

Prospective Closure of the Diablo Canyon Nuclear Power Plant Economic Impact Assessment

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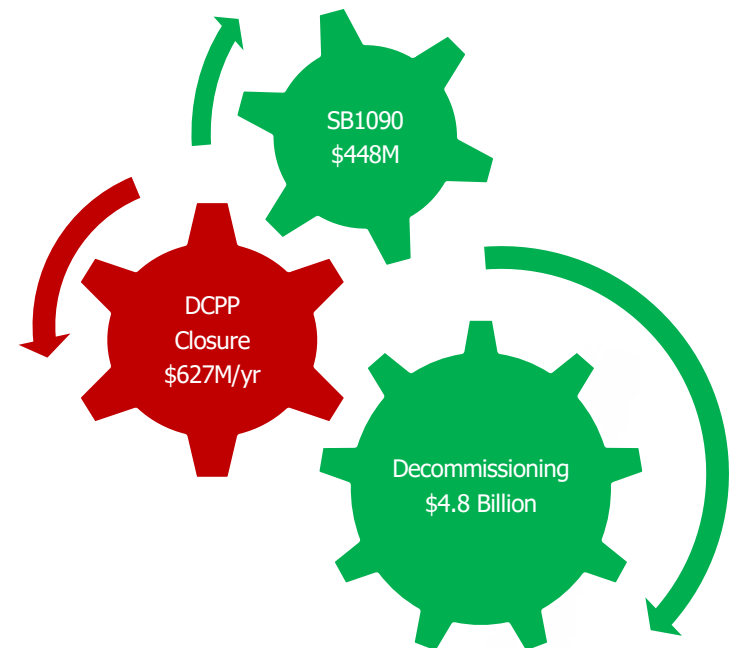
Our study was comprised of five parts:

1. Macroeconomic Assessment
2. Local Stakeholder Consultation
3. Local Stakeholder Survey
4. Real Estate Market Analysis
5. Bond Market Analysis

1. Macroeconomics: What we modeled

Three main economic drivers in the scenarios:

- **Impact 1: SB1090 and D.18-01-022 – Positive Shock (Pre-Closure)**
 - \$363.4 million for employee retention and retraining.
 - \$352.1 million for retention.
 - Payments vary across 7 years.
 - \$85 million for community impact mitigation settlement.
 - \$75 million for “Essential Services Mitigation Fund” (ESMF).
 - Spent evenly across 7 years.
 - \$10 million for “Economic Development Fund” (EDF).
 - One-time payment.
- **Impact 2: DCPD Closure – Negative Shock (Post-Closure)**
 - \$226 million for payroll.
 - 1,396 local employees.
 - \$374 million in expenditures for goods and services.
 - \$26.5 million unitary property tax.
- **Impact 3: DCPD Decommissioning Expenditures – Positive Shock (Post-Closure)**
 - \$4.8 billion, allocated over 10 years.
 - \$1.44 billion for waste management and remediation.
 - \$1.07 billion for utilities.
 - \$959 million for construction of other new nonresidential structures.
 - \$666 million for architectural, engineering, and related services.
 - \$401 million for investigation and security services.
 - \$227 million in other categories.



