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THE EFFECT OF TRANSITION TO LOW-CARBON ENERGY ON TEXAS TAX REVENUES: 2021–2050

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Executive Summary

The funding model for Texas K-12 education relies heavily on the state energy sector and specifically on the Texas fossil fuel industry. However, a shift away from fossil fuels and toward low-carbon and renewable energy is currently underway, necessarily leading to a reduction in a key source of Texas K-12 education funding. In this report, we forecast the size of the projected Texas education funding shortfall from this sectoral shift through 2050, and we propose some possible policy solutions for shoring up this funding. Our main forecast findings are:

- The projected education funding shortfall will likely be between $13 billion and $120 billion over the next 30 years.
- Annual deficits would start between 2022 and 2029.
- Average annual shortfall across all scenarios is $2.5 billion.
- Maximum annual funding shortfall in the worst-case scenario is $5.8 billion in 2050.

Although these shortfall totals seem large, they only represent between 0.5% and 3.0% of the total baseline K-12 funding over the next 30 years. We show that these manageable deficits can be offset by modest policy changes implemented in a timely manner.

A wide variety of tax or spending policy changes are available to replace the projected shortfall in Texas K-12 funding. In the last section of this report, we focus on the following three potential policy changes. The first source of revenue is a natural candidate for additional revenue, while the last two are sources of revenues in a number of other states, but would be new sources of revenue in Texas:

- Additional sales tax revenue
- Marijuana tax revenue
- Gambling and gaming tax revenue

These revenue sources can offset the revenue shortfall while broadly maintaining the existing structure of the Texas tax system. Alternatively, the state legislature could consider a fundamental reform of the Texas tax system to address the revenue shortfall caused by the impending fiscal headwinds from declining oil prices.

1. Introduction

A shift from fossil fuel to low-carbon and renewable energy sources has been underway in the United States for the last 20 years.[1] Accounting and preparing for this shift is important in the state of Texas because fossil fuel energy is a significant share of the Texas economy. In 2020, Texas—the top producer of fossil fuel energy in the United States—accounted for 43% of the nation's crude oil production and 26% of its marketed natural gas production (U.S. Energy Information Administration [EIA] 2021). It is important to note, however, that

[1] The share of final energy consumption from renewable resources was 4.68% in 2001 and steadily rose to 8.72% in 2015 (see Our World in Data, 2021).

Texas also leads the nation in wind-powered electricity generation, producing about 28% of all U.S. wind-powered electricity in 2020 (U.S. EIA 2021).

The sectoral shift away from fossil fuels to low-carbon energy will not only affect the number of Texas jobs in the oil and gas industry, but it will also affect tax revenues generated from economic activity in the Texas oil and gas industry. The shift to low-carbon and renewable energy will create new jobs that offset a share of the lost jobs in the Texas oil and gas industry, but the job losses will likely dominate in the first few decades.

In this report, we forecast the production totals and prices in the Texas oil and gas industry through 2050, as well as state oil and gas employment (both direct and indirect) and contributions of the oil and gas industry to gross state product. We build our analysis from projections produced by the Center for Houston's Future (CHF 2021), using its four scenarios for projections of the Texas oil and gas industry through 2036. We then use those scenarios to forecast the Texas tax revenues that contribute to Texas K-12 education funding. We quantify the size of the revenue deficit in K-12 education funding created by the shift to low-carbon resources over the next 30 years, and we explore three policy changes to replace lost revenue.

Given these forecasts, the cumulative funding gap for Texas K-12 education over the next 30 years ranges from $13 billion in a best-case scenario to $120 billion in the most pessimistic scenario. Annual deficits under current school finance policies would start between 2022 and 2029. Over the projected timespan, the average annual shortfall across all scenarios is $2.5 billion, and the maximum annual funding shortfall in the worst-case scenario is $5.8 billion in 2050. Although these shortfall levels are large, our forecast average annual shortfall is only 2.8% of Texas' total baseline K-12 funding. These are manageable deficits that can be replaced by modest policy changes.

