



NISA INVESTMENT ADVISORS, LLC

# 2020 NDT SURVEY

**NISA**<sup>®</sup>

# U.S. OPERATING COMMERCIAL NUCLEAR POWER REACTORS

Arkansas Nuclear 1, 2	Monticello
Beaver Valley 1, 2	Nine Mile Point 1, 2
Braidwood 1, 2	North Anna 1, 2
Browns Ferry 1, 2, 3	Oconee 1, 2, 3
Brunswick 1, 2	Palisades
Byron 1, 2	Palo Verde 1, 2, 3
Callaway	Peach Bottom 2, 3
Calvert Cliffs 1, 2	Perry 1
Catawba 1, 2	Point Beach 1, 2
Clinton	Prairie Island 1, 2
Columbia Generating Station	Quad Cities 1, 2
Comanche Peak 1, 2	River Bend 1
Cooper	Robinson 2
D.C. Cook 1, 2	Saint Lucie 1, 2
Davis-Besse	Salem 1, 2
Diablo Canyon 1, 2	Seabrook 1
Dresden 2, 3	Sequoyah 1, 2
Farley 1, 2	Shearon Harris 1
Fermi 2	South Texas 1, 2
FitzPatrick	Summer
Ginna	Surry 1, 2
Grand Gulf 1	Susquehanna 1, 2
Hatch 1, 2	Turkey Point 3, 4
Hope Creek 1	Vogtle 1, 2
La Salle 1, 2	Waterford 3
Limerick 1, 2	Watts Bar 1, 2
McGuire 1, 2	Wolf Creek 1
Millstone 2, 3	

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# INTRODUCTION

NISA Investment Advisors, LLC (NISA) is pleased to present the 17th edition of the biennial Survey of Nuclear Decommissioning Trust (NDT) Sponsors. This report is published as a resource for, and service to, the NDT community. It is intended to provide insight into investment activities and trends within the NDT industry. Information contained herein has many potential uses and a variety of audiences, including Trust sponsors, federal and state regulatory bodies, Trust custodians, and investment managers.

## INDUSTRY HIGHLIGHTS

- The U.S. Nuclear Regulatory Commission (NRC) has issued combined licenses (COL) representing eight new units and is reviewing one COL application for one new unit.
- Two new nuclear power plant units are under construction in Georgia. These plants are expected to come online between late 2021 and 2022.
- There are currently 93 operating nuclear power plant reactors with 31 boiling water reactors (BWRs) and 62 pressurized water reactors (PWRs) which generate about 20% of our nation's electrical use. There are 80 individual plant owners and 20 plant operators. Investor-owned Utilities (IOUs) represent approximately 80% of operating megawatt capacity.
- The NRC approved 94 units for license renewal, extending plant life from 40 to 60 years, with three more units expected to apply. Six units have been approved for a second license renewal (SLR) to extend their license another 20 years, while seven are under review and 12 more at least publicly announcing intentions for a SLR.
- Since the prior survey and through June 2021, five units have closed; four have been announced for early closure in the latter half of 2021 due to "severe economic challenges;" and three have been announced for premature closure within the next few years. Eight reactors, all operating in wholesale electricity markets, have ceased operation prematurely.
- In 2019, the President signed the Nuclear Energy Innovation and Modernization Act (NEIMA), introducing Accident Tolerant Fuels (ATF) - a set of technologies designed to make existing nuclear reactors more resistant to a nuclear incident and lower the cost of electricity over the lifetime of an existing commercial nuclear reactor.
- Average nuclear generation costs have decreased from \$42/MWh in 2012 to \$30/MWh in 2019. Industry wide, capital expenditures hit a decade low of \$4.62 billion in 2019.
- In 2020, U.S. nuclear plants generated over four billion megawatts of electricity and 789 million megawatts of nuclear power.
- As of August 2020, 92 of the operating reactors have been approved for uprates that have added over 7,920 megawatts of electricity capacity.

## NUCLEAR DECOMMISSIONING TRUSTS

### ESTIMATED ASSETS

The total estimated market value of NDT assets grew by almost 12% for the second consecutive survey to over \$82 billion, despite a number of plants shutting down and incurring decommissioning expenses. Assets held by IOUs grew to approximately \$74 billion as assets held by Public Power Authorities (PPAs), Municipalities, and Cooperatives remained relatively stable. Qualified Trust assets increased more than 10% for the sixth consecutive survey while Non-qualified Trust assets decreased for the first time since 2014 when there were numerous pour overs. The asset change discrepancy was due to IOUs tendency to spend their Non-qualified assets first on decommissioning activities plus variations in asset allocation within each Trust type, costs associated with various plant shutdowns, changes in survey respondents and contributions.

### EXPECTED CONTRIBUTIONS

Outside of a single out-sized Non-qualified contribution in 2021, total expected contributions continued their longer-term trend of declining in this survey. Projected 2021 contributions are approximately \$280 million, with just over \$100 million allocated to Qualified Trusts, \$160 million to Non-qualified Trusts and \$17 million to Non-taxable Trusts. While only two Public Power respondents indicated projected contributions in 2021, NRC filing data shows one sponsor estimating contributions averaging approximately \$450 million per year over the next several years.

Information as of December 31, 2020 was requested from IOUs and several PPAs. Surveys were sent to owners/operators of nuclear plants. Twenty one sponsors completed surveys, many representing multiple plants/units, which represents over 85% of total IOU megawatt capacity and 82% of total megawatt capacity. Unless otherwise noted, averages are calculated based on the number of responses.

