclear energy was evident last week, with the near-unanimous passage of legislation that encourages public-private collaboration on advanced nuclear research projects at national laboratory sites.

The Nuclear Energy Innovation Capabilities Act (S 2461), approved 87-4, is now an amendment to the larger Energy Policy Modernization Act of 2016 (S 2012), which is expected to be voted on by the Senate next week.

S 2461 directs the U.S. Department of Energy to prioritize partnering with private innovators on developing and prototyping new reactor technologies and to use DOE sites such as Idaho National Laboratory (INL) to build, test and demonstrate privately funded prototype reactors.

The bill requires the U.S. Nuclear Regulatory Commission to report to Congress any foreseeable problems in licensing reactors within four years of receiving an application, whether introduced through a DOE partnership or privately developed. DOE also is required to develop a 10-year plan for prioritizing nuclear research and development programs that support new reactor technology.

[Amendment to Energy Modernization bill]
In 2018, NEICA and NEIMA
Drivers for the Political Economy of Nuclear Energy

McKinsey: 600 Global Cities = 60% of World GDP

The Primary Driver for Nuclear Power is Urban Development, the need for Clean, Reliable Energy. Cities fuel more than 60% of world GDP. Growth shifted to Asia in 2000 as OECD crested.

Urban world: Mapping the Economic Power of Cities (March 2011)

Almost all EV electricity sales will be in urban areas (buses, cars)
"Urban Dominance"

Massive Urbanization to 2050: +3b since 2000

Urban and rural population projected to 2050, World
Total urban and rural population, given as estimates to 2016, and UN projections to 2050. Projections are based on the UN World Urbanization Prospects and its median fertility scenario.

Source: OWID based on UN World Urbanization Prospects 2018 and historical sources (see Sources) CC BY

https://ourworldindata.org/urbanization
Nuclear is for large cities. Why pursue parity with Renewables?

Large Cities need reliable power 24/7, all seasons…

Where to put the wind turbines and solar panels?

Chongqing on the Yangzi

BBC weather outlook: “Chance of sun”
IEA: Change in Primary Energy Demand to 2040

World Energy Outlook: Growth is clearly in Developing Asia

Change in primary energy demand, 2016-40 (Mtoe)

World Energy Outlook 2017

www.iea.org/weo2017/
EIA: Nuclear Capacity by decade, 2010

Global generation capacity for nuclear power has grown to over 370 gigawatts since 1955. Stasis from 2000-10; Asia emerging.
EIA: Nuclear Capacity by decade, 2030

Global generation capacity for nuclear power has grown to over 370 gigawatts since 1955. Asia dominates to 2030 to feed cities.

World nuclear electricity generating capacity by region, 1955-2011 (in gigawatts):
- North America: 100
- Europe: 100
- Former Soviet Union: 40
- Asia: 230
- MENA: 20
- Africa: 4
- Central & South America: 6

National Targets:
Large Gen III reactors feed cities >1 million

Projected (2018):
480 GW TOTAL (IAEA mid-range)
350 to 510 GWs
EIA: Nuclear Capacity by decade, 2050

Global generation capacity for nuclear power has grown to over 370 gigawatts since 1955. Asia builds to 2050 to feed cities.

FEEDING CITIES
SMRs / Gen IV reactors can feed many more cities sooner, at a scale they can finance.

Projected (2018)
600 GW TOTAL
(IAEA mid-range)
350 to 750 GWs
“Urban Dominance”

Largest cities by 2030 concentrated in Asia

Cities with a projected 2030 population of more than 10 million

2030 population

<table>
<thead>
<tr>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>40M</td>
</tr>
<tr>
<td>25M</td>
</tr>
<tr>
<td>10M</td>
</tr>
</tbody>
</table>

