CIVILIAN RADIOACTIVE WASTE MANAGEMENT

2008 FEE ADEQUACY ASSESSMENT

LETTER REPORT

Prepared for

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Executive Summary

This Fiscal Year 2008 Civilian Radioactive Waste Management Fee Adequacy Letter Report presents an evaluation of the adequacy of the one mill per kilowatt-hour fee paid by commercial nuclear power generators for the permanent disposal of their spent nuclear fuel by the Government. This evaluation recommends no fee change.

This letter report supports the requirement in Section 302(a)(4) of the Nuclear Waste Policy Act that the Secretary of Energy annually review whether the current fee level will provide sufficient revenues to offset commercial utilities' share of the cost of the Civilian Radioactive Waste Management System. If warranted, the Secretary shall transmit to Congress a fee adjustment to ensure full cost recovery.

The evaluation assumes that the statutory limitation will be removed so that a single repository can be used for disposal of all spent nuclear fuel generated by U.S. commercial reactors, including the 48 reactors that had received Nuclear Regulatory Commission license extensions as of January 2008.

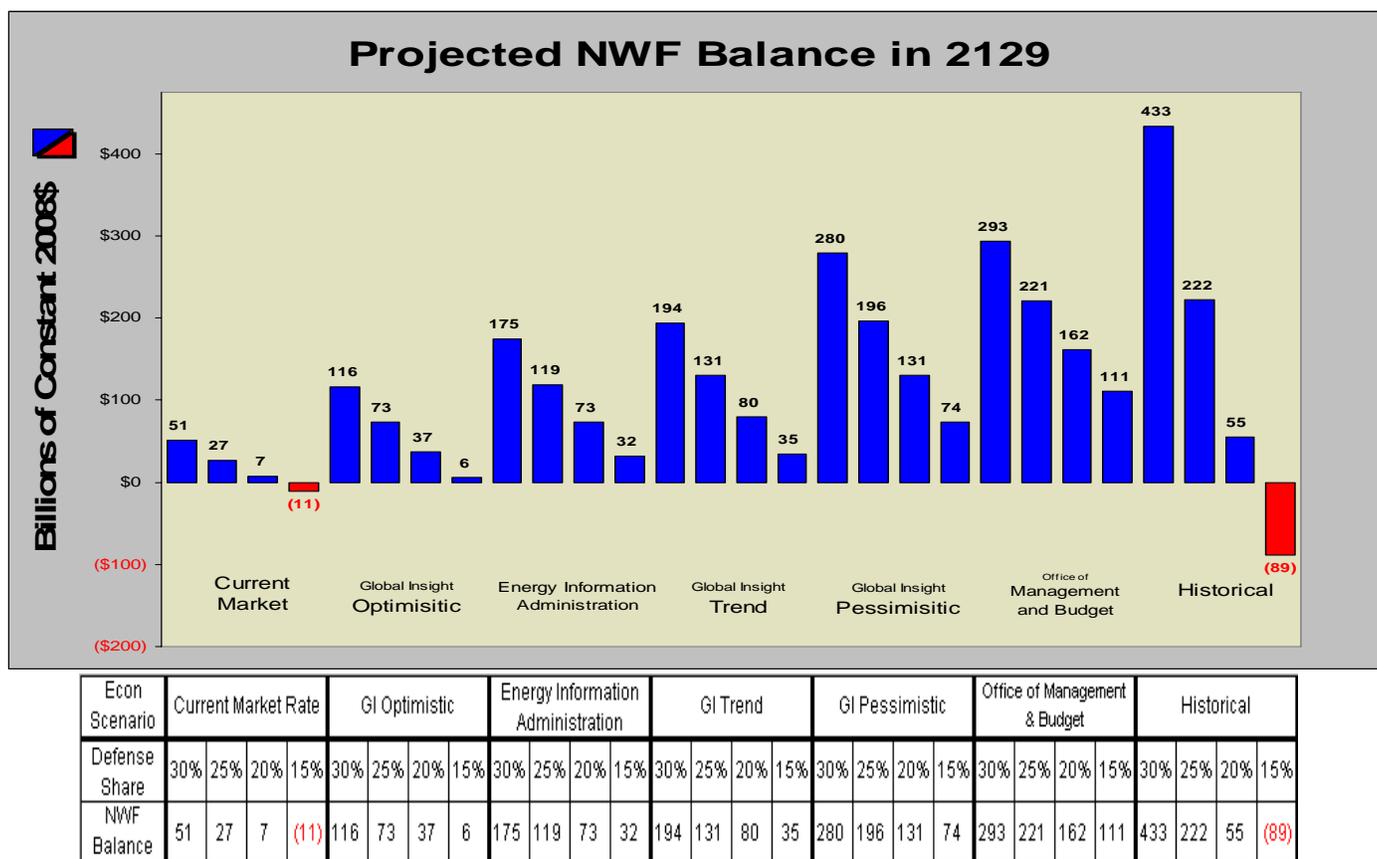| Econ Scenario	Current Market Rate				GI Optimistic				Energy Information Administration				GI Trend				GI Pessimistic				Office of Management & Budget				Historical			
Defense Share	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%
NWF Balance	51	27	7	(11)	116	73	37	6	175	119	73	32	194	131	80	35	280	196	131	74	293	221	162	111	433	222	55	(89)