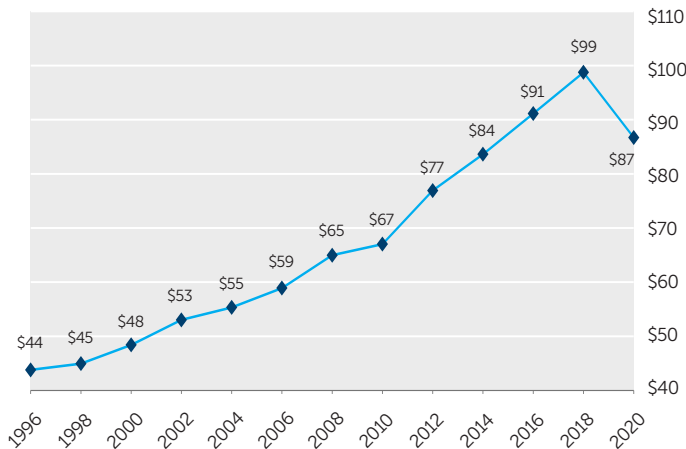
## ESTIMATED DECOMMISSIONING COSTS

Total IOU and PPA 2020 estimated decommissioning costs declined for the first time in survey history. This decline can be attributed to fewer plants to decommission than in prior surveys due to closures of several plants for both economic and political reasons. Furthermore, more plants are using the DECON method, resulting in a significant amount of assets being spent in the early years of decommissioning. According to site-specific estimates and survey respondents, the increase in costs for remaining operating plants from 2018-2020 was 8%. The annualized cost escalation rate for the 24-year period from 1996 to 2020 was approximately 2.9%.

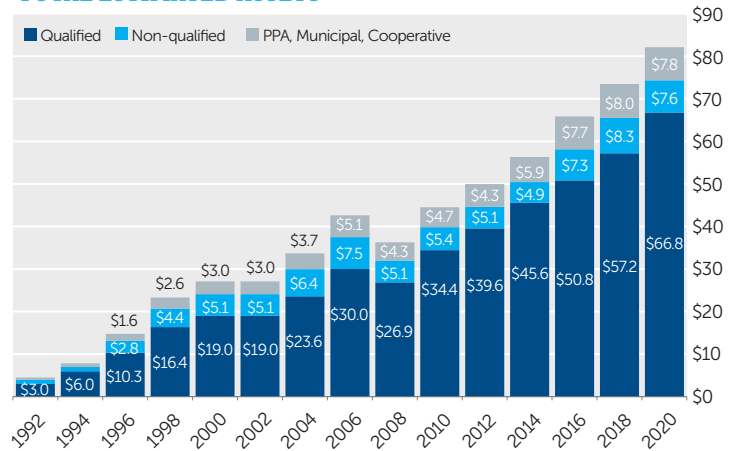
*Approximately 70% of respondents with Qualified Trusts indicated continued contributions to that Trust, with the majority of contributions under \$10 million per year.*

The estimated costs shown below represent the greater of NRC-filing or site-specific costs provided by respondents. Based on individual survey responses, NRC costs were, on average, approximately 82% of site-specific costs, compared to 60% from the prior survey.

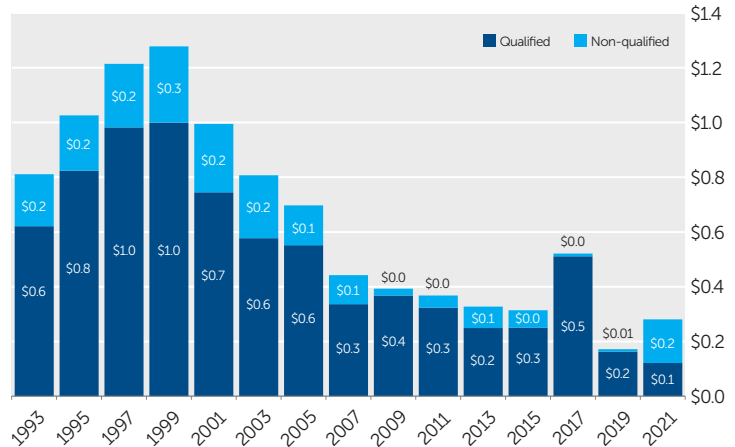
### TOTAL ESTIMATED DECOMMISSIONING COSTS<sup>1</sup>



### TOTAL ESTIMATED ASSETS<sup>1</sup>



### TOTAL EXPECTED CONTRIBUTIONS<sup>1</sup>



## NRC FILING DATA

Selected asset and cost data from publicly available decommissioning financial assurance filings, as of December 31, 2020, were compared to survey data as a reasonableness check. Survey and NRC differences appear to result primarily from assets and costs attributable to non-radiological decommissioning, spent fuel storage, and site-specific vs. CFR 50.75 methodologies as well as a high ratio of assets to megawatt capacity for a number of the PPAs not included in the survey results. The data in the table below were estimated based on NRC filings.

### NRC<sup>1</sup>

#### Cost Assets

#### OPERATIONAL

Investor-owned Utilities	\$44.5	\$60.3 <sup>2</sup>
Non-investor-owned Utilities	\$9.5	\$9.0

**TOTAL \$54.0 \$69.3**

<sup>1</sup>\$ billions.

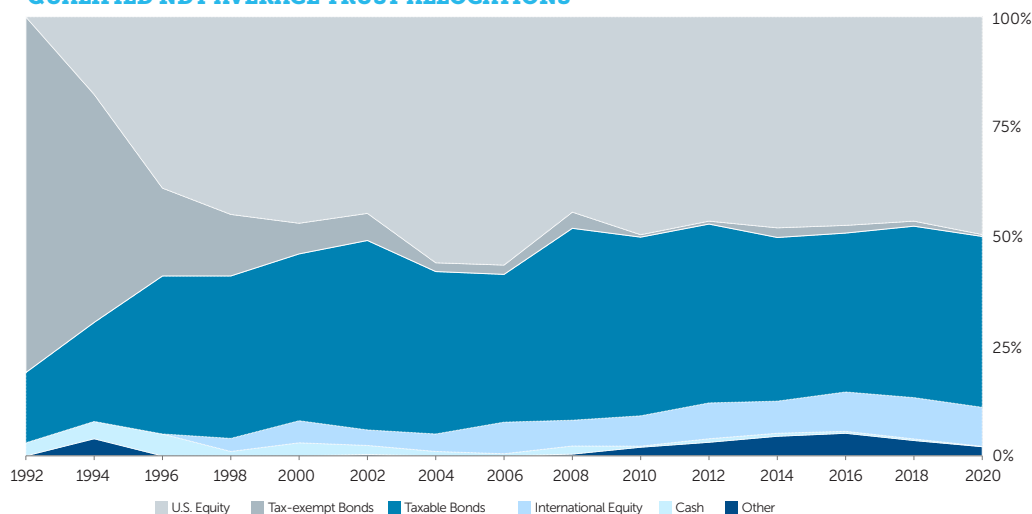
<sup>2</sup>After-tax.

