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Save Diablo Canyon So It Can Continue to Supply Massive Quantities of Clean Power

The attached 06 February 2016 Atomic Insights blog post by Rod Adams titled, " Save Diablo Canyon So It Can Continue to Supply Massive Quantities of Clean Power" summarizes the environmental - and some of the economic benefits that would result CEC advocacy for the renewal of the NRC license renewal of Diablo Canyon Power Plant (DCPP.)

The second response to Rod's blog post provided a web link. The contents are appended for the convenience of CEC Commissioners and staff. The comparisons between two large lower Colorado River hydropower projects and DCPP are particularly informative. Note that those hydropower projects are producing less power than when they began operation, while DCPP's power output has remained constant.

One of the reasons that the lower Colorado River hydropower projects are producing less power is because anthropogenic global warming caused by the combustion of fossil fuels has diminished annual rainfall in the Colorado River watershed. (My 19 January 2016 15-IEPR-01 docket entry
http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN207632_20160119T133026_Gene_Nelson_PhD_Comments_Climate_Change_Impacts_on_California_E.pdf

noted a similar diminution since 1983 in the annual California hydropower production as a consequence of anthropogenic global warming.)

Additional submitted attachment is included below.

Atomic Insights

Save Diablo Canyon so it can continue to supply massive quantities of clean power

Rod Adams · **February 6, 2016** · 2 Comments http://atomicinsights.com/save-diablo-canyon-so-it-can-continue-to-supply-massive-quantities-of-clean-power/

California has one of the most confusing energy policies in the country. Though it loudly proclaims itself as an environmental leader, with some of the most strict air and water pollution regulations in the world, it has a state law that prevents consideration of new nuclear power plants. It has forced the early closure of 5 completed and operable reactors, replacing their output with additional electricity imports or with local natural gas combustion plants.

It heavily subsidizes or mandates wind and solar energy, giving the impression that it is replacing clean nuclear power with other forms of clean power, but the numbers show that those sources are not providing anything close to the same total amount of electricity as the shuttered nuclear units. They are certainly not providing the other forms of grid stabilization services provided by moderate to large thermal power generation systems like nuclear energy.

My studies into the history of the state's schizophrenic energy policies has led me to the conclusion that they have been strongly influenced by the fact that California has a long tradition as a natural resource state and as the home of several major oil and gas producers. They have always known that abundant nuclear energy threatens their business model.

Now that Diablo Canyon is the last remaining nuclear power plant operating in California, the organizations, individual citizens and political leaders that have made nuclear energy opposition one of their significant activities have been forced to concentrate their efforts. We've covered some of the pressures being applied to force the plant owners to give up and shut the plant down in previous articles.

Fortunately for people who care about rational thinking and clean air, the pressure to protect Diablo Canyon and enable it to continue providing safe, clean, affordable, and reliable power is also growing. Many well-informed, experienced people are realizing that good decision making in a democracy requires their input and actions.

Californians for Green Nuclear Power (CGNP) is an outstanding group that has been working hard to publish op-ed pieces, participate in public meetings, provide docketed comments to policy actions, and speak to community groups all with the goal of helping their fellow Californians understand the importance of nuclear technology. Headquartered on the central coast, they have focused much of their effort on one of their most productive neighbors, Diablo Canyon.

There are other groups that have been focusing their efforts on helping the enormous "tech" industry in Silicon Valley and San Francisco remember that not all technology is based on silicon. They are working to generate excitement about technologies that use thorium, uranium, and plutonium in new and powerful ways to make life better for humanity. At least one of the advanced reactor start-up companies – Oklo – has chosen to locate in Silicon Valley so they they can more easily tap the tech industry's resources, both human and financial.

Michael Shellenberger, one of the co-founders of the Oakland, California based Breakthrough Institute, has been supportive of efforts to improve public knowledge and acceptance of nuclear energy for several years. He was one of the converted former antinuclear environmentalists who were the main characters in Robert Stone's Pandora's Promise. He's still an environmentalist and an ecomodernist who fully supports what Breakthrough is doing, but at the end of 2015, he decided it was time for a new challenge.