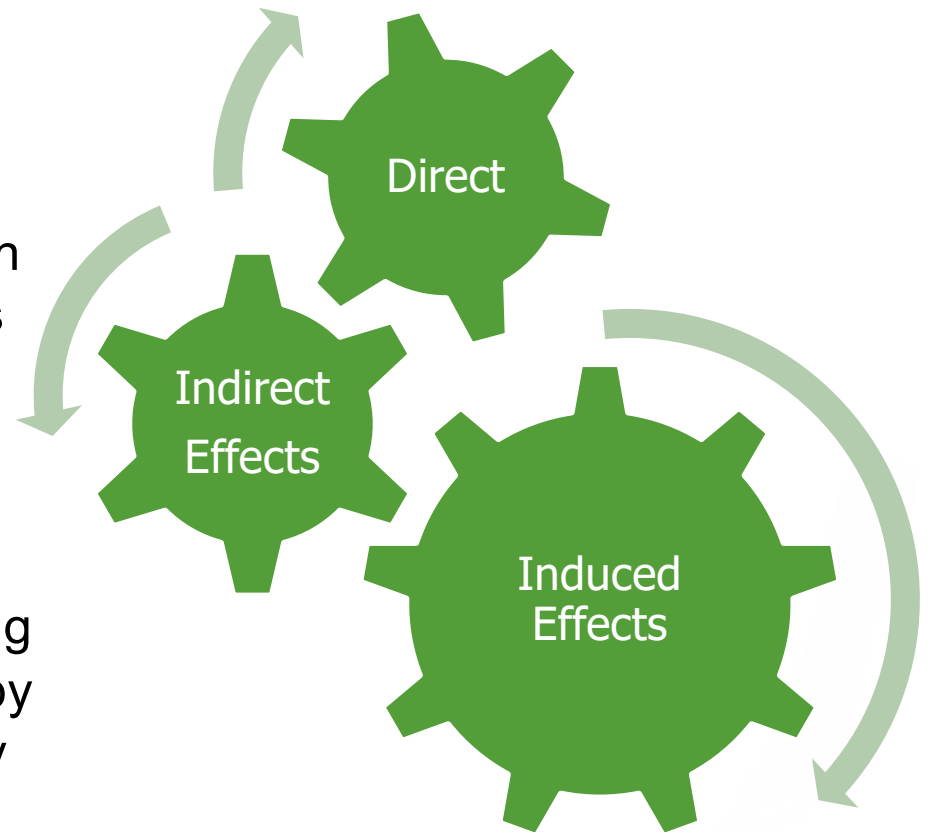


Macroeconomics: Results

- Average net economic losses for SLO county would be about \$77 million per year for a decade, far less than previous estimates which placed losses closer to \$1 billion/yr.
- Previous studies have only considered the negative shocks, whereas we take account of how decommissioning expenditures will substantially offset economic losses attributable to plant closure.
- Although DCPD closure will result in meaningful economic adversity for some stakeholders, overall economic growth in the region will still be positive.
- In today's SLO economy, \$77 million equals 0.6% of annual gross product, well below historical growth rates.

Component Impacts

- Direct Effects: Increased economic activity in response to direct spending (investment or consumption).
- Indirect effects: Economic activity in enterprises linked by supply chains to directly affected sectors (e.g., suppliers of input components and raw materials).
- Induced effects: Demand from rising household income (e.g. spending by employees of directly and indirectly affected firms).



Economic Linkages Transmit Impacts

Table A - 1: Net Annual Economic Impact of DCPD Closure with Requested Decommissioning Expenditures, San Luis Obispo County (2016 Dollars Annually for 10 years)

Impact Type	Employment (FTE Jobs)	Labor Income	Output
Direct Effect	1,646	-\$56,810,617	-\$121,440,277
Indirect Effect	460	\$21,567,039	\$54,126,942
Induced Effect	-76	-\$3,138,360	-\$9,677,013
Total Effect	2,030	-\$38,381,939	-\$76,990,348

Table A - 2: Net Annual Economic Impact of DCPD Closure with Requested Decommissioning Expenditures, Santa Barbara County

Impact Type	Employment (FTE Jobs)	Labor Income	Output
Direct Effect	0	\$0	\$0
Indirect Effect	82	\$5,027,960	\$13,973,808
Induced Effect	-83	-\$4,118,519	-\$11,670,337
Total Effect	-1	\$909,440	\$2,303,471

Table A - 3: Net Annual Economic Impact of DCPD Closure with Requested Decommissioning Expenditures, Rest of California

Impact Type	Employment (FTE Jobs)	Labor Income	Output
Direct Effect	0	\$0	\$0
Indirect Effect	358	\$26,277,475	\$73,786,852
Induced Effect	124	\$6,572,130	\$19,457,409
Total Effect	483	\$32,849,605	\$93,244,262

- Closure reduces SLO GDP but increases employment
- This is a more inclusive economy, but with slightly lower average wages (-0.6%)
- Rest of the state benefits



2. Local Stakeholder Consultation

- At the request of CPUC, we engaged nine key stakeholders to discuss issues they identified as important related to the closure of DCP.
- Topics included the following:
 - Fiscal challenges for county and city managers
 - Local Community Expenditure Concerns
 - Perceptions of regional variation in ability to adapt to the closure
 - Discussion of how to adapt the local economy post-closure
 - Housing crisis and affordability gap
 - The Impact to community not reflected in economic numbers



Fiscal challenges for county and city managers

- The key fiscal concern is loss revenue from the unitary property tax paid by PG&E on DCPD land and assets.
- SB 1090 alleviates some of these shortfalls in the short-run (pre-closure) but concerns remain about fiscal sufficiency post-closure.
- This concern was most pronounced for the county government.
- In-depth fiscal planning has already begun.



Local Community Expenditures

- DCPD closure and associated loss of high-income jobs could lead to a reduction in discretionary spending in the surrounding community.
- What will be the impacts on the single high-end grocer and/or the mid- to high-tier restaurants?
- Given how small the community is, there are concerns that the loss of specialty business revenue could have an outsized impact on the community.



Perceptions of regional variation in adaptation capacity

- Average household income for San Luis Obispo county is approximately \$65,000, average DCPD salary is approximately \$150,000.
- DCPD workers are also quite spread out across the county in terms of residence.
- There is concern in certain communities (North County in particular) that losing these residents will have relatively large negative expenditure effects.
- In the city of SLO, this seemed to be less of a concern because the economy is more diversified.



Post-closure adaptation challenges

- The point was made several times that employment in the county of San Luis Obispo is largely supported by government agencies and DCPP.
- Several stakeholders expressed concern about the loss of high-income earners currently employed at DCPP.
- There is a feeling that new economic development opportunities must be aggressively pursued in order to diversify the economy and attract new businesses, particularly ones that support a high-skilled labor force.



Housing affordability gap

- The affordability gap between average household income and the rising cost of housing is clearly a concern, but few thought DCPD closure would affect this.
- Permitting for new residential construction can be restrictive and several stakeholders felt that this was a serious barrier to diversifying the residential market.
- Many who work in the service and public sector are unable to afford much of the existing housing stock.
- Community marketing is needed to improve the investment climate for two priorities
 - Increasing the share of affordable housing
 - Targeting new, higher wage employers



Community impacts not reflected in economic numbers

- There were significant concerns about who DCPP employees are and what they mean for the local community.
- DCPP employees hold head-of-household jobs that cannot be easily replaced with service sector or government jobs. DCPP employees donate to local schools, volunteer, or serve in other leadership roles.
- Will the fabric of the community, especially in bedroom communities, be threatened as the DCPP jobs leave?