# QUALIFIED NDT

## HISTORICAL ASSET ALLOCATION

Despite several significant equity market movements, a record-long economic expansion, the pandemic, and other periods of high volatility over the past 20+ years, asset allocations have remained fairly constant. The average Qualified Trust equity allocation rose slightly to 58% in 2020, while the Other category declined slightly survey-over-survey (primarily private equity and real estate) to 2% of Qualified Trust assets. However, on an asset-weighted basis that number almost triples to near 6%. Put another way, sponsors with a larger amount of assets are typically those with an actual alternative asset allocation. Only 15% of sponsors indicated a target allocation to alternative asset strategies; the average target allocation of those sponsors is just over 15%. Taxable fixed income allocations remained steady since the prior survey at 39% of Qualified Trust assets.

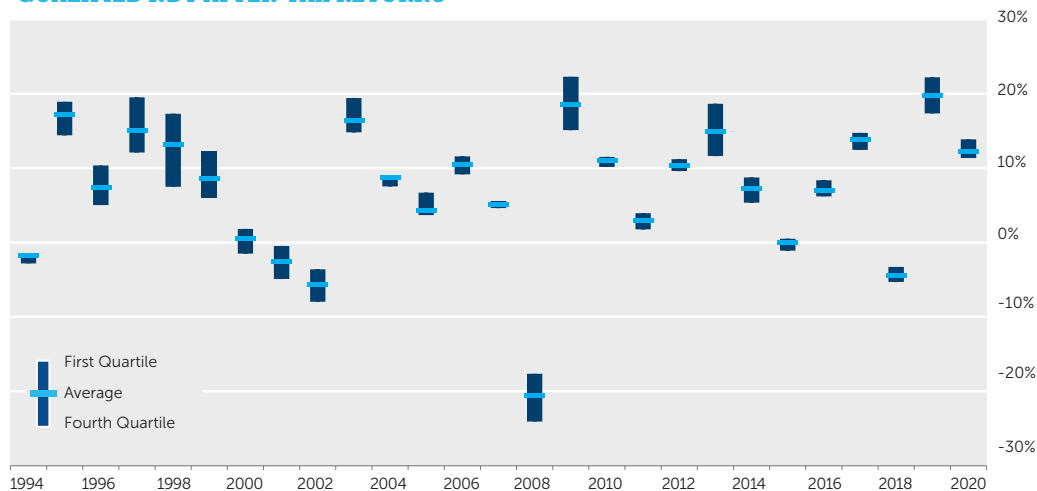
QUALIFIED NDT AVERAGE TRUST ALLOCATIONS



## HISTORICAL AFTER-TAX RETURNS

Qualified Trust average performance posted its best year on record in 2019, then followed that by another solid (albeit volatile) year in 2020. The average Trust return has been flat or positive for 22 of the 27 years shown in the graph. The average annual after-tax return for the 27-year period was 7.0%.

QUALIFIED NDT AFTER-TAX RETURNS

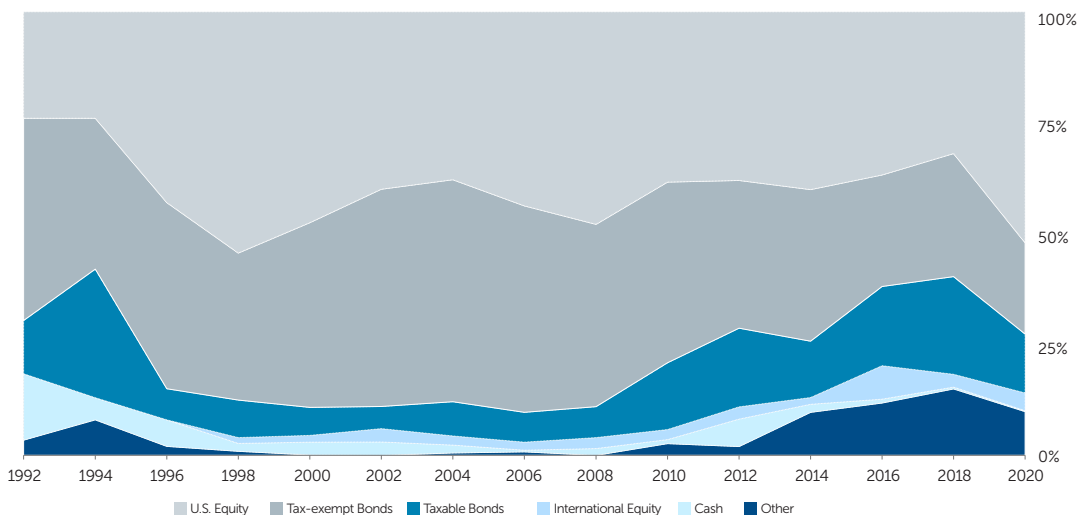


# NON-QUALIFIED NDT

## HISTORICAL ASSET ALLOCATION

Non-qualified Trust assets dropped to 9% of total NDT assets in 2020. Of the respondents, 10 reported having Non-qualified Trust assets. Several Non-qualified Trusts have nearly all of their allocations tied to a specific asset class. The Other category remained outsized when compared to Qualified Trusts or PPA asset allocations due to one sponsor holding a large portion of its Non-qualified assets in private equity and private debt, while Public equity allocations bounced back to 56% of Non-qualified assets. Despite the nearly identical federal tax rate of Qualified Trusts since 2018, the allocation to municipal bonds remains a large part of Non-qualified Trusts.