He left the Breakthrough Institute and began raising money for a new venture to build an organization that can focus on clean, reliable, affordable energy. The new group, named Environmental Progress, has chosen to Save Diablo Canyon as one of their first campaigns.

Shellenberger has a strong network. He is a professionally trained and experienced campaign organizer who is passionately committed to making a positive impact. Even though Environmental Progress is so new that I was unable to locate its home page, its effort to SaveDiabloCanyon has already been featured in the San Francisco Chronicle with both a front page article titled *Yes nukes! Conservationists rally to save state's nuclear plant* and an op-ed by Shellenberger and Peter Raven titled *Diablo Canyon is needed to save the climate, coasts*.

The news story that helped attract the attention of the SF Chronicle writer was the publication of an open letter to elected state officials and heads of state agencies with assigned areas of responsibility affecting Diablo Canyon informing them of the importance of the plant and petitioning them to take actions to keep it open.

The letter was initially signed by an "international group of scientists, conservationists, and philanthropists"; the campaign also established a capability to add additional signers who want their voices to be heard.

Steven Weissman — Lecturer at the Goldman School of Public Policy and Director of the American Jobs Project, and a former administrative law judge at the California Public Utility Commission — published a rather piqued reaction to the Chronicle's decision to cover the open letter with a front page article. Here is a quote from his post on Berkeley Law's Legal Planet blog titled *The Future of the Diablo Canyon Nuclear Plant*.

The role that nuclear power could or should play in helping to mitigate greenhouse gas emissions is worthy of serious debate, but the latest nuclear-related front-page story in the San Francisco Chronicle is a head-scratcher. Above the fold, the headline reads "Nuclear plant's surprise backers," followed by the following subheading: "Environmentalists push for Diablo Canyon to stay open." The accompanying article reports on a letter sent by a new coalition identifying itself as "Save Diablo Canyon," calling on regulators to relicense the plant. The stated concern is that a closed nuclear plant would make it harder to meet the state's greenhouse gas reduction goals. Constructed on a cliff along the central California coast, Diablo is the last remaining commercial reactor in the state and it soon must either receive a new license, or cease operation.

The mystery about the article is that it only mentions three of those who signed the letter, and each of those three has been on the public record for years as favoring nuclear power. So, where is the surprise? Where is the news item?

After challenging the newsworthiness of the letter, Weissman questions the credibility of claims that the people signing the letter because they care about clean air and water are environmentalists. He seems to believe they are simply good at getting attention as people who have donned the easy-to-assume moniker of "environmentalist" and then challenged environmental orthodoxy.

Weissman ends with a litany of reasons that he opposes the plant, including what he considers to be a poor siting choice, mistakes during construction and a series of "reported incidents." There are several lengthy comments attached to the article, including an exchange between Shellenberger and Weissman that is worth reviewing for civil expression of differences of opinion. Here is the comment that I contributed to the discussion.

February 4, 2016 at 4:49 pm #
Steve:

I'd like to challenge some of the points you asserted and for which you can probably find plenty of supporters. Nuclear energy has been controversial in CA since the early 1960s, when two of California's largest companies (Chevron and Gulf) recognized that it was going to threaten their dominance of the state's energy production and take market share. Shell Oil, though headquartered in Europe, also played a role as did several smaller oil companies, notably ARCO.

You assert that a new nuclear plant being built in CA today wouldn't be located at Diablo Canyon, but you stated that judgment as if it was a known fact with which "everyone" would agree. I can guess the basis for your assertion, but did you know that the Sierra Club specifically worked with PG&E to select the Diablo Canyon site as preferable to several others under consideration? The "cliff" that you mention is a safety feature, it is what puts the plant's safety related systems, structures and components out of reach of any conceivable tsunami.

Since the site is already the location of nuclear power plants, it is probably the best place in CA to site new ones. There is a supportive local community — outside of the Mother's for Peace — and there are knowledgeable professionals who can train a new generation of plant operators. There are transmission corridors that could be expanded, and readily available cooling water.