In the next section, we discuss revenue options to offset the projected funding shortfall. We look at three main tax revenue reforms—sales tax expansion (tax base and tax rate increases), marijuana taxation, and gambling and gaming revenue. These revenue sources present a menu of options that can offset the revenue shortfall using a piecemeal approach. Alternatively, the state legislature could consider a fundamental reform of the Texas tax system to address the revenue shortfall caused by the impending fiscal headwinds from declining oil prices.

2. Projected Oil and Gas Prices and Production

We forecasted Texas crude oil and natural gas volumes by extrapolating CHF (2021) forecasts to 2050.[2] The figures below present four scenario forecasts and one Texas Comptroller forecast with labels and corresponding definitions described in Table 1.

Table 1. Forecasts Labels and Definitions, Shown in Figure 1

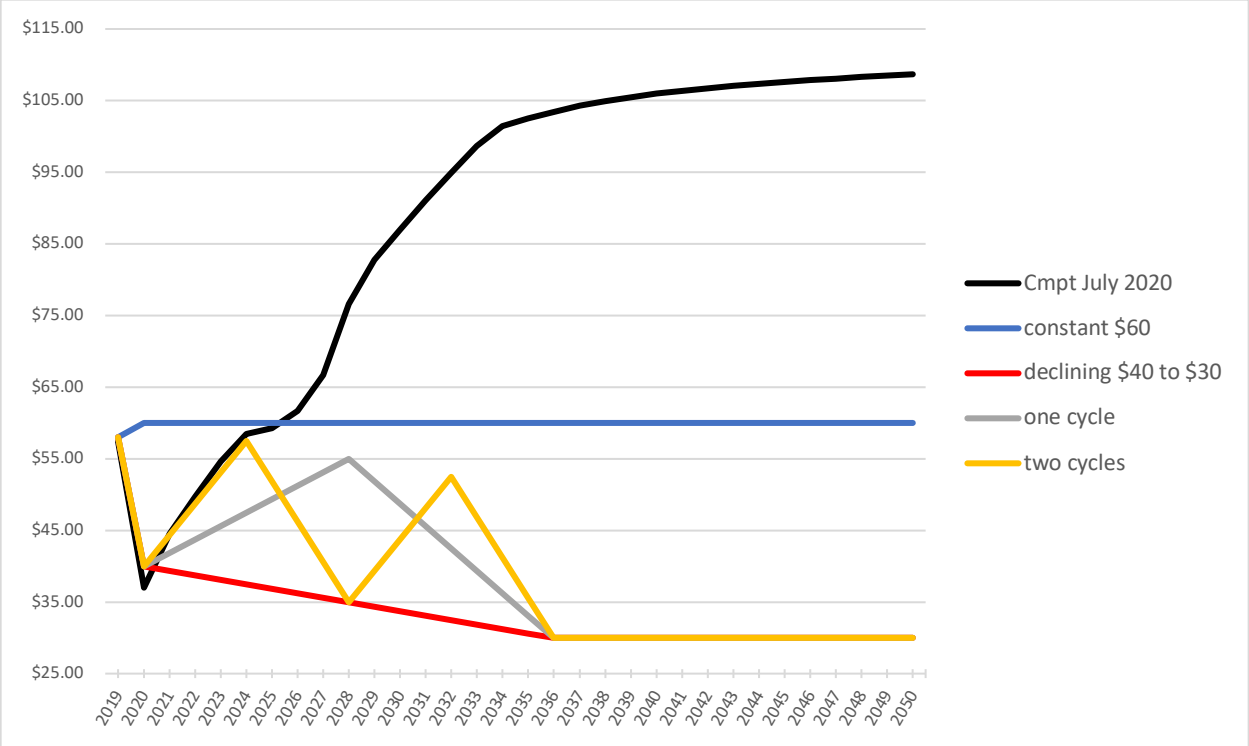
Label	Definition
Cmpt July 2020	Texas Comptroller forecast from July 2020
constant $60	*Most optimistic.* WTI oil price stays constant at $60 per barrel (in 2020 dollars).
declining $40 to $30	*Most pessimistic.* WTI oil price declines from $40 per barrel in 2021 to $30 per barrel in 2036, then remains constant at $30 per barrel through 2050.
one cycle	One upward price cycle. WTI oil price starts at $40 per barrel in 2021, rises to $55 per barrel in 2028, then declines to $30 per barrel in 2036, then remains at $30 per barrel through.
two cycles	Two upward price cycles. WTI oil price starts at $40 per barrel in 2020, rises to $58 per barrel in 2024, declines to $35 in 2028, rises to $52 in 2032, then declines to $30 in 2036 and remains at $30 through 2050.