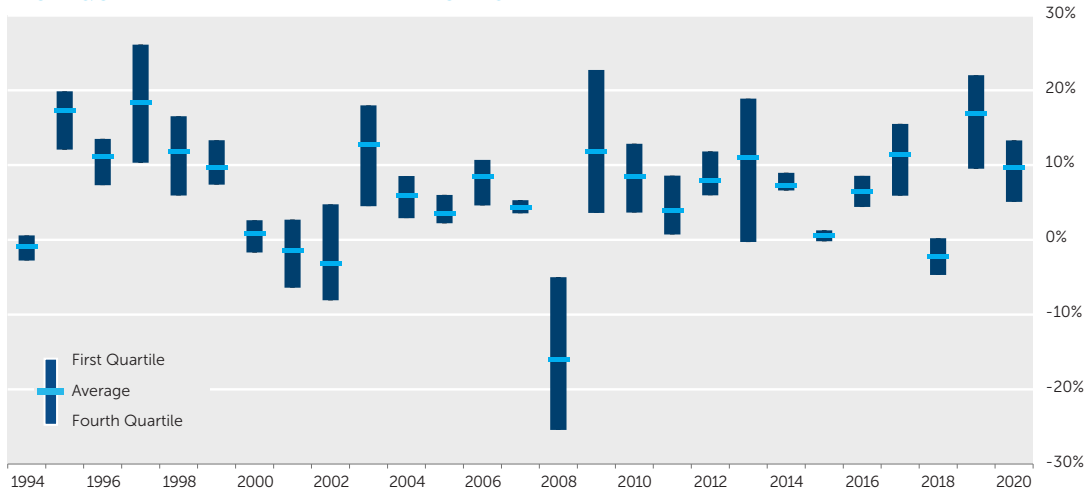
NON-QUALIFIED NDT AVERAGE TRUST ALLOCATIONS



## HISTORICAL AFTER-TAX RETURNS

The average Non-qualified Trust after-tax total return for the two-year period since the last survey was 13.2%. The pre-tax total returns of the S&P 500 Index and Bloomberg Barclays Full Municipal Bond Index over the same period were 55.7% and 13.1%, respectively. The average annualized after-tax return for the 27 years displayed was 6.5%, which compares favorably with the after-tax return assumptions for the same period.

NON-QUALIFIED NDT AFTER-TAX RETURNS



# TOTAL NDT

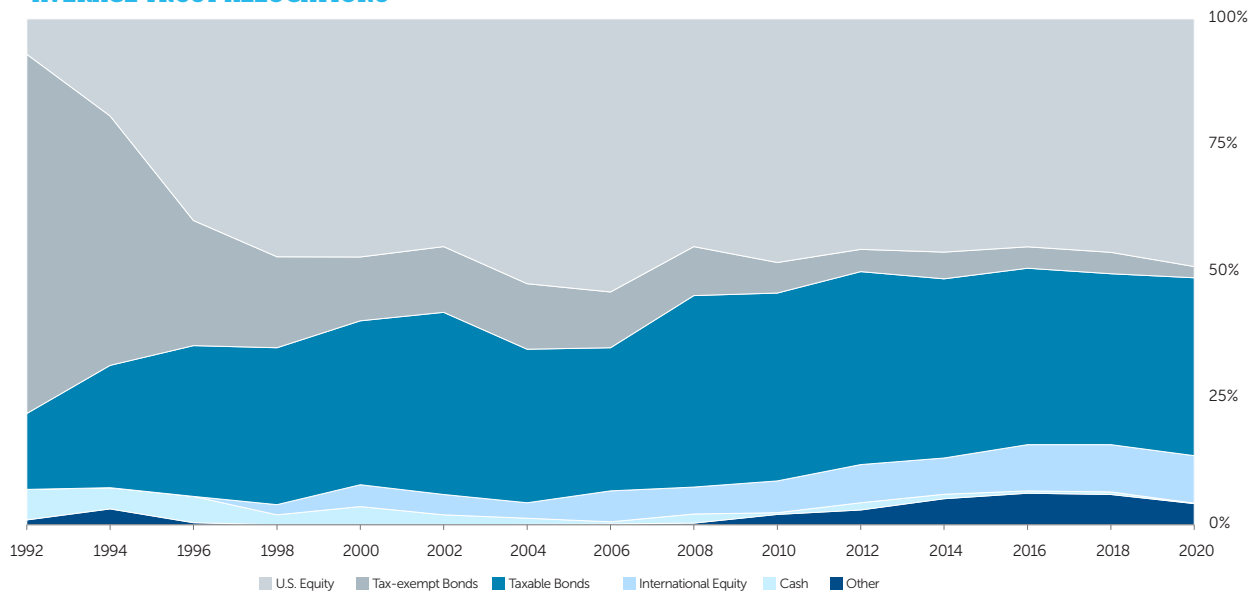
## HISTORICAL ASSET ALLOCATION

The graph below shows average actual allocations to major asset classes since 1992. Overall, asset allocations remained steady once again from the prior survey. The largest movers were domestic equity with a 3% increase and tax-exempt bonds with a 2% decrease. All other asset allocations moved less than 2% in the two years ending December 31, 2020.

The overall target allocation for equity decreased to levels last seen in the mid-90s at 53%, while the fixed income target allocation rose by 6% to 44% in 2020, which is not terribly far off from the actual allocations. One sponsor has 100% of its assets in taxable fixed income despite having over a decade remaining on their operating license, presumably “de-risking” a fully-funded Trust.

Approximately 1/4 of respondents indicated an allocation to alternative asset strategies resulting in a 4% allocation to the Other asset class. For those respondents, the average was 16%, with a maximum target of 22% and a minimum target of 14%.