There is a good bit of controversy in the scientific community about the overall environmental effect of once through cooling versus other ways to dissipate the heat from a thermal power plant. The volume of ocean that is affected is minute compared to the size of the body of water, so the effect on living creatures is equally minute. Many other nations have made no attempt to regulate the long established practice of once through cooling out of existence.

There has been plenty of ink spilled in opposition to Diablo Canyon and in an effort to spread fear, uncertainty and doubt about its performance in an earthquake. I've been suspicious of that heavily promoted earthquake risk ever since I learned that the Hosgri fault was discovered and named by two Shell Oil geologists who delayed promoting their findings until after PG&E had already completed much of the facility. That seems to have been calculated to impose huge costs on a competitor but no one seems to have batted an eyelash at the time.

I don't claim to be a converted former anti-nuclear activist. I've been in favor of the technology ever since I was 8 and my dad explained how his company's new power plants didn't need smokestacks. I know a bit about transmission lines, unreliable power sources, and power generation and believe that Jacobson's studies are build on dreams or mirages, not reality. His employer at Stanford is named the Precourt Institute for Energy. It's named after a generous alumni donor named Jay Precourt, who has given the institute at least $80 million since it was formed in 2006.

No surprise to me, but Jay Precourt earned his BS and MS degrees in Petroleum Engineering and made his fortune in a variety of positions in the oil and gas industry. He probably knows full well that wind and solar projects are really gas projects with nice PR and signage.

I encourage all readers to recognize the importance of full participation in what is going to become a rather loud and contentious discussion about whether or not Diablo Canyon should continue to operate. Like Shellenberger, I believe that this is a great opportunity for people who favor the use of nuclear energy to clearly explain their reasons. Including a bit of passion and honest concerns for current and future generations in that explanation will likely help strengthen the statements.

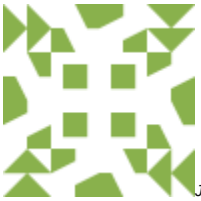
Categories: Aging nuclear, Atomic Advocacy, atomic philanthropy, Diablo Canyon

About Rod Adams

Atomic energy expert with small nuclear plant operating and design experience. Financial, strategic, and political analyst. Former submarine Engineer Officer. Founder, Adams Atomic Engines, Inc. Host and producer, The Atomic Show Podcast. Resume available here. Please subscribe to the Atomic Show RSS feed.

2 Responses to “Save Diablo Canyon so it can continue to supply massive quantities of clean power”

Read below

1.  *James Greenidge* says:

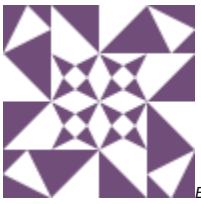
   February 6, 2016 at 5:42 PM

   It’d sure help if just a sliver of California’s oodles of cause-celebs and avant garde activists chimed in support of nuclear-clean air and environment. Their silence is killing.

   BTW the NYC media today is going nuts over a radioactive reading that’s out of place at Indian Point (the WCBS-Radio female reporter even quipped that ANY radiation is very bad to get) — and even the Gov chimed in to assure the media and public while holding an axe behind his back. It’s these very FUD media eruptions that’s tailor-made for nuclear media and nuclear organizations to raise their heads and knock on the media’s door to straighten them out with some real life perspective.

   Remember Shoreham!

   James Greenidge
   Queens NY

2.  *Ed Leaver* says:

   February 6, 2016 at 6:57 PM

   Thanks Rod. Shellenberger’s Environmental Progress site is pretty much a place-holder at present., but no-doubt worth bookmarking.

   RE:. Diablo Canyon, I wrote a short Letter to the Editor of *The Denver Post* a few months ago. It wasn’t published, but is available online along with some supplementary material here.