The four scenarios in Table 1 and Figure 1 were chosen by an expert industry panel convened by CHF (2021), and the forecasts chosen were pessimistic by design.[3] Figure 1 shows the oil price forecasts through 2050. The time series through 2036 are from the CHF (2021) report, and the forecasts from 2037 through 2050 are our extrapolations.

[2] The Appendix provides a description of the logarithmic function used to forecast the data and the desirable properties of that function.

[3] Long-term oil price forecasts are generally prone to significant uncertainty. As the economy transitions to low-carbon energy sources, the demand and supply of oil will likely decrease. A decrease in the demand and supply of oil would lead to a decrease in the quantity of oil exchanged and an uncertain change in the price of oil (which would be determined by the relative elasticities of oil supply and demand). While there is considerable uncertainty regarding movements in the price of oil, a decline in the equilibrium level of expenditures on oil are more likely.

Figure 1. WTI Oil Prices (in 2020 $/barrel)

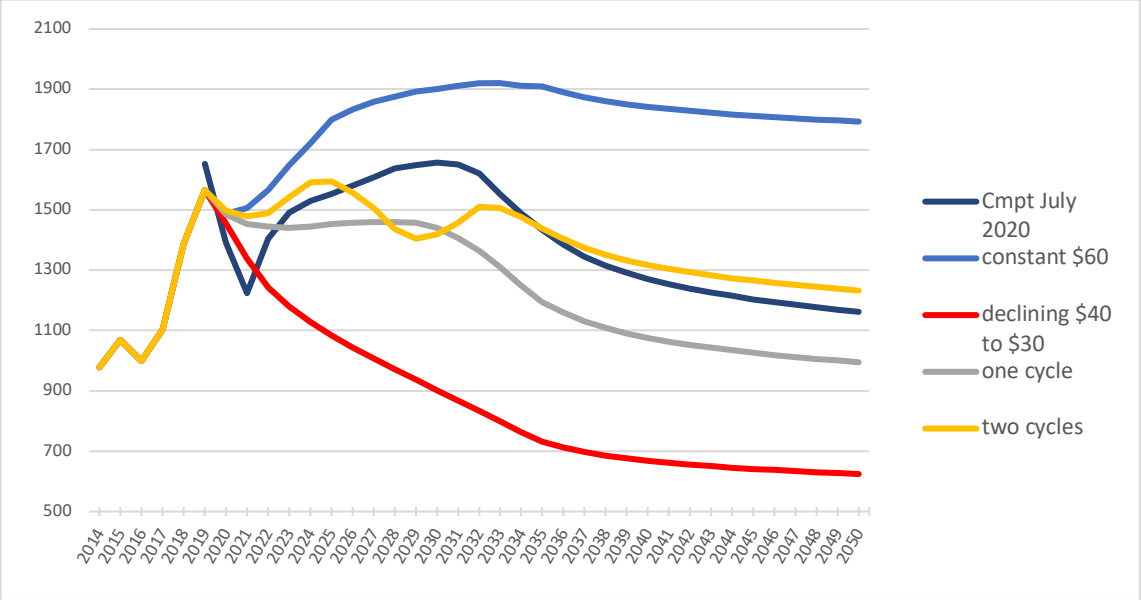


Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