3. Stakeholder Population and Survey Sample: Percent Shares by ZIP Code

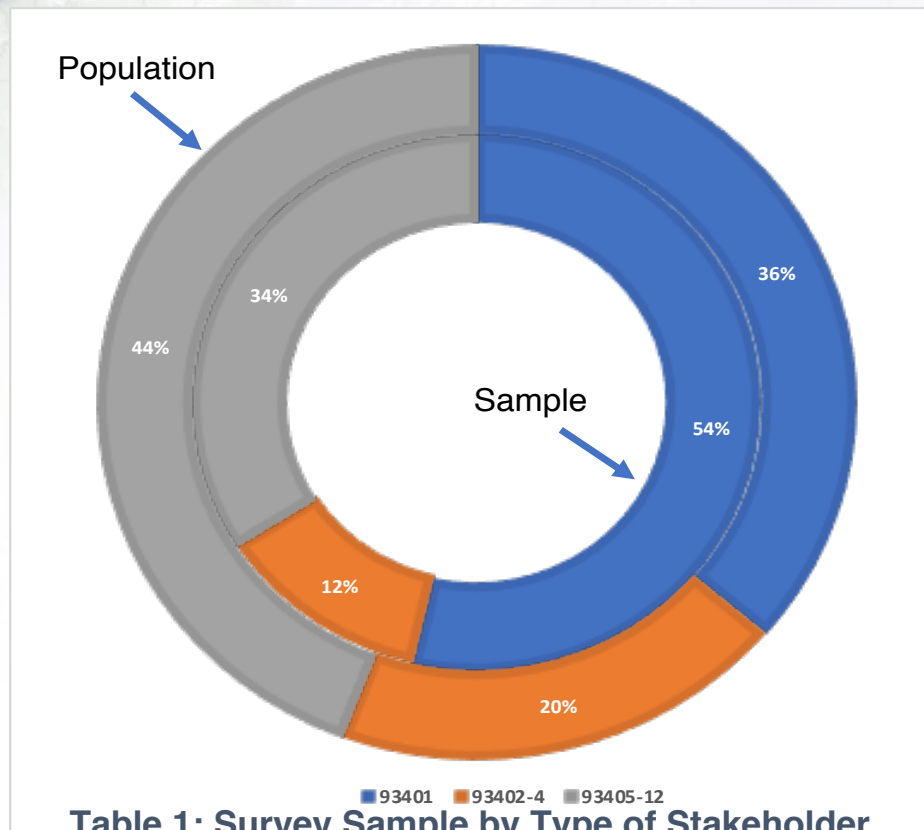


Table 1: Survey Sample by Type of Stakeholder

Answer	Percent
Private Enterprise	31
Non-Governmental Organization	13
Public Agency / Education	56
	100

- Randomized sample (Dunn and Bradstreet)
- Three different stakeholder groups
- 239 respondents

Optimistic Enterprise Outlook

Table 38: Percent of Firms Reporting Business Expansion Compared to 1 and 5 Years Ago

Category	1-Year Horizon	5-Year Horizon
Employment	39%	55%
New Orders	47%	66%
Dollar Sales / Earnings	50%	61%

Table 39: Percent of Firms Reporting Business Decline Compared to 1 and 5 Years Ago

Category	1-Year Horizon	5-Year Horizon
Employment	18%	27%
New Orders	19%	19%
Dollar Sales / Earnings	16%	29%

Twice the number of SLO enterprises reported business expansion in the last 1-5 years as those who reported contraction.

Shared Values

Table 40: Percent of the Sample in Agreement with Each Statement, by Stakeholder Group

Statement	Percent in Agreement		
	Business	NGO	PubAdm
"San Luis Obispo County has a robust, vibrant economy."	50%	53%	58%
"Housing prices are having a negative impact on the local economy."	75%	87%	80%
"Marketing to and attraction of job candidates is a persistent challenge in the county."	81%	80%	72%
"Economic anchors like DCPD or CalPoly benefit the economy, but also allow county residents to be complacent about long-term challenges to promote economic growth and diversification."	71%	80%	63%
"San Luis Obispo County suffers from a persistent 'affordability gap' between wages and housing costs."	94%	93%	90%

Majorities of all three stakeholder groups agreed with the statement that "San Luis Obispo County has a robust, vibrant economy."

High Conviction on Cost of Living Risks

Table 41: Average Ranking of Agreement on Each Statement, by Stakeholder Group

Statement	Weighted Average		
	Business	NGO	PubAdm
"San Luis Obispo County has a robust, vibrant economy."	2.3	2.2	2.5
"Housing prices are having a negative impact on the local economy."	3.2	3.4	3.3
"Marketing to and attraction of job candidates is a persistent challenge in the county."	3.2	3.4	3.0
"Economic anchors like DCPD or CalPoly benefit the economy, but also allow county residents to be complacent about long-term challenges to promote economic growth and diversification."	2.8	2.9	2.7
"San Luis Obispo County suffers from a persistent 'affordability gap' between wages and housing costs."	3.7	3.7	3.7

Note: Rankings are average scores for each statement and stakeholder type.

Percentages indicate agreement, rankings show conviction.

Optimism was tempered, however, with expressions of concern regarding growth challenges, especially affordability.

Disparities of expectations regarding closure impacts

Table 43: Following DCPD closure, do you expect your Institution to fare better, worse, or stay the same?