On Nuclear Power Losing its Glow in California

Celebrating Climate Change 2015

Posted by Edward Leaver, 3 December 2015
http://www.edleaver.com/Archives/2015/11/OnLosingItsGlowCalifornia/OnLosingItsGlowCalifornia.php

Michael R. Blood's AP piece Nuclear power losing its glow in Calif. that appeared in The Denver Post Sunday, 29 November 2015, reported on movement to close California's last remaining nuclear power plant. We examine some environmental costs of such action.

Hoover Dam | Diablo Canyon | Lake Powell

Diablo Canyon's two nuclear reactors combine for 2.24 GW and 87% capacity factor. Pacific Gas and Electric, seeking a 20-year extension to their operating license, faces determined opposition from traditional environmental organizations. Prematurely closed, 20 lost years operation would have generated 340 TWh essentially zero carbon electricity and 1100 tons[1] readily stored used fuel which, if not recycled, would decay to natural pitchblende levels in about 250,000 years. (Properly recycled, in about 500 years.)

1 TW is 1,000 GW, or 1 million MW.

Lakes Powell and Mead today combine for 2.8 GW and 25% capacity factor. Diablo Canyon generates four fifths the peak power and over 2.5 times the total yearly energy as the entire lower Colorado – about the same as that generated by California's 33 year accumulated build-out of solar and wind.

Were Diablo Canyon forced to close, it's replacements – whatever they might be – might as well have avoided 340 TWh coal generation somewhere else, generation that will release 300 million tonnes of dangerous carbon dioxide, as an irretrievable and essentially permanent gas, into our atmosphere.[2]

One wonders why we're losing our war with coal.

* * * *

Supplementary Material

Table 1: Hydropower and Nuclear: Clean Reliable Generation

	Capacity			Yearly Production	
	nameplate	current	average	current	historical
Glen Canyon Hydro:	1.3 GW	1.2 GW	300 MW avg at 25% Cf	2.6 TWh/y	2.85 TWh/y[3]
Hoover Dam Hydro:	2.0 GW	1.6 GW	400 MW avg at 25% Cf,	3.5 TWh/y	4.20 TWh/y[4]
Diablo Canyon Nuclear:	2.24 GW	(same)	1.94 GW avg at 86.4% Cf	17.0 TWh/y avg	19.6 TWh/y max[5]

As of 2014 California had 6,020 MW installed wind capacity, or 1.8 GW average at 30% Capacity Factor. In an average year Diablo Canyon Nuclear Power Plant puts out more usable electricity than all of California's wind farms, installed over 33 years, combined.

The combined yearly output of the two large Colorado River dams, 7.1 TWh, is less than half Diablo Canyon's 17 TWh average generation. Considering the environmental cost of those major river dams, and utter lack of remaining sites for their like, I'd hope opponents of Diablo Canyon would carefully think through their position. The 17 TWh/y base load gas needed to replace Diablo Canyon will emit at least 6.2 million tonnes CO2 each year, and could alternatively replace nearly all of California's remaining 3 GW base load coal which is currently emitting today at least 15.1 million tonnes CO2 to generate the same 17 TWh:

Table 2: Three ways to generate 34 TWh a year.
Diablo Canyon averages 17 TWh/y. California proposes to replace it with an equivalent amount of fracked gas, and perhaps some wind. Since Diablo Canyon can almost certainly be recertified for operation through 2044, the proposed early replacement generation might alternatively be used to retire baseload coal instead:

Current emissions from 34 TWh/y, coal and Diablo Canyon:	15.1 Mt CO2 from coal + 0 from Diablo Canyon	15.1 Mt/y CO2
Emissions if fracked gas replaces Diablo Canyon:	15.1 Mt CO2 from coal + 6.2 Mt from gas	21.3 Mt/y CO2
Emissions if fracked gas replaces coal:	0 from coal + 0 from DC + 6.2 Mt from gas	6.2 Mt/y CO2

1 Mt = 1 million tonnes. We assume 360 tonnes CO2 is emitted for each GWh of natural gas generation operating as combined cycle baseload, and 890 tonnes for each GWh of coal.[6] (1 tonne = 1000 kg = 2,200 lb.)