Change in population from 2014 to 2030

- Pop. decline
- + 0-15%
- 16-30%
- 31-45%
- 46% or more

**Bolded cities:** projected to surpass 10 million people between 2014 and 2030

**Tokyo and Osaka**
Both are expected to lose population due to low birth rates and declining immigration.

**Only Japan is losing population**

Luanda, Angola
Its population is expected to grow to 10.4 million in 2030, from 5.3 million in 2014, the fastest growth rate among the 2030 megacities. Lagos and Kinshasa are close behind.
Land Use for Energy much more important in Asia

Clean Energy Comparison

- **100 Sq Miles**
  - 225 Mwe on 60,000 acres [depends on wind profile]

- **40 Sq Miles**
  - 225 Mwe on 24,000 acres [depends on solar index]

- **2 Sq Miles**
  - 225 Mwe on 15 acres of land

www.westinghousenuclear.com/New-Plants/Small-Modular-Reactor
Massive Urbanization drives Electricity Demand

Rapid growth of cities is driving demand for Power, Water, Food Security. Nuclear Energy is essential for clean urban living.

**ASIA: 4b people ➞ 6.5b+ by 2050**

200m people use 600 GWs (80 GWs of nuclear energy)

Two-thirds of near-term electricity growth by 2030 will be in Asia & MidEast – much more by 2050

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### Electricity growth (Regions) from 2015 to 2030 [IAEA]

<table>
<thead>
<tr>
<th>Region</th>
<th>Growth</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.AM</td>
<td>250</td>
<td>1.5%</td>
</tr>
<tr>
<td>S.AM</td>
<td>2,215</td>
<td>13.7%</td>
</tr>
<tr>
<td>W.EUR</td>
<td>710</td>
<td>4.4%</td>
</tr>
<tr>
<td>E.EUR</td>
<td>625</td>
<td>3.9%</td>
</tr>
<tr>
<td>Africa</td>
<td>1,530</td>
<td>9.5%</td>
</tr>
<tr>
<td>India</td>
<td>900</td>
<td>5.6%</td>
</tr>
<tr>
<td>ME/S.Asia</td>
<td>4,100</td>
<td>25.3%</td>
</tr>
<tr>
<td>SE Asia</td>
<td>1,020</td>
<td>6.3%</td>
</tr>
<tr>
<td>China</td>
<td>3,600</td>
<td>22.2%</td>
</tr>
<tr>
<td>Japan</td>
<td>40</td>
<td>0.2%</td>
</tr>
<tr>
<td>Far East</td>
<td>1,200</td>
<td>7.4%</td>
</tr>
<tr>
<td>World</td>
<td>16,200</td>
<td>100%</td>
</tr>
</tbody>
</table>

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**TWhs**
Almost all the EV electricity sales will be in urban areas.

Forecasts have shifted further out over time but battery costs are coming down; EVs might enter an S-curve as SMRs / GenIV are slated for commercial deployment.

Electricity sales volume for charging vehicles rises 4x from 2030 to 2040

21st Century: Urbanization drives demand in Asia

ASIAN SOVEREIGNS don’t have a problem picking winners. Nuclear is a WINNER.

Where do I put a wind turbine or solar panel?

There are more people living inside this circle than outside of it.

Seoul

May 7, 2013
Driver for Nuclear in Asia: Deadly PM 2.5 Pollution

Rising Water Stress will fuel demand for desalination for Cities

Largest Desalination Plant in world
(220m Gal/day)
**“Urban Dominance”**

Global Covenant of Cities not waiting for UNFCCC

About The Global Covenant of Mayors for Climate & Energy

The Global Covenant of Mayors for Climate & Energy is an international alliance of cities and local governments with a shared long-term vision of promoting and supporting voluntary action to combat climate change and move to a low emission, resilient society.

**Urban Emissions**

- **Local Governments are Key Contributors:** The Global Covenant of Mayors works to organize and mobilize cities and local governments to be active contributors to a global climate solution.

**Regional Networks**

- **City Networks as Critical Partners:** Local, regional and global city networks are core partners, serving as the primary support for participating cities and local governments.

**Shared Solutions**

- **A Robust Solution Agenda:** Focusing on those sectors where cities have the greatest impact, the Global Covenant of Mayors supports ambitious, locally relevant solutions, captured through strategic action plans that are registered, implemented and monitored and publicly available.