Figure 1: Fee Adequacy Assessment Results

Fee adequacy is evaluated by modeling cash flows over the Program's life under a variety of cost and income projections. A total of 28 combinations of four cost and seven economic conditions are modeled. As shown in Figure 1, 26 combinations resulted in a

positive ending Nuclear Waste Fund balance; an increase from 18 positive cases last year. There are more positive outcomes this year as compared to last year. Last year's projections included several low inflation/high real interest rate scenarios that tended to magnify any surplus or shortfall. In light of recent economic events, one can understand the importance of annual fee adequacy evaluations.

While this assessment does not warrant a fee change, it must be noted that without a change to the current budgetary process to allow consistent and sufficient annual funding, the assumed schedule cannot be maintained. Future fee assessments may need to evaluate a scenario in which consistent and sufficient funding each year is not assumed.

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Acronym List

Term	Meaning
2008$	Constant$ having the purchasing power dollars had in 2008
the Act	The Nuclear Waste Policy Act of 1982, as amended
Constant$	Dollars that have the same purchasing power throughout time – requires specification of the year whose purchasing power they have, e.g., 2008 constant$. Sometimes written as simply the year and dollar sign, e.g., 2008$.
DOE	Department of Energy
EIA	DOE's Energy Information Administration
FR	Federal Register
the Fund	The Nuclear Waste Fund
GI	Global Insight, a leading econometric forecasting firm
HLW	High Level Waste
IOC	Initial Operating Capability
kWh	Kilowatt-hour
MTHM	Metric Tons of Heavy Metal
Nominal Dollars	Dollars with the purchasing power of the year in which they are used, e.g., the number of dollars that need to be appropriated to fund a year's activities. Also called YOE$ dollars.
NRC	Nuclear Regulatory Commission
NWF or the Fund	Nuclear Waste Fund
NWPA or the Act	Nuclear Waste Policy Act of 1982, as amended
OCRWM	DOE's Office of Civilian Radioactive Waste Management
OMB	Office of Management and Budget
One-mill Fee	The fee of one mill per kilowatt-hour of electricity generated and sold, established in the NWPA and clarified in Wisconsin Electric Co v. U.S. and Consolidated Edison Company v. U.S.
One-time Fees	Radioactive waste disposal fees, plus accumulated interest, owed by civilian power generators for disposal of their SNF generated prior to 1983. The fee is equivalent to the one-mill fee. Several utilities selected the option of deferring payment of this fee until waste acceptance.
the Program	The Civilian Radioactive Waste Management Program established by the NWPA
SNF	Spent Nuclear Fuel
TAD	Transportation, Aging and Disposal Canisters
TIPS	Treasury Inflation-Protected Securities
TSLCC	Total System Life Cycle Cost estimate
YOE$	Dollars with the purchasing power of the year in which they are used, e.g., the number of dollars that need to be appropriated to fund a year's activities. Also called nominal dollars.

1   Introduction

1.1 The Nuclear Waste Policy Act Requires an Annual Fee Adequacy Report

The Nuclear Waste Policy Act (NWPA or the Act) established the Office of Civilian Radioactive Waste Management (OCRWM) to manage the Government's Program (the Program) for disposal of spent nuclear fuel (SNF) and high level radioactive waste (HLW).