AVERAGE TRUST ALLOCATIONS



*Sponsors remain satisfied with their current asset class lineup. Just under 40% of sponsors indicated other asset classes not currently being utilized were being considered. Emerging Market Equity and TIPS led the choices, with four sponsors each. None of the sponsors cited consideration of MLPs, if not already in their current asset lineup.*

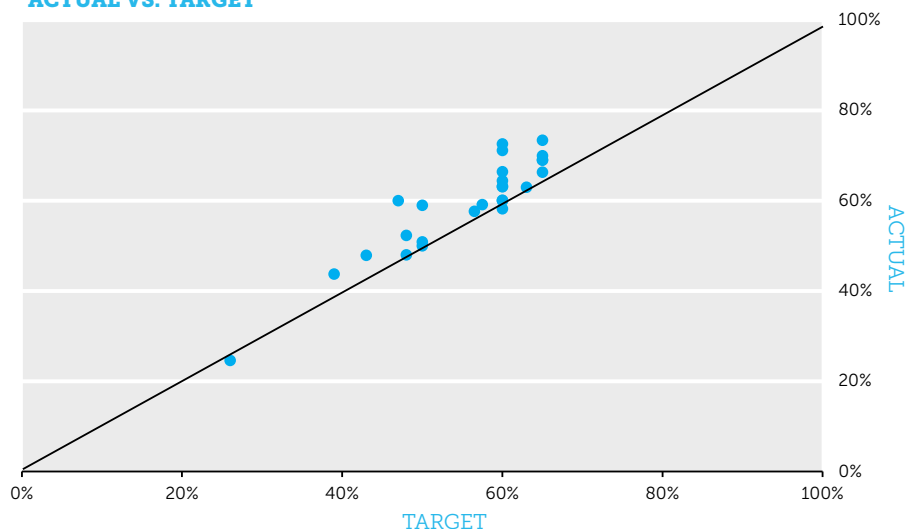


# ASSET ALLOCATIONS

## EQUITY ALLOCATIONS

The chart below shows each Trust's actual equity allocation relative to its target allocation for December 31, 2020. The two points just below the diagonal reflect equity allocations that are below their targets, while those above the diagonal reflect allocations above their targets. Strong equity markets over the past two years have pushed actual allocations above the target allocations because many sponsors have been hesitant to meaningfully rebalance due to tax consequences from gain realization and few opportunities to offset those gains through loss harvesting in the Trust. The target and actual allocation near 25% is a result of a plant currently undergoing decommissioning.

### ACTUAL VS. TARGET

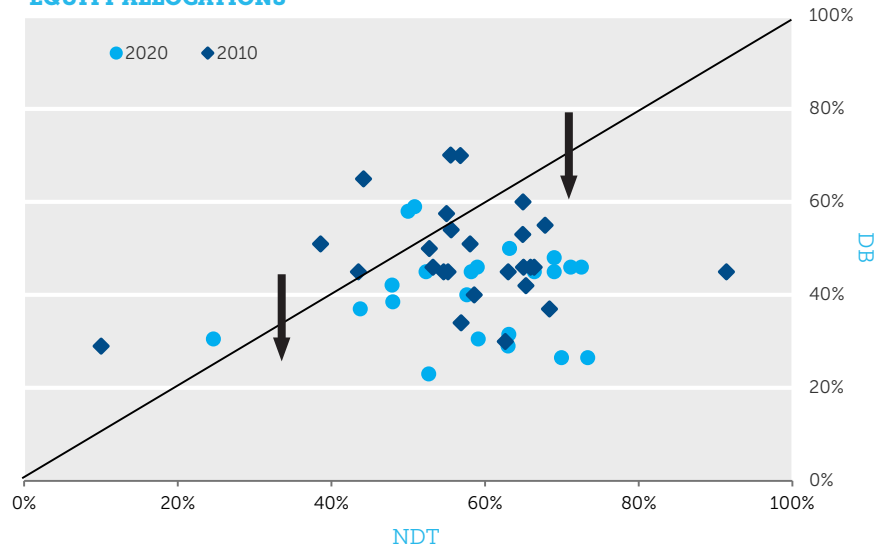


*For the 2020 survey, the average actual equity allocation was more than 5% over the target allocation – the first time in six surveys it was not within +/- 2%.*

## NDT VS. DEFINED BENEFIT

The chart below shows the relationship of each sponsor's NDT equity allocation relative to its Defined Benefit (DB) equity allocation. Observations above the diagonal indicate a larger equity allocation in the DB plan relative to the NDT. A decade ago, it was often difficult to distinguish between a DB portfolio and an NDT. However, DBs have drastically shifted their asset allocation into long duration fixed income and alternatives. Survey responses indicated that the average NDT had a 15% larger allocation to the U.S. Equity asset class than did the average DB plan. The overwhelming majority of DB Fixed Income assets were in longer duration strategies, while no sponsors indicated an allocation to long duration fixed income strategies in their NDTs. DBs also represented a 20% allocation to the Other category.

### EQUITY ALLOCATIONS



*Based upon survey responses, the average equity allocation overweight was +7.4%, while the average underweight was -1.6% and one standard deviation around the mean was 10%.*

# EQUITY

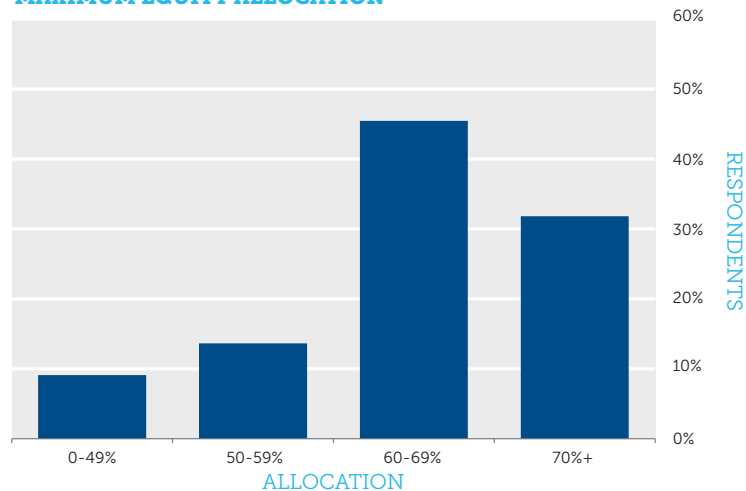
## STYLE ALLOCATIONS

The estimated total equity allocation was \$39 billion for Qualified Trusts, \$4 billion for Non-qualified Trusts, and \$5 billion for PPAs, Municipalities, and Cooperatives. International Equity accounted for approximately 15% of the total equity allocation, however, PPAs and Cooperatives indicated an allocation percentage almost twice the size of their taxable peers. Large cap domestic equity styles in Non-qualified Trusts dominated the overall equity allocation, potentially due to the dividend-received-deduction (DRD). The Russell 3000, S&P 500, and MSCI All World-Ex U.S. (USD) had total returns, as reported by the index providers, of 58.4%, 55.7%, and 34.5%, respectively, for the two-year period ending December 31, 2020.