Respondent	Percent		
	Better	Same	Worse
Private Businesses	7%	77%	17%
Non-governmental Organizations	17%	50%	33%
Public administration / government	3%	50%	47%

Yet remarkable agreement about important local economy issues

Table 44: What are Your Primary Concerns About DCPD Closure

Statement	Percent “Very Important”		
	Business	NGO	PubAdmin
Economic uncertainty	73%	50%	66%
Loss of tax revenue	70%	73%	81%
Loss of jobs	72%	78%	72%
Emigration	21%	20%	23%
Electricity costs	47%	45%	44%
Change in real estate values	43%	44%	43%



Conclusions from the Survey

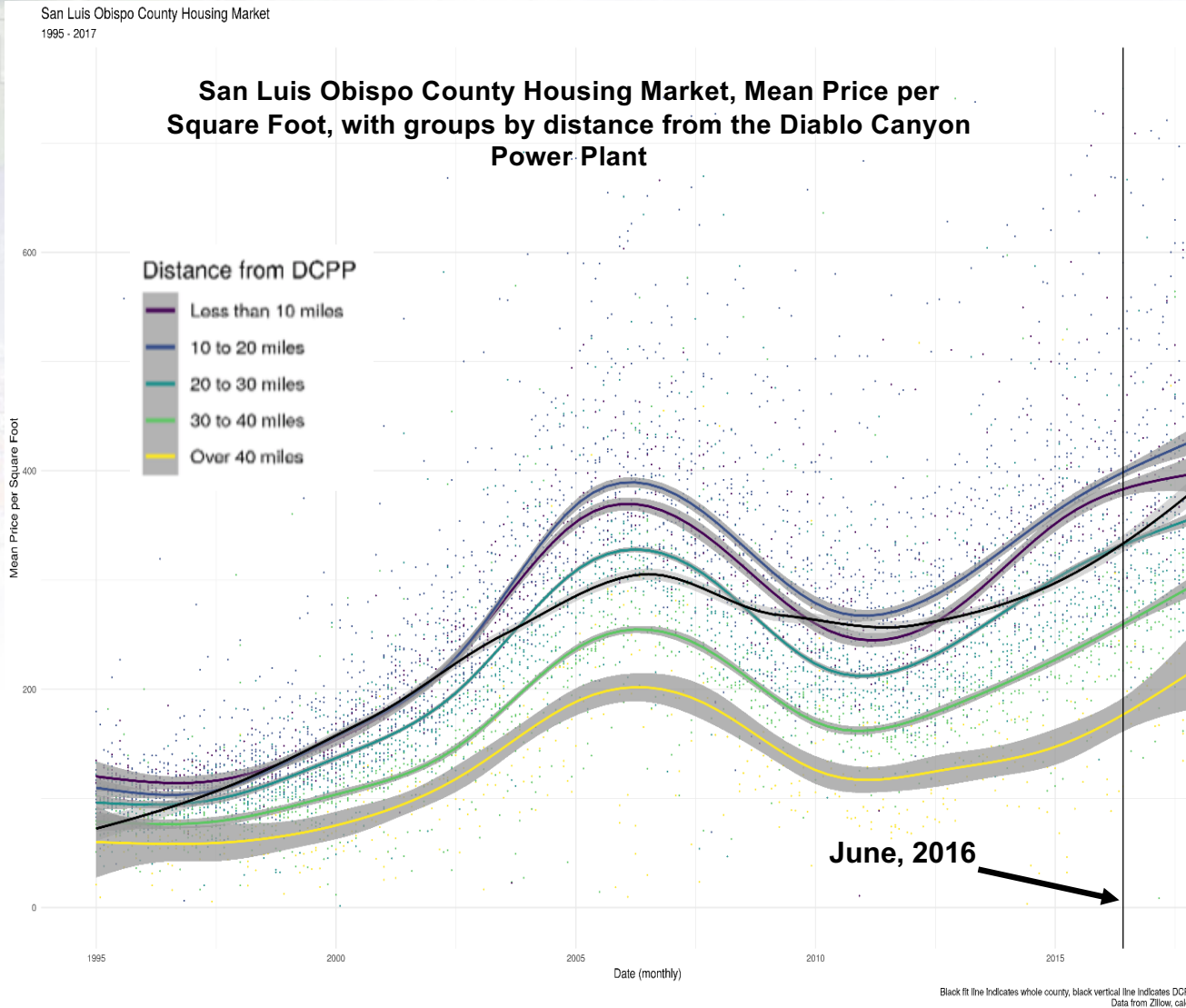
- Not only the most relevant, but perhaps the most important findings for our assessment relate to the sentiments aroused by DCPD closure, discordant expectations over shared values.
- An unintended but valuable benefit of DCPD closure could be a new generation of multi-stakeholder commitment to more sustainable and inclusive growth across the SLO economy.
- Shared values offer welcome cohesion, while discordant expectations can stimulate constructive discourse, motivate discovery, and impel the community to improve mutual awareness and cooperation.
- To facilitate this, our survey also sought to identify leading concerns and opinions about DCPD. These hallmark issues could be used to jump start and sustain dialog for community strategic planning.



4. Housing Market Analysis

- The impact of the DCPD closure on real estate values has been a frequently expressed concern across the spectrum SLO public and private stakeholders.
- To assess this risk, we made use of a newly-available database of historical housing prices from Zillow.
- Comparing two different statistical models, we found that the DCPD closure announcement had very small (and partially conflicting) impacts on SLO housing prices.
- The same was true for SONGS and NPP closures we looked at elsewhere in the US.

