

Financing the Transition to a Low C Economy: Perspectives from the Nuclear Industry



JOHN PARSONS

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MIT Global Change Forum



The Future of Nuclear Energy in a Carbon-Constrained World

AN INTERDISCIPLINARY MIT STUDY

energy.mit.edu

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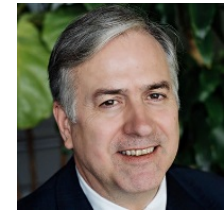
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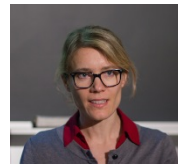
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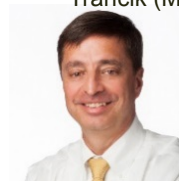
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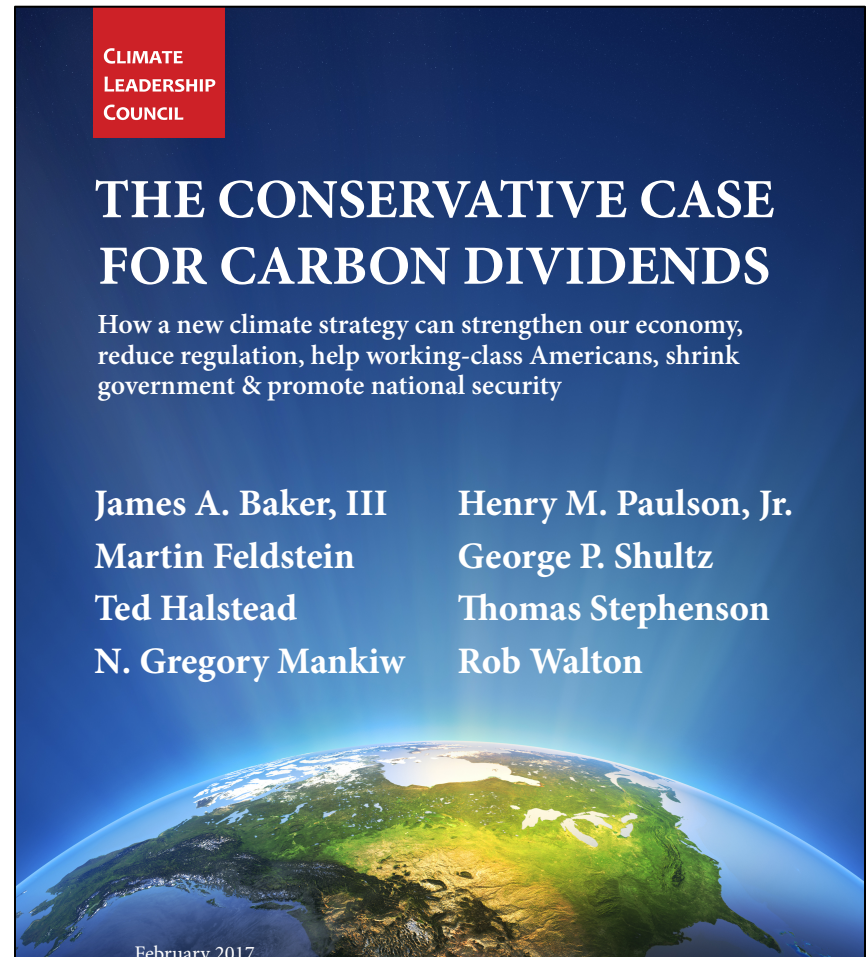


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Which Do We Need, A Green New Deal or a Revenue Neutral Carbon Tax?



Cognitive Dissonance is Your Friend

- **There is nuclear, and there is nuclear**
 - Existing reactors
 - New builds of large LWRs
 - Advanced reactors
- **Tomorrow is not like today**
 - Modest decarbonization v. deep decarbonization
 - Prices and marginal costs will be dramatically different
- **Tradeoffs differ in rich and poor countries ...**
 - but we share one atmosphere.