The Act requires civilian and government waste generators to pay their fair share of the Program's costs. The Government pays for disposal of defense-related SNF and HLW through annual appropriations to the Defense Nuclear Waste Disposal account.

The Act established a fee of one mill per kilowatt-hour (kWh) for nuclear electricity generated and sold by civilian power generators. It also established an equivalent one-time fee for disposal of wastes generated prior to enactment. Civilian fee payments are deposited in the Nuclear Waste Fund (NWF), a separate account in the U.S. Treasury. Any fee income not used for current expenses is invested in Treasury securities so that the income from these investments can fund Program costs in the decades after reactors close and fee payments end.

Section 302(a)(4) of the NWPA requires that the Secretary of Energy annually review the level of the fee to evaluate whether it will provide sufficient revenues to offset the civilian costs of developing, operating, monitoring, closing, and decommissioning the Civilian Radioactive Waste Management System.   The Secretary is required to recommend a change in the fee, if necessary. This letter report supports the annual review requirement.

1.2 Organization of this Report

The remainder of this letter report proceeds as follows: Section 2 discusses the methodology used to assess fee adequacy; Section 3 describes the cost sharing and economic scenarios used in the model; Section 4 reports the outcomes of modeling the scenarios; and Section 5 contains the conclusion.

Unless otherwise noted, all dollar amounts in this report are in constant 2008 dollars (2008$).

2   Methodology

Various economic conditions and defense shares were used to evaluate their effect on revenue and fee adequacy. Seven economic projections are combined with four defense shares and the current total system life cycle cost estimate, to provide 28 scenarios upon which to assess the fee adequacy. By using a range of defense shares and economic projections, the Department makes the best assessment, at this time, of whether the fee would be adequate to sustain the Program.

The analysis uses a projection of the Program's annual cash flows to determine the ending balance in the Nuclear Waste Fund. For each year from 2008 through repository closure, the analysis adds fee and investment income and subtracts the Program's civilian costs from the NWF balance. If income exceeds expenditures, the excess is invested; if expenditures exceed income, investments are sold to fund the shortage. If the Nuclear Waste Fund balance is positive when the repository closes, the fee is considered adequate.

Four defense cost shares are used because the amount of Government-managed waste requiring disposal may change as decisions are made about processing defense waste before sending it to the repository. The civilian cost estimate is based on the 2008 Total System Life Cycle Cost estimate (TSLCC), adjusted by assumed defense shares of 15, 20, 25, and 30 percent. This range encompasses the estimated defense share of 21.2 percent, which was made using currently available information.

Seven economic scenarios provide real interest rate and inflation projections that are used to estimate future Program income. The majority of the Program's future income will come from investment earnings. This income is estimated by applying the projected real interest rate to investments made with each year's surplus. Future inflation reduces the purchasing power of two sources of civilian income: future utility fee payments and payments from the current investments of Nuclear Waste Fund. The analysis addresses this change in purchasing power by converting income from these sources to constant current-year dollars.

2.1 The 2008 Total System Life Cycle Cost Estimate

The cost projection made in the 2008 TSLCC estimate is used in this analysis. The estimated total Program cost is $97.0 billion in 2008$. Of this amount, future costs amount to $82.5 billion and historical costs are $14.5 billion.

As outlined below, the life cycle cost estimate reflects the current system design presented in the Yucca Mountain license application submitted to the Nuclear Regulatory Commission (NRC) on June 3, 2008.

The 2008 TSLCC assumes a single repository system capable of accepting and disposing of SNF and HLW equivalent to 123,200 Metric Tons of Heavy Metal (MTHM). This estimate includes all defense wastes currently destined for disposal at Yucca Mountain and projected discharges of SNF from commercial utilities, including the 48 nuclear power reactors that had received license extensions from the NRC as of January 2008. Future license extensions and new reactor construction will be included as they are authorized by the NRC.

For this analysis, it was assumed that the Department will receive construction authorization from the NRC in 2011 and that the repository facility will reach initial operating capability in 2020. The TSLCC assumes waste transportation and repository surface and subsurface operations will start in 2020 and emplacement will end in 2069.