**Local Resilience & Adaptation**

- **Reducing Greenhouse Gas Emissions and Fostering Local Climate Resilience:** The Global Covenant of Mayors emphasizes the importance of climate change mitigation and adaptation, as well as increased access to clean and affordable energy.

www.globalcovenantofmayors.org/about/
Multi-$billion cost overruns… Need Gen IV, SMRs

Toshiba’s Record Fall Highlights Nuclear Cost Nightmare
by Mark Chediak
December 27, 2016, 1:30 PM EST  Updated on December 28, 2016, 2:21 AM EST

Need SMRs, Advanced Reactors

TVO steps up legal battle over Olkiluoto 3 reactor delays
28.9.2016 UUTISET -- Legal wrangling between French majority-state owned nuclear constructor AREVA and the Finnish power company TVO is escalating, with a new lawsuit filed in a French court. The start-up date for the third unit at the Olkiluoto plant near Pori – already nearly a decade late – remains in doubt.

Flamanville fiasco: The story of France's nuclear calamity
Feb. 2017

The construction site at Flamanville in northern France. Will it ever be completed? Photo: Charly Triballeau
IAEA (Sept 2017) – High & Low Estimates: Projected Nuclear Capacity in 2030, 2040, 2050

IAEA HIGH Case
Additions: 630 GWe
Retired: 285 GWe

IAEA LOW Case
Additions: 260 GWe
Retired: 328 GWe

IAEA: Even in the LOW case, >250 GWs must be built.

www-pub.iaea.org/MTCD/publications/PDF/17-28911_RDS-1%202017_web.pdf
### TABLE 5. WORLD NUCLEAR ELECTRICAL GENERATING CAPACITY, GW(e)

<table>
<thead>
<tr>
<th>Region</th>
<th>2017</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Northern America</td>
<td>113.5</td>
<td>78</td>
<td>107</td>
<td>36</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td>5.1</td>
<td>8</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Northern, Western and Southern Europe</td>
<td>110.5</td>
<td>66</td>
<td>97</td>
<td>48</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>50.1</td>
<td>51</td>
<td>72</td>
<td>55</td>
</tr>
<tr>
<td>Africa</td>
<td>1.9</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Western Asia</td>
<td>0.4</td>
<td>8</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Southern Asia</td>
<td>8.5</td>
<td>22</td>
<td>34</td>
<td>31</td>
</tr>
<tr>
<td>Central and Eastern Asia</td>
<td>101.8</td>
<td>116</td>
<td>173</td>
<td>131</td>
</tr>
<tr>
<td>South-eastern Asia</td>
<td></td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Oceania</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>World Total</td>
<td>391.7</td>
<td>352</td>
<td>511</td>
<td>323</td>
</tr>
</tbody>
</table>

“One Belt (by land) + One Route” (by sea)

Silk Road development adds to Nuclear Buildout

GBTIMES, March 2016: **China to build 30 nuclear plants on Silk Road**

http://gbtimes.com/business/china-build-30-nuclear-plants-silk-road-countries  
GBTIMES (Finland)
China using nuclear units to reinforce BELT-ROUTE INITIATIVE (BRI) with Russia
Russia actively locking up Marine Route sites (ports), with Military Basing Rights

Chinese nuclear plants along BELT path have not been sited yet (proposed)

**Active Russian Nuclear Project... most bolstering global trade hubs for BRI**

**NUCLEAR CAPACITY (GWs)**

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>96</td>
<td>80?</td>
<td>60?</td>
</tr>
<tr>
<td>China</td>
<td>48</td>
<td>120</td>
<td>200</td>
</tr>
<tr>
<td>Russia</td>
<td>28</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>India</td>
<td>10</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>WORLD</td>
<td>440</td>
<td>480</td>
<td>600</td>
</tr>
</tbody>
</table>

*Forecast varies based on rate of retirements, license renewals. EU will see more retirements.*
Is China playing “GO” on the UK Game Board while others play STOP?