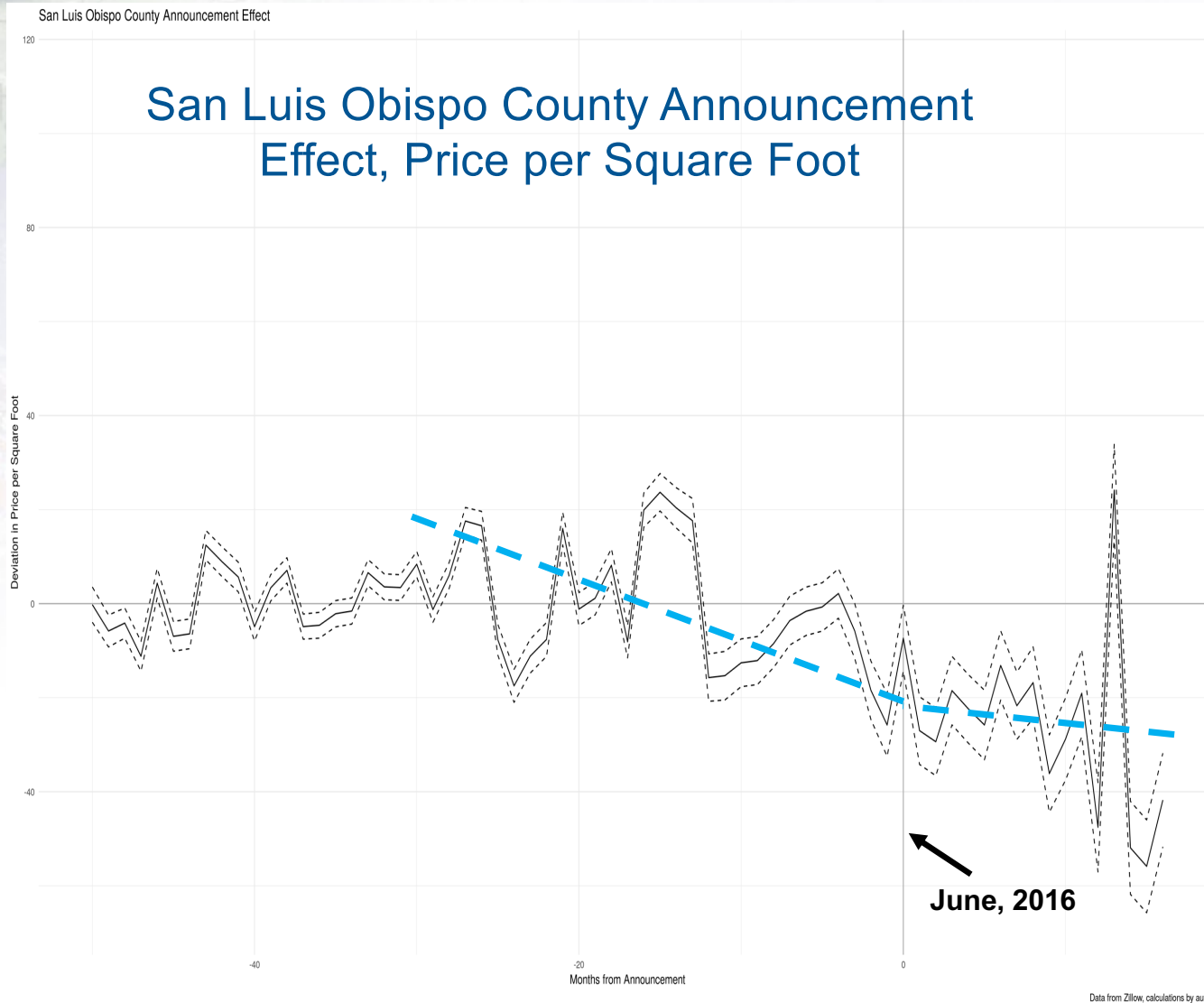
DCPP Announcement Effect: Event Study Results



Overall impacts:

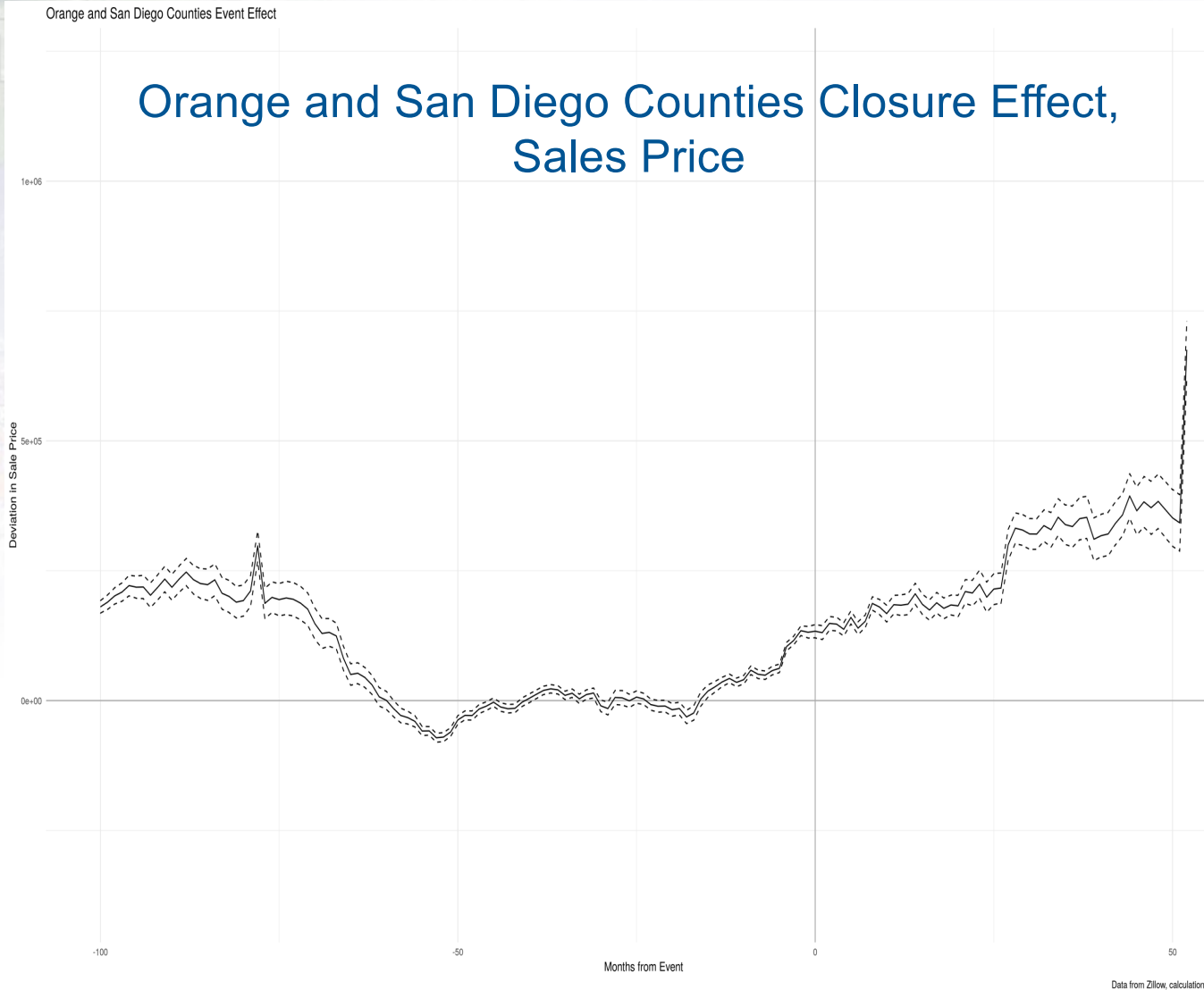
- Small trend effects
- Depends on Proximity
- Small post-announcement sample

DCPP Announcement Effect: Difference in Differences Results



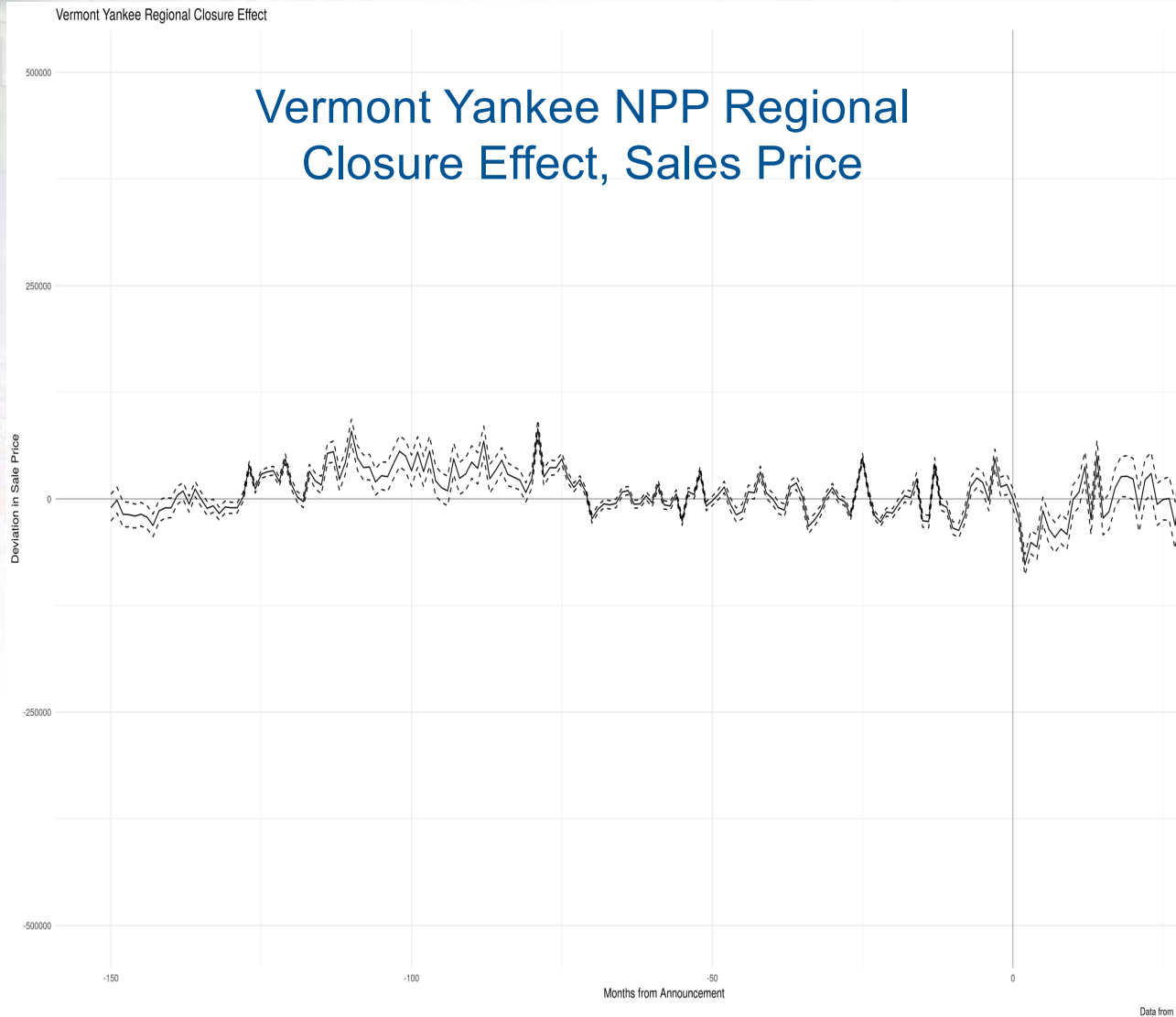
- This approach actually showed small trend appreciation
- Changed risk perception?