The estimate assumes that monitoring, including the installation of drip shields, will take place following the end of emplacement activities. Closure and decommissioning activities will follow monitoring, with final repository closure expected in 2129.

This analysis assumes that annual costs during the initial phase of the monitoring period to be significantly lower than during the emplacement period, thereby allowing growth of the NWF's investments in order to fund the cost of drip shield emplacement and closure during the last 20 years of the Program's life.

An overview of the key variables used for the cost estimate is provided in Table 1.

Table 1: Key Variables

Total MTHM	123,200
Civilian	109,100
Defense	14,100
License Renewals	48
Operations Start Date (IOC)	2020
End of Receipt	2063
End of Emplacement	2069
Closure	2129

The 2008 TSLCC analysis is based on the License Application design, which is a canister-based waste handling system using transportation, aging, and disposal (TAD) canisters. Under this system, SNF is packaged in sealed canisters that are transported to the repository and placed in a waste package for ultimate underground disposal at Yucca Mountain.

A summary of results of the cost analysis is provided in Table 2 and shown in Figure 2. The TSLCC estimate includes estimated historical costs through fiscal year 2007 of $14.5 billion and $82.5 billion in future costs. Approximately 71 percent of future waste management system costs will be incurred by the end of emplacement operations, expected in 2069. The remaining 29 percent of costs will be incurred during repository monitoring, drip shield installation and the closure and decommissioning of repository facilities.

Table 2: Summary of 2008 TSLCC Costs

Repository	$63.0
Transportation	$21.1
Balance of Program	$12.8
TOTAL	**$97.0**

Billions of constant 2008$

Individual elements may not sum due to rounding.
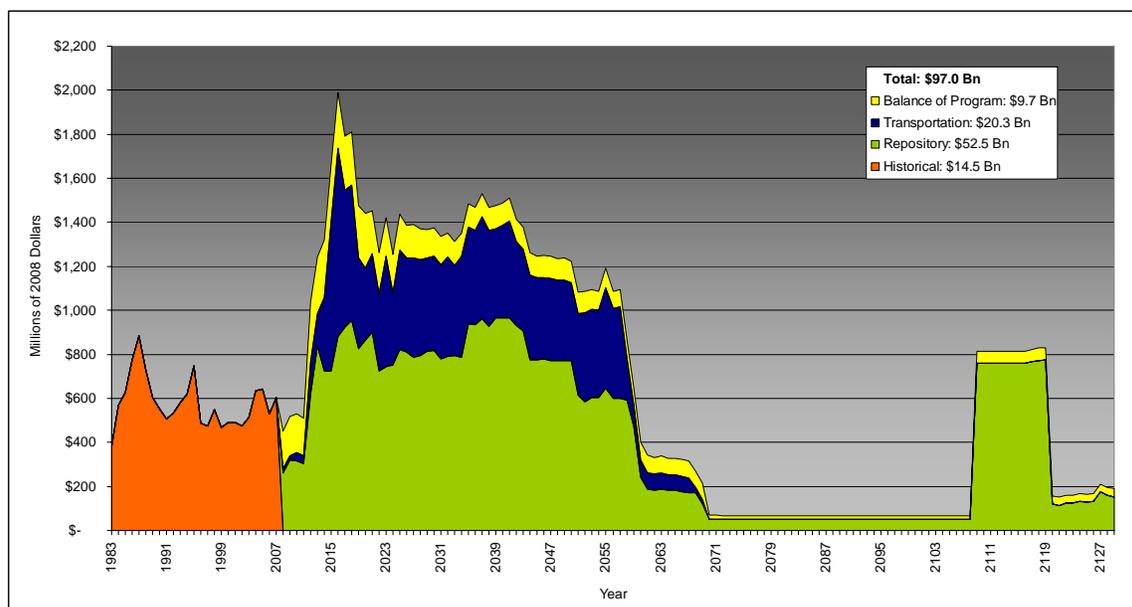Includes historical costs (1983 – 2007) of $14.5 billion.

Figure 2: 2008 Total System Life Cycle Cost Annual Profile

2.2 Comparison of Updated 2008 TSLCC and 2007 TSLCC

The 2007 TSLCC estimate issued in July 2008 was $96.2 billion (in 2007$, equivalent to $98.4 billion in 2008$). Each year, the Program updates the prior estimate to reflect changes in system design and schedule.