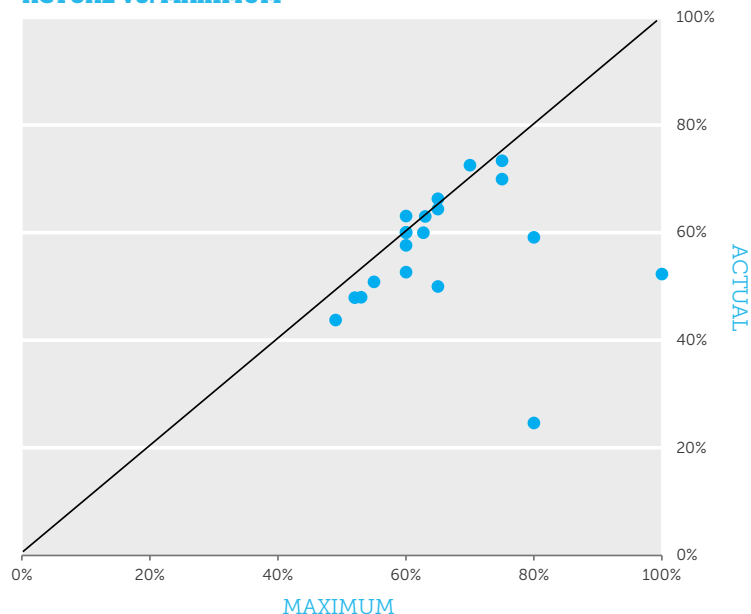
## MAXIMUM ALLOCATIONS

The average maximum equity allocation decreased slightly to 66% in 2020 in comparison to the last survey, and is still down from 74% over a decade ago. The average actual equity allocation was approximately 7% below the average maximum allowed. A number of respondents were either nearing their maximum equity allocation or slightly exceeding the stated maximum.

MAXIMUM EQUITY ALLOCATION



ACTUAL VS. MAXIMUM



# FIXED INCOME

## SECTOR ALLOCATIONS

The estimated total fixed income allocation was \$26 billion for Qualified Trusts, \$3 billion for Non-qualified Trusts, and \$2 billion for PPAs, Municipalities, and Cooperatives.

Despite having nearly equal tax rates as Qualified Trusts, tax-exempt bonds remain a significant portion of Non-qualified Trust assets. Even so, their share has declined significantly over recent years as allocations to equity and taxable bonds (including the Bloomberg Barclays Aggregate) have increased. The Other category, which primarily consists of private credit/debt, declined to 10% of Non-qualified fixed income assets, while PPA Trusts remained in a mix of Credit and Government securities as well as public real assets.

## FI SECTOR ALLOCATIONS: SELECT BENCHMARKS

### QUALIFIED TRUSTS

- Aggregate
- Full Credit or Corporate
- U.S. Treasury
- TIPS
- Securitized
- Universal Bond Index
- Emerging Market

### NON-QUALIFIED TRUSTS

- Municipal
- Aggregate
- Custom Blends
- TIPS
- ML High Yield Cash Pay
- 3m LIBOR + 300 bps
- U.S. Leveraged Loan

### PPAs

- Aggregate
- U.S. Treasury/Agency
- TIPS

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*The search for yield is on in the current low-rate and tight-spread environment as a handful of respondents indicated they are considering High Yield fixed income as an asset class.*

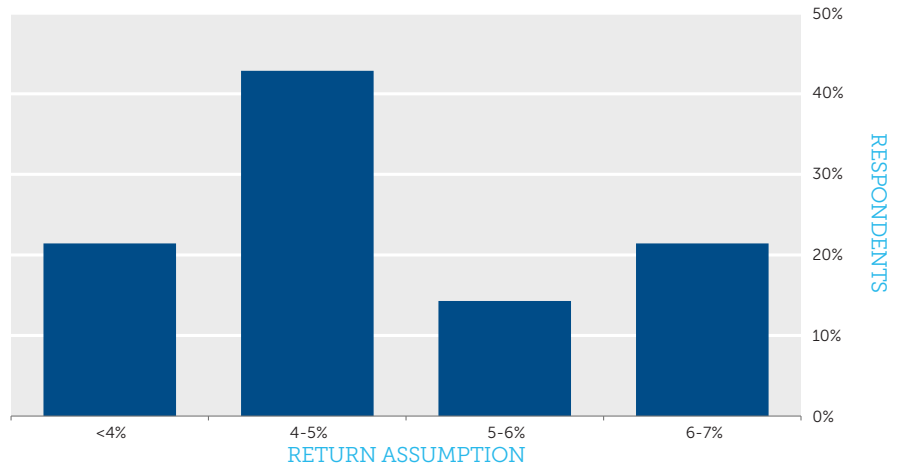
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# ASSET RETURN ASSUMPTIONS

## AFTER-TAX RETURN ASSUMPTIONS: QUALIFIED TRUST

The Qualified Trust average after-tax return assumption dropped again, albeit slightly, to its lowest level in survey history, well below peak levels of the late 1990's. This is likely due to interest rates remaining at historical lows and tapered expectations of a continued equity run. Based on each respondent's target asset allocations and expected returns for each asset class, the average after-tax return assumption was 5.0%.