Existing Reactors

- **Cost-efficient source of low-C electricity**
- **Premature closures undermine efforts to reduce CO2 and other power sector emissions.**
- **problem is not electricity markets per se, but public opposition**

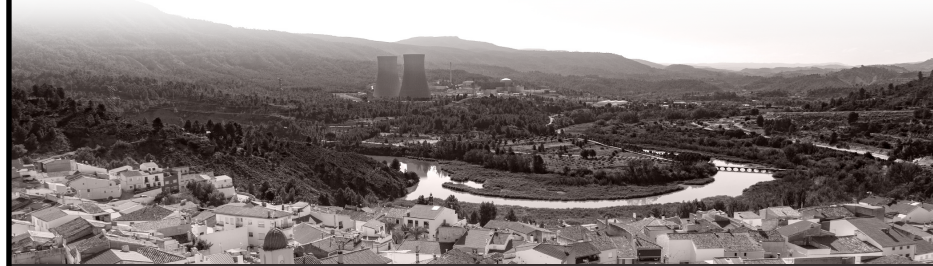
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Working Paper Series

The Climate and Economic Rationale for Investment in Life Extension of Spanish Nuclear Plants

ANTHONY FRATTO OYLER AND JOHN E. PARSONS



NOVEMBER 2018

CEEPR WP 2018-016



MASSACHUSETTS INSTITUTE OF TECHNOLOGY

ssrn.com/abstract=3290828



New Builds of Large LWRs

Abandoned V.C. Summer Project



New Builds of Large LWRs

- **Current projects in the U.S. and Western Europe have been a disaster. Long construction delays and large cost overruns.**
 - The industry in the U.S. and Western Europe is facing an existential crisis.
 - Korea's build of an APR-1400 in the UAE was completed on time and without cost overruns.
 - The true cost is not public.
 - Wait and see on Russian exports and new Chinese investments.
- **Even the advertised cost is not competitive with other low-C alternatives, such as wind and solar, for a marginal addition to current system.**
- **But the terms of deep decarbonization are altogether different.**
 - Nuclear at advertised cost is needed in the portfolio.
 - Reducing the cost of nuclear has a big impact on total system cost.



Where is the Cost in a Nuclear Power Plant?