UK: China engulfing FIVE nuclear sites

With France and Japan (Toshiba) failing to raise capital, China is now looking at ALL sites.

BBC

UK: Building 10+ nuclear reactors

Dec. 2018: Chinese nuclear giant GGN signals interest in NuGen’s abandoned Cumbria plant

*Shut-down site known as Calder Hall

[SOURCE: DECC]
WHERE ARE WE?

Competitiveness Landscape: Outlook after 2020

Current Trajectory leaves Nuclear Energy Dominance to China and Russia

Building overseas (exports), Pak, UK …

Building in India (closing at home)

India: all domestic, not exporting

Building in LDCs

Massive Wave of Urbanization in Asia (+3B people) is driving New Reactor Build (Power, EVs, Water)

USA With SMRs & Adv Reactors

USA With more retired

Building in China, India

Building in India

Massive Wave of Urbanization in Asia (+3B people)

FRANCE

Including Exports

Domestic

NOW: DOE & EIA Projections for USA, 2010 to 2030

BAD NEWS
NCSL Forum - DOE with States (Nov 2017)

This is NOT Leadership; Utilities & Banks will NOT invest without Incentives

Cost competitive new build.

Move sooner on Advanced Reactors

Current trajectory

Improved market and regulations

More shutdowns without market corrections

Regulations

Market reform

PPP & Financing
China Development Bank dwarfs all other Financial Entities

CRS: Comparison of Development Finance

Table A-1. Comparison of OPIC and Selected Bilateral Foreign DFIs

<table>
<thead>
<tr>
<th></th>
<th>OPIC (U.S.)</th>
<th>CDC (UK)</th>
<th>DEG (Germany)</th>
<th>Proparco (France)</th>
<th>CDB (China)</th>
<th>JBIC (Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016 Portfolio/</td>
<td>$21.5B</td>
<td>£3.8B</td>
<td>€8.6B</td>
<td>€5.9B</td>
<td>10.3 trillion yuan</td>
<td>¥17 trillion</td>
</tr>
<tr>
<td>Outstanding</td>
<td>billion</td>
<td>(£5.5B)</td>
<td>($10.6 billion)</td>
<td>($7.3 billion)</td>
<td>($1.6 trillion)</td>
<td>($158 billion)</td>
</tr>
<tr>
<td>Commitments</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Began Operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(reorganized)</td>
</tr>
<tr>
<td>Structure/</td>
<td>Wholly owned</td>
<td>Wholly</td>
<td>Wholly</td>
<td>Limited liability</td>
<td>State “policy”</td>
<td>Policy-based</td>
</tr>
<tr>
<td>ownership</td>
<td>U.S.</td>
<td>owned by</td>
<td>owned by</td>
<td>bank, Chinese</td>
<td>bank, Chinese</td>
<td>financial</td>
</tr>
<tr>
<td></td>
<td>government</td>
<td>UK</td>
<td>German</td>
<td>Ministry of</td>
<td>Ministry of</td>
<td>institution</td>
</tr>
<tr>
<td></td>
<td>corporation</td>
<td>government</td>
<td>development</td>
<td>Finance and</td>
<td>Finance and</td>
<td>wholly owned</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>bank that is</td>
<td>other public/state-owned</td>
<td>other public/state-owned enterprises</td>
<td>by the Japanese</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>80% owned</td>
<td>subsidiary of</td>
<td>enterprise</td>
<td>government</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>by German</td>
<td>Agence Française</td>
<td>shareholders</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>government</td>
<td>de Développement</td>
<td>; other</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>that is main</td>
<td>shareholders;</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>shareholder;</td>
<td>other</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>other shareholders</td>
<td>shareholders</td>
<td></td>
</tr>
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<td></td>
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<td></td>
<td>are public and</td>
<td>are public and</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>private institutions</td>
<td>private</td>
<td></td>
</tr>
</tbody>
</table>

EDC (Canada)
C$60B in Assets
C$10B in Equity
1944 Crown Corp
“Export Development”

www.edc.ca/EN

CRS: OPIC, USAID, and Proposed Development Finance Reorganization, 27 April 2018
US nuclear industry seeks presidential support
14 February 2019
A strong domestic industrial base is vital to enable US companies to compete overseas, nuclear industry executives told President Donald Trump at a meeting on 12 February. Participants argued that US national security would be jeopardized if the country does not retain a position as a chief developer of civilian nuclear power plants.
WHAT CAN WE DO?