Major assumption changes since the 2007 TSLCC estimate include:

o The individual thermal output of waste packages at the time of emplacement was increased to 18.0 kW from 11.8 kW. This reduced the amount of aging required before civilian waste can be emplaced, decreasing the cost of aging pads and overpacks. Because aging time was reduced, the operations period was shortened, further reducing costs.

o Plans for activities were revised due to lower than expected funding in FY2008 and FY2009.

o The average power plant capacity factor used by the Energy Information Administration (EIA) in estimating energy (and SNF) production was reduced from 91.7 to 91.0 percent to reflect current industry practice. The capacity factor measures the percentage of time that a plant is actually producing power and the slight decrease implies that more time will be used for refueling and maintenance as plants age.

o The number of license renewals granted by the NRC increased by one to 48, slightly increasing the amount of SNF generated. However, the net effect, when coupled with the lower capacity factor assumption, is a decrease in the SNF requiring disposal.

2.3 Income from Fees and Current Investments

Civilian waste disposal costs are paid from the existing balance in the NWF, one-mill and one-time fees and investment earnings.

Basic data for income projections consists of fee revenues from civilian power generators and cash inflows from current investments, both of which can be accurately forecasted. Both are originally projected in nominal (year-of-expenditure) dollars and are adjusted to constant-year dollars according to the economic scenario. While these two income sources are the same in all scenarios, income from future investments changes with the cost and economic scenario being modeled.

Fee income projections are based on the licensed life of existing reactors. Current reactor operators provide information about power production plans and spent fuel discharges to the Energy Information Administration in the Department of Energy (DOE). The EIA projects fee income for approximately 20 years. Projections for the remainder of reactors' licensed lives are prepared by the Program.

Several utility purchasers also owe the Department one-time fees for disposal of waste from electricity generated and sold prior to 1983. Each of these utilities must pay its one-time fee, plus accumulated interest, prior to the acceptance of SNF at the utility site. In the fee adequacy model, payments of outstanding one-time fees are assumed to occur in the year the Department would begin waste acceptance from that utility.

One-time and one-mill fees collected from utilities through September 2007 accounted for approximately 68 percent of the total fee income expected through the projected closure of the last reactor in 2046. Future one mill and one-time fee income accounts for the remaining 32 percent.

The other civilian source of Program revenues is the NWF investment portfolio, which provides interest and maturity payments. The returns from the NWF's current investments were specified when each security was purchased. About 90 percent of the Fund's investments are in conventional Treasury securities whose principal and interest payments are calculated at the nominal interest rate. One component of the nominal rate is the <u>expected</u> future rate of inflation. The model uses the different scenarios' projected inflation rate to adjust nominal payments to 2008$.

The remainder of the Fund's investments is in Treasury Inflation Protected Securities (TIPS) whose return does not include an <u>expected</u> inflation component. Instead, interest is calculated at the "real" rate and the principal values of TIPS securities are adjusted semiannually by the Treasury to pay investors for <u>actual</u> inflation. The return on inflation-linked securities is in constant 2008$ and does not need adjustment.

The current portfolio contains U.S. Treasury securities with maturities through 2037. The portfolio had a value of $20.7 billion (2008$) on September 30, 2007. As securities mature, they are reinvested if the funds are not needed for the Program's annual funding.

Current annual appropriations fall far short of the annual new one mill fee collected each year, thus all securities currently maturing are reinvested.

3   Model Scenarios

Four defense share and seven economic scenarios are used in the model, for a total of 28 combinations. The cost share scenarios model a likely range for civilian Program cost, based on the assumptions underlying the TSLCC. The economic scenarios model a range of conditions that may affect fee adequacy.

3.1 Defense Share Scenarios

A methodology for allocating costs between government-managed nuclear materials and commercial wastes was developed by public rulemaking and published in the Federal Register on August 20, 1987 (52 FR 31508). This rule provides guidance for calculating the defense and civilian shares of total costs. Applying this rule to the results of the 2008 TSLCC results in an estimated defense share of 21.2 percent of the total Program cost.