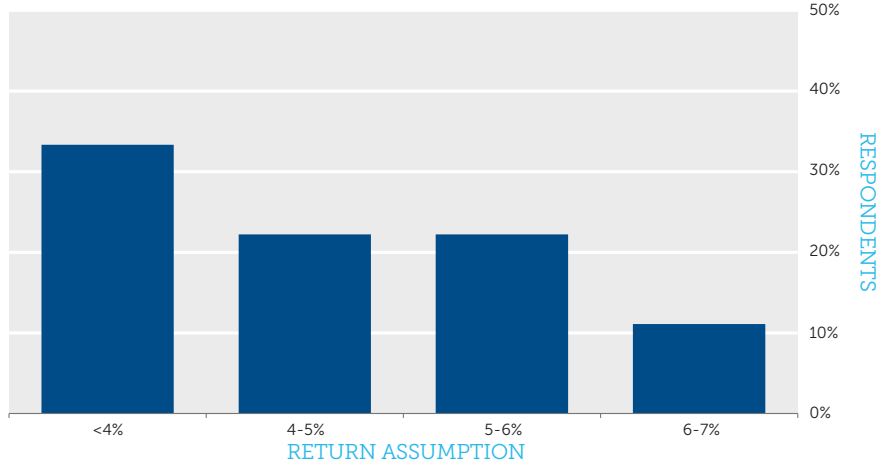
### AFTER-TAX RETURN ASSUMPTIONS: QUALIFIED TRUST



## AFTER-TAX RETURN ASSUMPTIONS: NON-QUALIFIED TRUST

The Non-qualified Trust average after-tax return assumption fell along with its Qualified counterpart, hitting survey low levels. Due to the current similar federal tax rates on both Non-qualified and Qualified Trusts and the slow movement of Non-qualified asset allocations from Municipal bonds into equity and taxable fixed income, both Non-qualified and Qualified Trust average after-tax return expectations continue to be in line.

### AFTER-TAX RETURN ASSUMPTIONS: NON-QUALIFIED TRUST



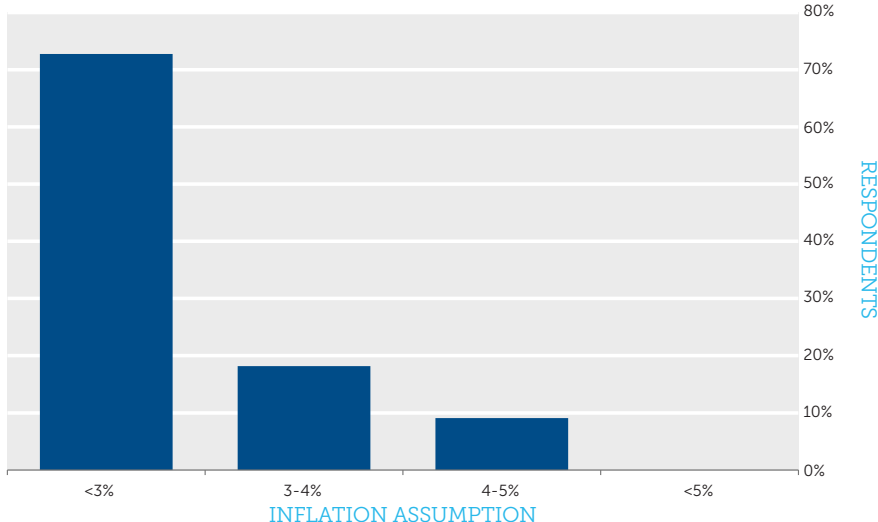
### AFTER-TAX RETURN ASSUMPTIONS

	QUALIFIED AVERAGE	NON-QUALIFIED AVERAGE
2020	5.0%	4.7%
2018	5.0%	4.8%
2016	5.4%	5.1%
2014	5.8%	4.8%
2012	6.0%	5.5%
2010	6.0%	5.5%
2008	6.3%	5.3%
2006	6.3%	5.4%
2004	6.6%	5.5%
2002	6.5%	5.9%
2000	6.3%	5.8%
1998	6.7%	6.2%
1996	6.5%	6.2%
1994	6.4%	6.0%
1992	6.1%	6.6%

## COST INFLATION ASSUMPTIONS

Inflation assumptions have a prevailing influence on estimating decommissioning liabilities and determining implied after-tax real rates of return. The average composite cost inflation assumption decreased by 40 basis points from the 2018 survey to an all-time survey low despite broader CPI forecasts remaining relatively stable. Over 70% of respondents now have a cost inflation estimate less than 3% compared to less than 40% of respondents only four years ago. Cost inflation estimates have averaged approximately 140 basis points over CPI forecasts from 1992 until the 2018 survey, while dropping to a spread of 40 bps in 2020. Estimates ranged from 2.0% to 4.2%.

### COST INFLATION ASSUMPTIONS



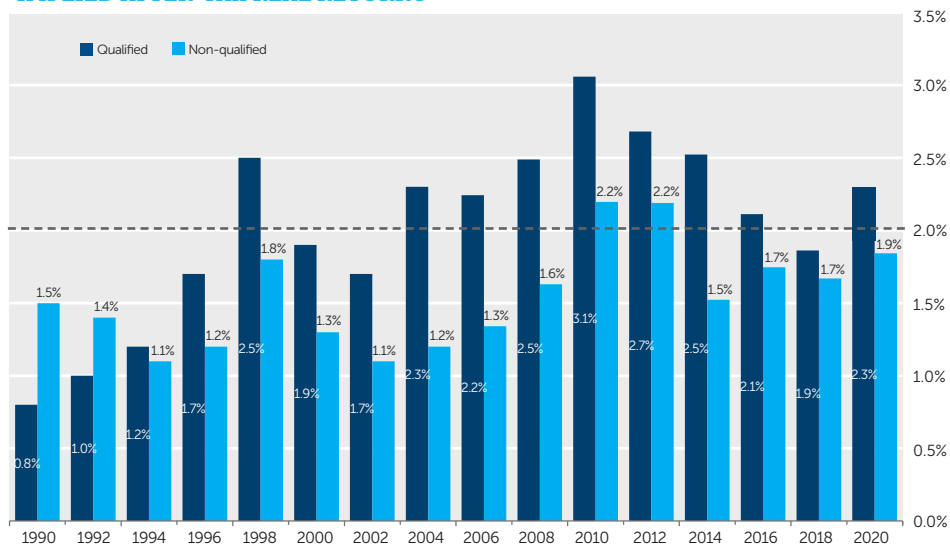
	AVERAGE COST INFLATION RESPONSE	CPI 10-YEAR FORECAST*
2020	2.7%	2.3%
2018	3.1%	2.2%
2016	3.3%	2.3%
2014	3.2%	2.2%
2012	3.3%	2.4%
2010	3.2%	2.5%
2008	3.6%	2.4%
2006	4.0%	2.4%
2004	4.2%	2.4%
2002	4.7%	2.4%
2000	4.4%	2.6%
1998	4.3%	2.5%
1996	4.7%	3.0%
1994	5.0%	3.4%
1992	5.2%	3.9%

\*Federal Reserve Bank of Philadelphia.