By installing 17 TWh/y of new gas generation and retiring 17 TWh/y of old coal or old uranium, we can either reduce the associated emissions by 15/6 = 2.5 fold, or increase them by 40%. Choose wisely. But do keep in mind that possible 2.5-fold reduction realized by replacing old coal with new gas won't be enough: we'll need essentially zero emissions from the electric sector if we're going to meet climate requirements.

As for the ongoing 2015 U.N. Framework Convention on Climate Change, COP21 in Paris, we've all seen the figures illustrating who is most responsible for present and historic carbon emissions:

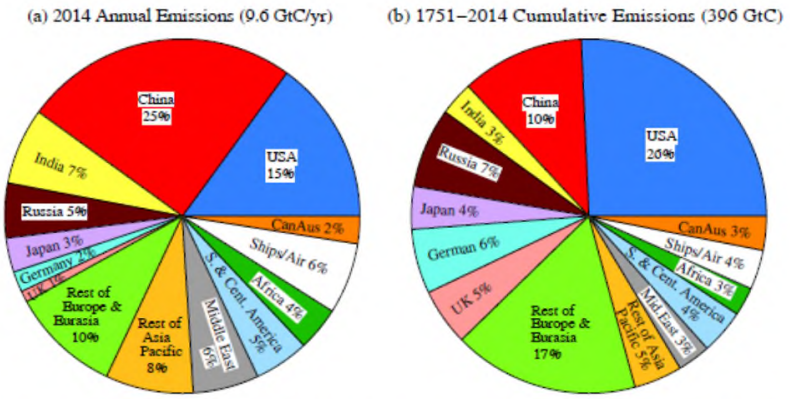


Fig. 1. Annual 2014 and cumulative (1751-2014) fossil fuel CO_2 emissions (CDIAC data, BP updates).[4]

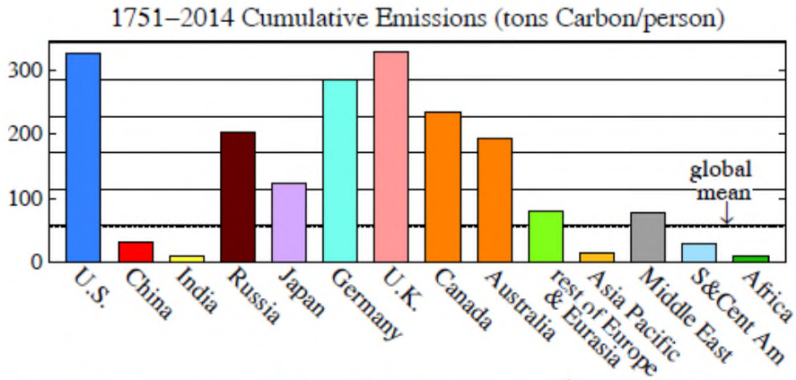


Fig. 2. Per capita cumulative (1751-2014) fossil fuel CO_2 emissions[4] based on 2010 populations.

Source: James Hansen Isolation of 1600 Pennsylvania Avenue: Part I, 27 November 2015.

Of course, our collective war on uranium did not start at Diablo Canyon, nor will it there end. Kewaunee, Vermont Yankee, Pilgrim, FitzPatrick, Oyster Creek, San Onofre, Diablo Canyon, Indian Point. Eight plants either closed prematurely, announced to be closed prematurely, or vociferously desired to be closed prematurely. And not one of them – not even San Onofre – for reasons of safety. With a combined 9.76 GW, if operated over twenty years at 85% average capacity, those eight plants alone would generate us another 1,453 TWh dispatchable electricity, essentially carbon-free,[7] sparing us from emitting another 1.3 billion tonnes carbon dioxide, emissions avoided simply by not burning coal.

Shutting down safely operating and fully licensable domestic nuclear power, to satisfy what amounts to provincial ideological whim, represents perhaps the epitome of fossil fuel profligacy, and sends a clear message the Rest of the World might not want to hear.