For purposes of this fee adequacy analysis civilian and defense cost shares are bounded to indicate the potential effects of increases or decreases in the cost. While the total Program cost was held constant, four civilian/defense share scenarios, ranging from 15 percent defense and 85 percent civilian to 30 percent defense and 70 percent civilian, were analyzed. These encompass a likely range of defense and civilian cost share allocations. The civilian shares determine the funding required from current NWF investments, future civilian fees, and future investments. Lower defense shares increase civilian costs and slow the growth of the NWF, making the fee less adequate.

3.2 Economic Scenarios

The other factor used in assessing the adequacy of the fee is the economic situation because interest and inflation rates affect Program income. The model uses projections of four related factors: nominal short-term interest rates, nominal long-term interest rates, inflation rates, and real long-term interest rates. Short-term rates are used to forecast utility one-time fee payments because the amounts utilities owe accrue interest at the 90-day Treasury bill rate. Nominal long-term rates are used together with inflation estimates to project the real long-term interest rates that, in turn, are used to estimate earnings from future investments. The inflation rate is used to convert the projections of future fee payments and the returns from current conventional investments from nominal dollars to 2008$.

This analysis uses seven series of interest and inflation rates from five separate sources. There are five economic forecasts, three from Global Insight (GI), one from the EIA, and one based on data from the Office of Management and Budget (OMB). The other two scenarios use current market data from Ryan Labs and long-term historical averages from Ibbotson Associates.

The available economic forecasts do not extend for longer than 30 years. Thus, for the purposes of this analysis, each of these projections was extended to cover the full 121

years remaining in the Program's estimated life. The method used to extend each series is described below.

The economic forecasts were prepared in late 2007 and, except for the Ibbotson historical data, reflect conditions and expectations at that time. Forecasts change from year to year as current conditions warrant.

3.2.1 Data Sources

Global Insight

Global Insight, a leading global econometric forecasting firm, provides three series of projections of economic conditions over the next 25 years. They expect that the combination of their Optimistic, Trend, and Pessimistic forecasts will encompass 90 percent of likely scenarios for future economic growth, exclusive of a major, unforeseen economic crisis (Global Insight 2008).

The Trend series represents Global Insight's base case forecast. The Trend forecast assumes that the economy (i.e., Gross Domestic Product) will grow smoothly at its potential rate over the next 25 years, consistent with projected growth in underlying factors such as population, capital investment, and technology development.

The Optimistic forecast generally predicts higher economic growth (e.g., higher population growth, higher consumer confidence) while maintaining a relatively low rate of inflation.

The Pessimistic forecast generally predicts lower economic growth with higher inflation. Inflation tends to reduce fee adequacy by reducing the value of the fee and investment revenues received.

The average of the forecasted rates in each Global Insight series is used to extend data through the end of the Program's life.

U.S. Department of Energy, Energy Information Administration

Data from EIA's *Annual Energy Outlook 2008* report provides an additional perspective on predicted inflation and interest rates through 2030. Their projections are intended to reflect the interaction between economic conditions and energy supply and demand. The average of the forecasted rates is used to extend data through the end of the Program's life.

Office of Management and Budget

The OMB projection combines data from two sources. One is OMB's annually updated Circular A-94, *Guidelines and Discount Factors for Benefit-Cost Analysis of Federal Programs* (OMB 2008), which provides guidance for the real interest rate. It recommends a single real interest rate for use in calculating the present value of cash

flows from long-term (30+ year) government projects. The model uses this rate for the life of the Program. The second source is the President's Budget Request, which provides inflation and short term interest rate data for the next six years. The average of these six years is used for inflation and short term interest rate data during the remaining life of the Program.

Market Yield Rates

Market yield data and associated implied inflation rates reflect the consensus interest rates currently demanded by investors. Ryan Labs, the NWF's investment consultant and a manager and advisor to many clients with long-term obligations, documents daily risk and reward across the relevant investment universe. Ryan Labs monitors interest rates on conventional and inflation protected Treasury securities and provides nominal and real interest rates and expected inflation rates for maturities from 0 to 30 years. The 30th-year (*2037*) rate was extended through the end of the life cycle.