Nuclear Island Equipment

13%

Turbine & Generator Equipment

5%

Engineering, Procurement & Construction

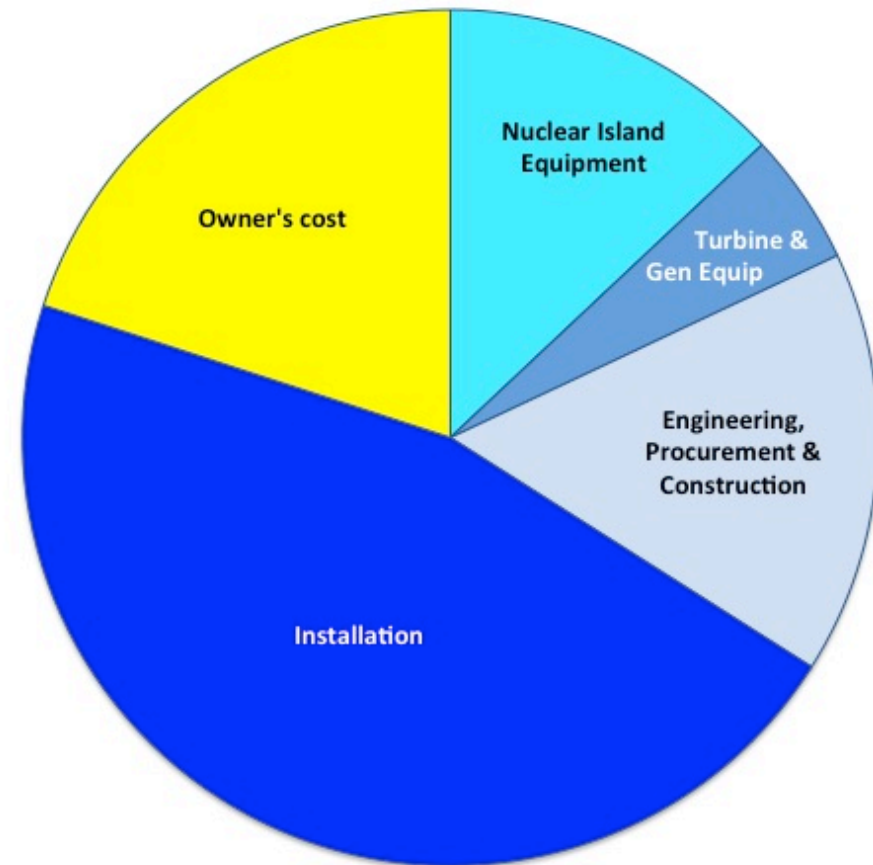
16%

Installation

46%

Owner's Cost

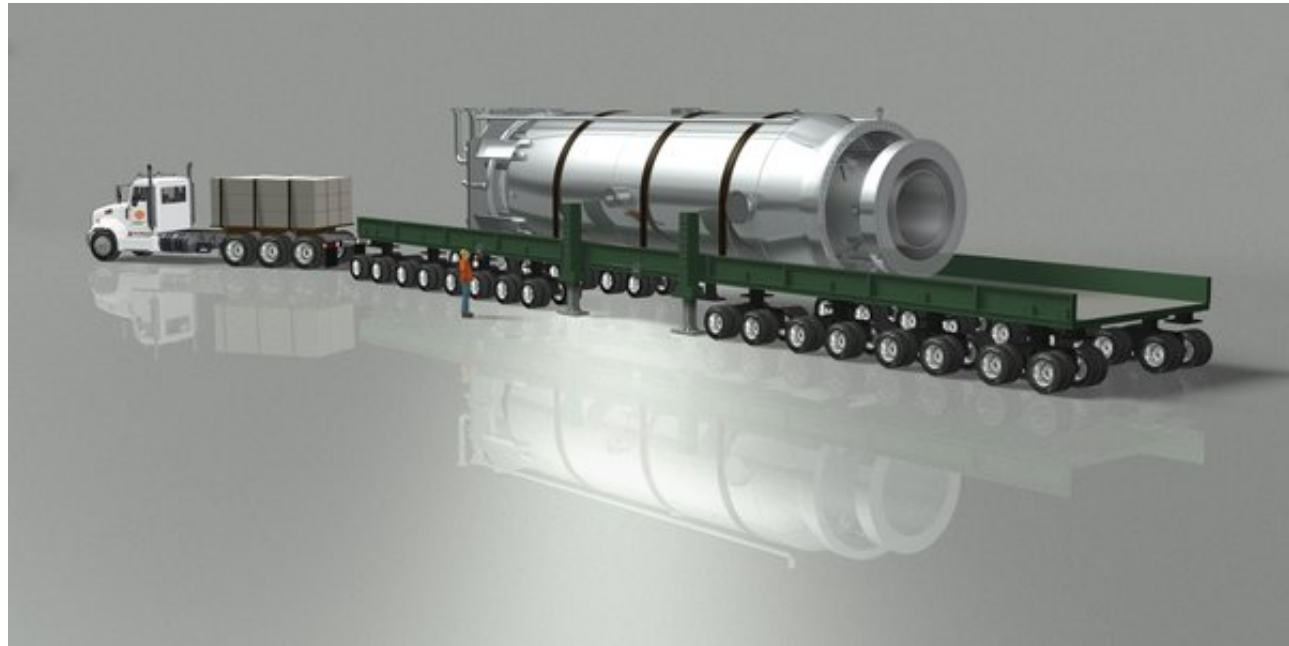
20%



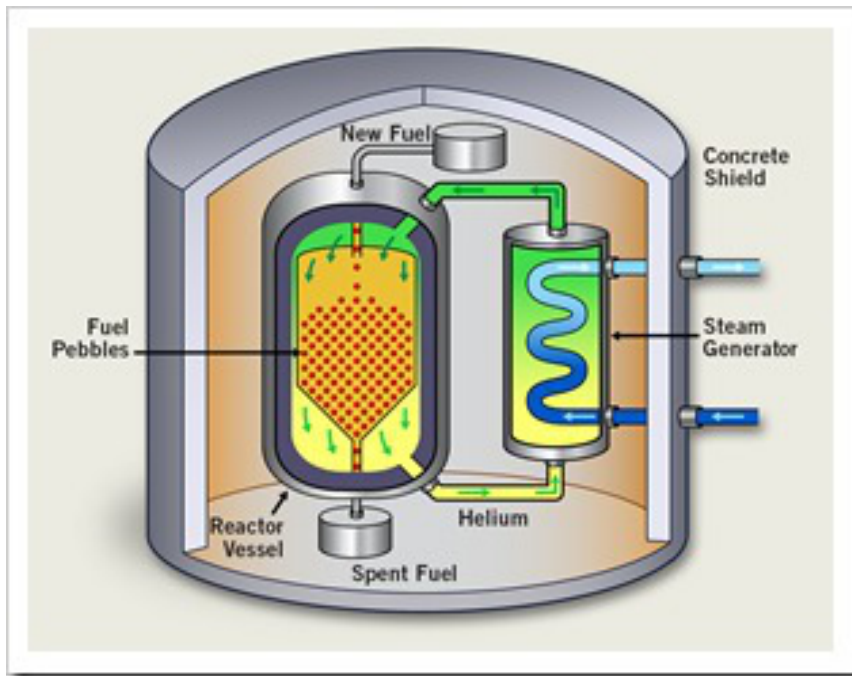
There are Ways to Reduce Cost

Basic blocking and tackling comes first. And, then...

- **Advanced concrete solutions**
- **Seismic isolation and embedment**
- **Modular construction and factory fabrication**



Advanced Reactors



High Temperature Gas Reactor: Two 250 MW modules recently installed in Shandong by China's State Nuclear Power Technology Co.

- **Opportunities for passive and inherent safety features are valuable.**
- **Reductions in cost are possible, but unproven.**
 - advertised claims are ill-informed.
 - parable of the jewel and the box.
 - cost reductions are potentially available if the focus is on the right items; improved fuel cycles cannot dent total cost.
- **An RD&D project**
 - a couple are ready for demonstration, but that is time consuming and expensive.
 - others have more R&D to go.



Policy Recommendations

- **Technology neutral valuation of carbon emissions**
 - whether a carbon tax or cap-and-trade or other structures
 - more a political recommendation than a market-design issue
 - essential to mobilizing private investment, whether for life extensions, construction innovation, or advanced designs
- **R&D focused on reducing construction costs, accompanied by government policy changes to enable, such as licensing changes, equipment code changes.**
- **Create sites to host advanced reactor demonstrations.**