* * * *

Epilogue

Throughout, I have advocated continued operation of safely operating reactors. Nuclear opponents might contend there is no such thing, at least in seismically active regions of the planet which, arguably, would be all of it. Such concerns have been ongoing since the beginning of the nuclear power era, particularly around Diablo Canyon, and there is little I can say to allay them here.[8] I will suggest that ongoing thermal pollution lawsuits and demands that PG&E replace ocean discharge with expensive cooling tower retrofit, are a red herring: that ecological damage has been done. Retiring the plant prematurely will needlessly introduce more ecological damage elsewhere.

And everywhere. No human activity is completely without risk. Regrettably, that includes nuclear power generation. Here I've tried to illustrate it also includes all probable alternatives to nuclear power generation. For nuclear advocates who might think it a black-and-white issue, I might suggest, global warming and environment notwithstanding, politically it is anything but: see The Diablo Canyon Timeline.

References and Reading:

- Wikipedia: Hoover Dam.
- Wikipedia: Glen Canyon Dam.
- Wikipedia: Wind power in California.
- American Wind Energy Association: California Wind Energy.
- World Nuclear Association: California's Electricity.
- E&E News: Receding Lake Mead poses challenges to Hoover Dam's power output 30 June 2014
- IEEE Spectrum: Colorado River Hydropower Faces a Dry Future 19 Sep 2013.
- High Country News: Glen Canyon Dam's Evaporating Hydropower.
- Forbes: Are California Carbon Goals Kaput? James Conca, 2 Oct 2014
- California Council on Science and Technology: California's Energy Future – Powering California with Nuclear Energy, Burton Richter, Robert Budnitz, Jane Long, Per Peterson, and Jan Schori, July 2011.
- James Hansen, Kerry Emanuel, Ken Caldeira and Tom Wigley: Nuclear power paves the only viable path forward on climate change The Guardian, 3 Dec 2015.

[1]The Table of Material Balance at the end of WNA's Nuclear Feul Cycle Overview gives an approximate 27 tonnes Used Fuel per year of GW nuclear power reactor operation. 40 reactor years would produce 1080 tonnes, or 1188 short tons.

[2]Statistically, those 340 TWh of continued coal generation will result in 5 thousand deaths from coal-related mining and pollution in the United States. There would be about 30 deaths from uranium – and those only if one assumes both the Linear-No-Theshold (LNT) radiation hypothesis, and includes Chernobyl in one's statistics. See Gail Marcus, PhD, in A Comparison of Energy Sources. Chernobyl's RBMK-1000 reactor was of a design that could never have been approved anywhere in the West.

[3]I was unable to find precise estimate of Glen Canyon power generation at time of this article. Most sources cite an 8% derating beneath its nominal maximum, or 1.2 GW. The power conversion factors cited in Glen Canyon Dam's Evaporating Hydropower suggest it may be nearly twice this: 15% or 1.1 GW. Glen Canyon saw 18 construction deaths

[4]Hoover Dam's current output is limited by historical low water levels due to drought. Hoover saw 112 construction deaths not counting carbon monoxide poisoning.

[5]Diablo Canyon saw no construction casualties.

[6]WNA's Energy Analysis of Power Systems, citing Swedish experience, suggests 450 tonnes CO2/GWh for combined cycle gas. In that case 360 tonnes/GWh would make a fairly generous allowance for wind.

[7]Roughly three-fifths nuclear carbon dioxide emission occurs during construction – steel and concrete – and decomissioning. For existing plants, those emission costs are sunk. Emissions during Uranium mining and refinement are tiny relative to the amount of carbon emission-free fission energy obtained while operating.

[8]Little but repeat the suggestion that while no deaths or injuries are likely from radiation released at Fukushima, the same cannot be said for the forced evacuation, which has resulted in over a thousand quite unneccesary stress-related deaths. Those were real people, radiophobia is a deadly disease. See J.A. Sigel, PhD, W. Sacks, PhD, MD, and M.G. Stablin, CHP, PhD in LNT 999, Health Physics News, Vol 43 No. 10, October 2015, pages 23-24.

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