Historical Rates

Historical rates are reported in *Stocks, Bills, Bonds, and Inflation* (Ibbotson, 2008) and represent the total annual holding period returns from various investments. For example, if Ibbotson reports a one-year return of 5.87 percent, it indicates that one dollar invested at the beginning of the year was worth $1.0587 by the end of the year. The 40-year averages of historical rates for 90-day Treasury bills, 30-year bonds, and inflation are used.

3.2.2 Data Values

Table 3 shows the extended interest and inflation rates from the sources used.

Table 3: Summary Showing Average Inflation and Real Interest Rates

Series	Description	Forecast/ Historical Period	Inflation Rate	Real Interest Rate	90-Day Treasury Bill Rate
Current Market	Market yield fiscal year averages for 2008-2038; 2038 values used for subsequent years	2008-2038	2.75%	1.72%	2.57%
Global Insight Optimistic	Fiscal Year Averages	2008-2033	2.56%	2.34%	4.03%
DOE Energy Information Adminis- tration	Fiscal year averages for 2008-2030; Average of the data from 2008-2030 used for years beyond 2030	2008-2030	2.62%	2.59%	4.78%
Global Insight Trend	Fiscal Year Averages	2008-2033	2.79%	2.72%	4.49%

Series	Description	Forecast/ Historical Period	Inflation Rate	Real Interest Rate	90-Day Treasury Bill Rate
Global Insight Pessimistic	Fiscal Year Averages	2008-2033	3.12%	2.97%	7.45%
Office of Management and Budget	Inflation and 90-Day T-Bill Interest Rate Forecast from President's Budget; Current 30 Year Bond Discount Rate	2008 to 2013 (inflation), 2038 (interest)	2.00%	2.84%	4.07%
Ibbotson Historical	Historical fiscal year average used for years 2007 and beyond	1968-2007	4.71%	3.93%	5.99%

4 Outcomes

A summary of results is shown in Table 4 and graphed in Figure 3. Results are grouped by economic scenario and the economic scenarios are organized from the lowest to the highest defense share case.

Table 4: Fee Adequacy Results: Nuclear Waste Fund Balance in 2129

Economic Scenario	Defense Share Scenario	Potential Ending Balance	Economic Scenario	Defense Share Scenario	Potential Ending Balance
Current Market Rates	30%	$51.42	Global Insight Pessimistic	30%	$279.77
	25%	$27.36		25%	$196.46
	20%	$7.11		20%	$130.50
	15%	($11.11)		15%	$73.81
Global Insight Optimistic	30%	$115.72	Office of Management and Budget	30%	$293.07
	25%	$72.72		25%	$220.53
	20%	$37.37		20%	$161.89
	15%	$6.10		15%	$110.68
Energy Information Administration	30%	$175.15	Historical	30%	$432.53
	25%	$118.61		25%	$222.09
	20%	$72.70		20%	$54.83
	15%	$32.47		15%	($89.34)
Global Insight Trend	30%	$194.50			
	25%	$131.41			
	20%	$80.15			
	15%	$35.22			

(billions of constant 2008 dollars)