## IMPLIED AFTER-TAX REAL RETURN ASSUMPTIONS

Implied after-tax real return assumptions were calculated based on each respondent's after-tax return and cost inflation assumptions. Qualified Trust implied after-tax return assumptions increased by 40 bps to 2.3%, while Non-qualified Trust implied after-tax return assumptions increased by 20 bps in 2020 due to lowered inflation expectations. The horizontal line at 2% represents the allowable real return assumption permitted in 10 CFR §50.75 (e) (1) (ii). Weighting the 2020 Qualified, Non-qualified, and PPA Trusts' implied after-tax returns by their market values as shown on page 5 yields a total NDT average implied after-tax real return of 2.2%.

### IMPLIED AFTER-TAX REAL RETURNS



*PPAs had an implied real return of 1.7% in 2020, down materially from the prior survey.*

# NDT MANAGEMENT

## OVERVIEW

A new question focusing on risks to decommissioning funding adequacy going forward was posed to participants starting with the 2014 survey. Once again, while most options received numerous votes, some consistency has developed over the four surveys for each response. Many respondents marked multiple risks; the overall percentage for each option can be seen below. While almost all respondents see cost increases outpacing investment returns as a major issue, over half view spent fuel disposal as a future risk.

One thing we attempted to extract from this round of surveys is a breakdown of asset values and allocations relative to remaining plant life and, furthermore, asset allocation depending on the chosen method of decommissioning. While the majority of multi-unit and multi-site survey responses were returned aggregated as one survey, we were able to make the following observations:

- A number of sponsors with near-term planned plant shutdowns or early shutdowns with immediate costs have shortened the duration of a significant portion of their assets and have dialed down the equity risk in the total Trust, sometimes using derivatives.
- For plants transferring assets to a third party post shutdown for decommissioning, various methods of market value preservation have been used until transfer, including derivatives. This may potentially help avoid a large tax event in case the necessary approvals for transfer don't materialize and the owner remains in charge of decommissioning.
- Despite the long duration of the decommissioning liability for the majority of operating plants, long duration fixed income remains virtually non-existent in plan sponsors' asset allocations.

About half of sponsors are planning to change asset allocations once a decommissioning methodology has been chosen, with most of those not planning to change until liability flows are more certain. Furthermore, if funds remain post decommissioning, the vast majority of sponsors plan to return excess funds to ratepayers, while a handful do not currently have any plans.

If not already implemented, Alternative/Absolute Return Strategies (ARS) are not being considered by any respondents at this time. Of those respondents who are using ARS, Private Equity, Private Credit, Middle Market Lending and Real Estate remained the most popular asset classes. Revised risk parameters, often courtesy of early shutdown of units, and revised return objectives are the primary motivations for asset allocation policy changes.

Rebalancing activity remains robust across Trust sponsors for numerous reasons. 85% of individual respondents indicated they rebalanced the asset allocation in the past two years, with the majority of those citing it was an internally driven decision as opposed to investment committee or regulatory driven. The majority of the remaining sponsors that did not actively rebalance, somewhat passively did by allocating contributions to certain asset classes and paying taxes/fees out of others. Some sponsors reduced risk (equity allocations) due to pending early shutdowns or near-term funding needs. Interestingly, no sponsors cited a license extension and only one cited a revised collection rate for any asset allocation changes.

The divergence between NDTs and DB plans remained through 2020 as DB plans continued to de-risk by shifting assets to fixed income. The average DB invests across a broader spectrum of investments and focuses on longer duration fixed income (despite, in many cases, having a materially shorter liability duration than an NDT) while the average NDT remains in a more traditional asset mix. For instance, sponsors reported a 31% allocation to long duration fixed income and a 20% allocation to the Other asset class in their DB plans while those numbers were 0% and 4% respectively in NDTs. There are many potential explanations for this including taxes, uncertainty of cash flow size and timing, regulatory restrictions, liability viewing method, and separate investment committees, among others.

	REGULATORY ISSUES	SPENT FUEL DISPOSAL	LOW-LEVEL RADIOACTIVE WASTE DISPOSAL	COST INCREASES OUTPACING INVESTMENT RETURNS	A "BLACK SWAN" EVENT	OTHER
2014	35%	54%	23%	69%	38%	8%
2016	50%	46%	19%	88%	38%	12%
2018	35%	58%	19%	74%	19%	6%
2020	33%	52%	24%	86%	14%	0%

## NISA'S NDT TEAM

NISA is a 100% employee-owned investment management firm based in St. Louis, Missouri. NISA has \$307 billion\* in physical assets under management for 205 clients including NDTs, defined benefit plans, defined contribution plans, and other institutional investors. NISA has managed assets for NDT clients since its inception in 1994 and is currently one of the largest NDT asset managers in the United States with \$17 billion\* in NDT assets under management for 12 utilities. NDT assets represent 75% of NISA's taxable assets under management.

NISA manages all portfolios with a team approach. A team of senior investment professionals services the NDT portfolios, supported by a staff of investment professionals. The Investment Committee (David Eichhorn, Jess Yawitz, Biswajit Bhattacharya, Ken Lester, Joe Murphy, Anthony Pope, and Daniel Scholz) has the primary responsibility for the overall NDT investment strategy.

Please contact Rusty Groth if you would like additional copies of this report or more information regarding NDT management services. This survey and prior year surveys are available at [www.nisa.com](http://www.nisa.com).

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\*As of June 30, 2021.

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