Comparison 1: SONGS Difference in Differences Results



- Large and statistically significant appreciation
- Probably compounded by other market drivers
- A highly diverse and resilient local economy

Comparison 2: VYNPP Difference in Differences Results

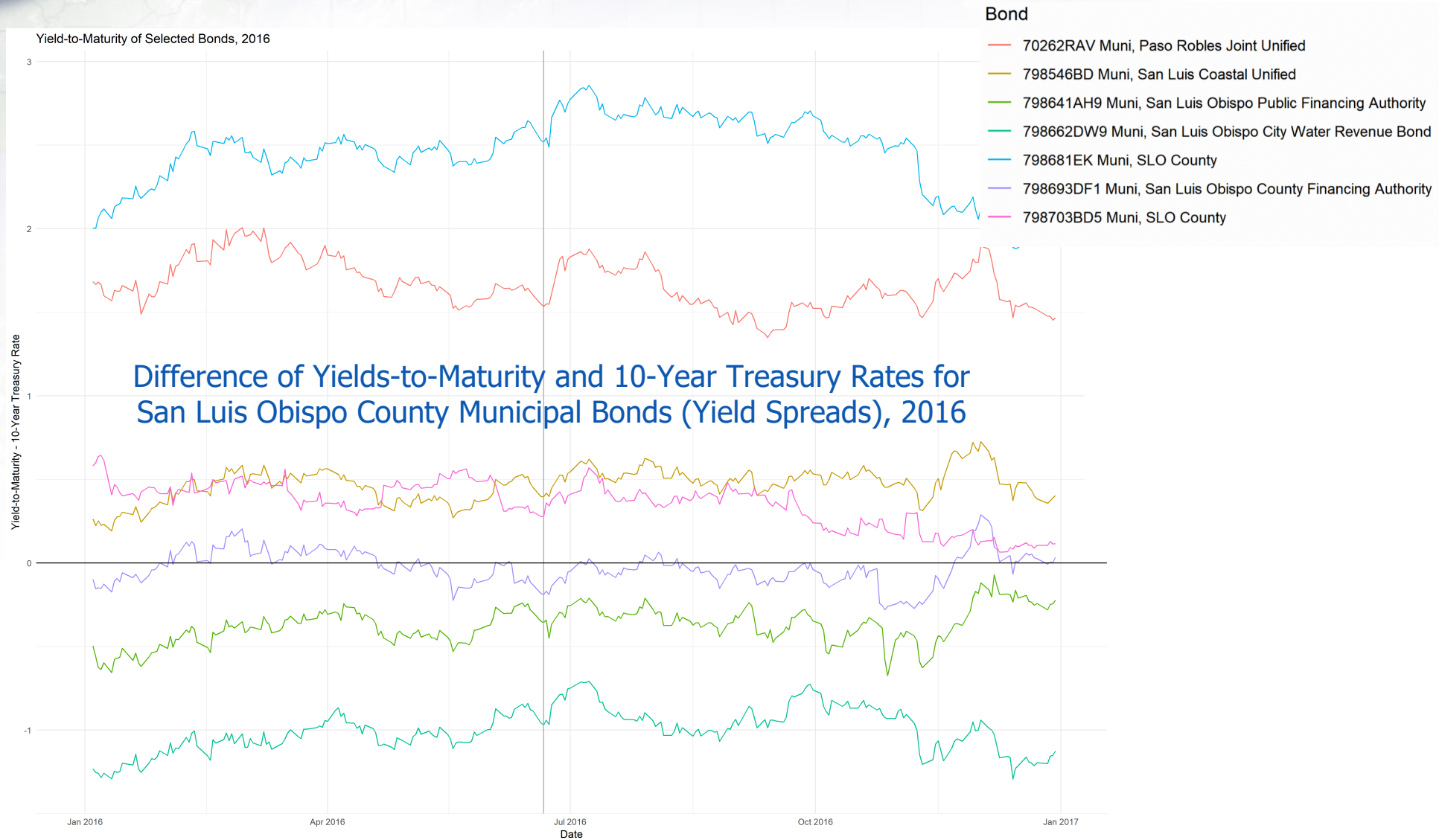


- Statistically significant announcement effect, but
- Small, and
- Very transitory