Projected NWF Balance in 2129

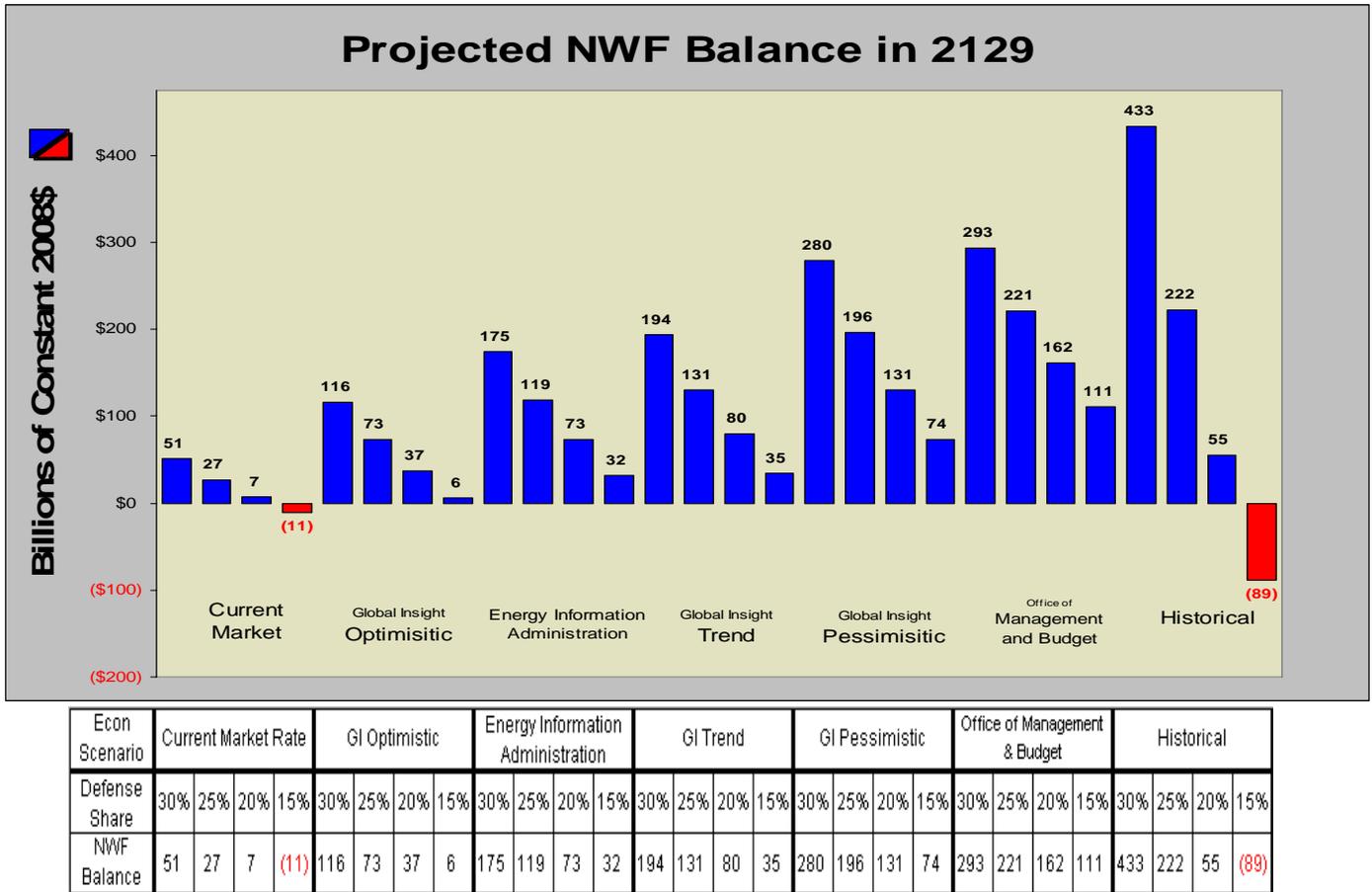| Econ Scenario	Current Market Rate				GI Optimistic				Energy Information Administration				GI Trend				GI Pessimistic				Office of Management & Budget				Historical			
Defense Share	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%	30%	25%	20%	15%
NWF Balance	51	27	7	(11)	116	73	37	6	175	119	73	32	194	131	80	35	280	196	131	74	293	221	162	111	433	222	55	(89)

Figure 3: Fee Adequacy Assessment Results

4.1 Comparison with the 2007 Fee Adequacy

Since the last Fee Adequacy report, average projected inflation rates have risen by 18 basis points (a basis point is one one-hundredth of one percent) and real interest rates have fallen by 43 basis points. In general, rising inflation decreases the purchasing power of future nominal cash flows from fee income and current investments while falling real interest rates decrease the value of income from future investments.

Conclusion

This analysis is conducted each year to evaluate the adequacy of the fee using current income, programmatic, and economic assumptions. It is understood that any adjustment to the fee would require compelling evidence that such an adjustment is necessary to ensure future full cost recovery. Such evidence would likely come from more than a single year's analysis. In the event the Secretary determines that the fee is either too low or too high, the Secretary is required to transmit a proposed adjustment to Congress.

Of the 28 scenarios analyzed, 26 result in a positive NWF balance in 2129, an increase of 8 from last year's analysis. Each outcome is dependent on both the economic scenario selected and the defense share.

While this assessment does not warrant a change in the fee, it should be noted that without a change to the current budgetary process to allow consistent and sufficient annual funding, the assumed schedule cannot be maintained.

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