- Nuclear Energy is a Global Arena: +90GWs underway
  - But, US sites are now <5% of New Reactor Build globally, $3T by 2050
- Recognize Vogtle project is THE New Build for USA
- The South is strongly positioned for EXPORTS
- With Congress & Cities:
  - Nuclear is essential to reduce harmful emissions, charge urban EVs
  - Not all benefits of Nuclear are reflected in prices: reliability, emissions
    - “100% Renewable” is Slogan not a Reliable Strategy, but cities are adopting
  - **Use existing tools** (DOE Loan Program, New Devel Finance Corp. / Ex-Im Bank…)
  - Invest in University Engineering Programs, and Nuclear R&D
- Engage with US allies to compete globally
  - Some large elements, forgings cannot be made in USA [Japan, S.Korea]
  - Developing Advanced Reactors **sooner** will be **essential** to US position
Upgrading “Nuclear Cornerstone” for 2020+:

- More than 80% of future nuclear construction through 2050 will occur overseas.
- Replacement reactors in USA: 20-40 GWe.
- Southeast suppliers are positioned to export.
- Southern Research Unv. brings global reach.
- DOE and DOD sites in the South offer “crown jewels” for first deployment advantages.
- Southern states can respond FIRST with the MOST, in partnership with federal agencies.

Avid, Broad Public Support for Nuclear
“Era of Urban Dominance”

Q&A: US Global Competitiveness in Nuclear Energy

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Managing Partner
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Treasury Grants (S1603): $26.2B, mostly Wind, Solar

Cumulative grants awarded, 2009 to Dec 2017: $26.2B for 34.6 GWs gross (11 GWe Net)

$26.2B in Tax subsidies
$94.3B in Total Project Value

34.6 GW gross
11.0 GWe Effective

Wind tax credits expire

Wind
$13.0B

Total investment: $94.3B
($26.2B from 1603 grants)
For 11 GWe (net),
Or ~$9,000 per Kwe
of total investment.

60% of funds went to 8 states.
CA received $7B.

Source: U.S. Treasury

www.treasury.gov/initiatives/recovery/Documents/P%20Status%20overview%202018-03-01.pdf
Cumulative grants awarded, **2009 to Dec 2017**: $26.2B for 34.6 GWs gross (11 GWe Net)

**Treasury Grants by State** (ARRA Sec. 1603 program)

**Total Awards by State** (map as of April 2011). 8 States comprise ~60% of activity.

- CA: 8,380 MW [ $7.1B ]
- TX: 3,400 MW [ $2.0B ]
- IL: 2,100 MW [ $1.3B ]
- OR: 1,780 MW [ $1.0B ]
- NV: 1,200 MW [ $1.1B ]
- WA: 1,470 MW [ $1.1B ]
- NJ: 820 MW [ $1.0B ]

**Update: At March 2018**

Top 8 States cover >50%

- CA: 8,380 MW $7.1B
- TX: 3,400 MW $2.0B
- AZ: 1,320 MW $1.4B
- IL: 2,100 MW $1.3B
- NV: 1,200 MW $1.1B
- WA: 1,470 MW $1.1B
- OR: 1,780 MW $1.0B
- NJ: 820 MW $1.0B

Total 20,470 MW $16.0B

60% 60%

Of 34,600 MW $26.2B

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Treasury 1603 Grant Status:
https://www.treasury.gov/initiatives/recovery/Documents/P%20Status%20overview%202018-03-01.pdf