5. Bond Market Impacts

- Like real estate values, fiscal sufficiency has been a frequently expressed concern in the DCPD closure dialog, especially by public sector stakeholders.
- In our macroeconomic assessment, we estimated the direct, indirect, and induced revenue implications of the main DCPD closure effects.
- Perhaps even more significant for SLO public finance, however, is the cost of capital. In times when economic sentiments about a regional economy turn negative, bond markets usually send a clear signal by pricing risk into higher bond rates. The effects of this on overall budgets can be even greater than the loss of individual revenue sources.
- To ascertain the significance of this for SLO and DCPD, we studied high frequency data on local bond prices econometrically.
- Looking across many borrowing agencies and debt instruments, we found no persistently adverse announcement effects.

Announcement Effects on SLO Local Financing



Net Impacts Revisited

Table A - 101: Net Annual Economic Impact of DCPD Closure with Upper Bound Decommissioning Expenditures, San Luis Obispo County, (2016 Dollars Annually for 10 years)

Impact Type	Employment (FTE Jobs)	Labor Income	Output
Direct Effect	2,406	-\$14,469,030	-\$1,583,243
Indirect Effect	688	\$31,990,474	\$84,178,960
Induced Effect	170	\$6,862,873	\$21,370,822
Total Effect	3,265	\$24,384,315	\$103,966,539

Table A - 102: Net Annual Economic Impact of DCPD Closure with Upper Bound Decommissioning Expenditures, Santa Barbara County, (2016 Dollars Annually for 10 years)

Impact Type	Employment (FTE Jobs)	Labor Income	Output
Direct Effect	0	\$0	\$0
Indirect Effect	106	\$6,531,112	\$18,112,850
Induced Effect	-70	-\$3,456,097	-\$9,738,150
Total Effect	36	\$3,075,015	\$8,374,700

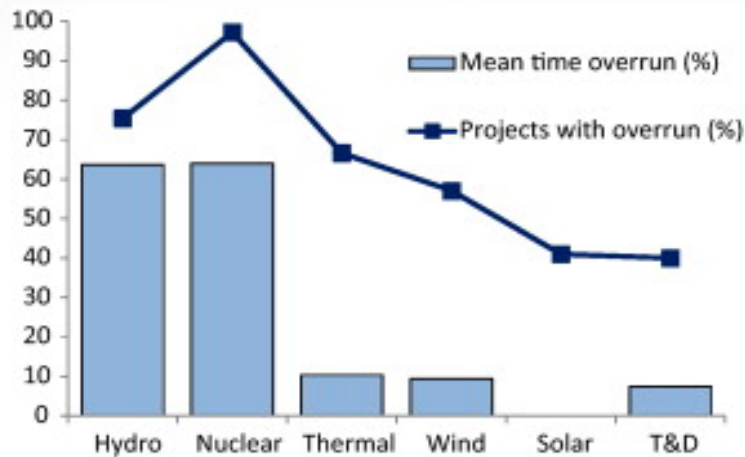
Table A - 103: Net Annual Economic Impact of DCPD Closure with Upper Bound Decommissioning Expenditures, Rest of California, (2016 Dollars Annually for 10 years)

Impact Type	Employment (FTE Jobs)	Labor Income	Output
Direct Effect	0	\$0	\$0
Indirect Effect	459	\$33,714,444	\$94,494,605
Induced Effect	196	\$10,937,006	\$31,674,514
Total Effect	655	\$44,651,450	\$126,169,119

- We examined net macroeconomic impacts for alternative Decommissioning Budgets
- The Upper Bound case (\$6B budget) results in net stimulus for the overall SLO economy.
- This scenario would be analogous to a 25% cost overrun on the decommissioning project.

Cost Overruns are Endemic to the Nuclear Power Sector

Figure 1: Mean Time Overruns and Percentage of Projects with a Cost Overrun for Electricity Infrastructure by Energy Source



Source: Sovacool et al (2014).

Table A - 1: Mean Cost Escalation for Various Infrastructure Projects

Technology	Mean Cost Escalation (%)	(n) for the Sample
Nuclear reactors	117	180
Hydroelectric dams	71	61
Railway networks	45	58
Bridges and tunnels	34	33
Roads	20	167
Mining projects	14	63
Thermal power plants	13	36
Wind farms	8	35
Transmission projects	8	50
Solar farms	1	39

Source: Data for electricity infrastructure comes from this study. Data for other items come from (Flyvbjerg et al., 2002, 2004).

- A recent survey of 180 nuclear reactor construction projects found that 100% were over budget, by an average of 117%.
- Of course, decommissioning differs in many ways from construction, but perhaps less so by these metrics.



Quo vadis?

- Taking the results of this study together, DCPD closure would appear to present as many opportunities as it does challenges.
- Overall economic impacts of closure will be quite modest, but significant adjustments can still be expected.
- Adaptability of the local economy will depend on community resilience, cohesion, and foresight.
- Today we see discordant expectations over shared values, making a strong case for more determined and expanded commitments to policy dialog.
- SLO county governments are already pursuing this with dedicated (SB1090) and discretionary funds, including the new Hourglass Project.
- We hope the evidence presented here can support more robust and constructive engagement, mobilizing the community for sustainable and inclusive prosperity.



Thank you