 - NRC participation in demonstration and safety testing.
 - Provisions for fuel and waste.
- **RD&D funding for innovative designs.**
 - Private investors choose designs and invest in construction up-front
 - Federal support through R&D and licensing cost sharing, commercial contracts with milestone support payments, and pay-for-performance credits.



Reflections on the Back-and-Forth re Carbon Tax or Green New Deal (1)

- **A carbon tax is a useful tool.**
- **It is not enough. Not by a long shot.**
 - There are a host of government responsibilities which enable technologies. For nuclear, think waste. ...also, fuel cycle, global market, safety, etc.
 - R&D in all technologies is underfunded.
 - The efficacy of the tax itself depends upon a larger political commitment that is currently missing. For example, any carbon tax can be undone...see Ontario. See also SO₂.
 - Potential financial investors are adamantly reluctant to finance new innovation in nuclear. A price on carbon is not enough for them. There are too many political risks. Each round of investment is large and the horizon long. Policy must be structured accordingly.



Reflections on the Back-and-Forth re Carbon Tax or Green New Deal (2)

- **The Green New Deal is about 3 things: (1) urgency, (2) scale, and (3) social cohesion.**
 - A carbon tax can be an element of a Green New Deal, but a carbon tax alone is weak tea that responds neither to the urgency nor to the scale.
 - Within a comprehensive GND, a carbon tax can mobilize and efficiently allocate enormous sums of investment dollars in certain critical channels.