The most optimistic scenario for oil prices, especially in the long run, is the forecast from the Texas Comptroller of Public Accounts from its July 2020 forecast. This Comptroller forecast includes the recessionary impact of the COVID-19 pandemic on oil prices and is the most optimistic from 2026 on. Of the four CHF scenarios, the assumption of constant $60 per barrel prices is the most optimistic. The least optimistic scenario forecast is the declining oil price from $40 per barrel in 2020 to $30 per barrel in 2036. The other two forecasts include one and two price uptick cycles, respectively, and represent intermediate scenarios. All the other oil production volume forecasts (Figure 2) and natural gas production volume scenario forecasts (Figure 4) are based off these oil price scenario forecasts in Figure 1.

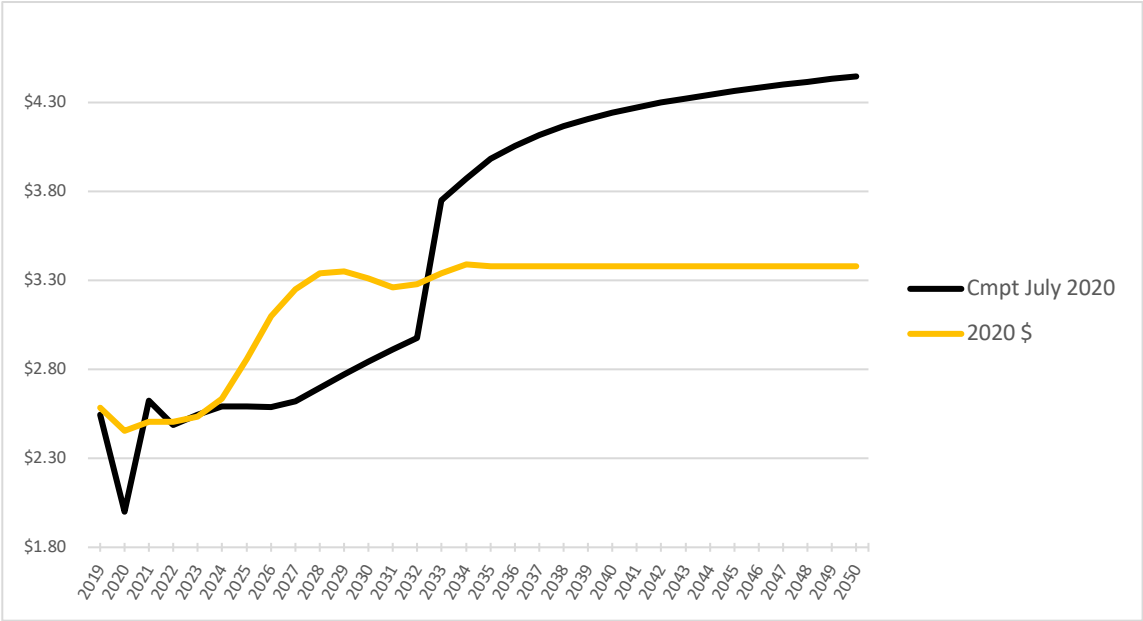
We assume that the four CHF oil price scenarios account for the move away from fossil fuels more than the Texas Comptroller's July 2020 forecast. As such, we treat the Texas Comptroller's July 2020 forecast as a baseline, and we treat each CHF scenario as a forecast that accounts for the shift away from fossil fuels in varying degrees. We define the K-12 funding gap as the difference in K-12 revenue from the oil and gas industry derived under the assumptions of a given scenario minus the K-12 revenue derived from the Comptroller's July 2020 oil price forecasts.

Figure 2. Oil Production (million barrels per year)



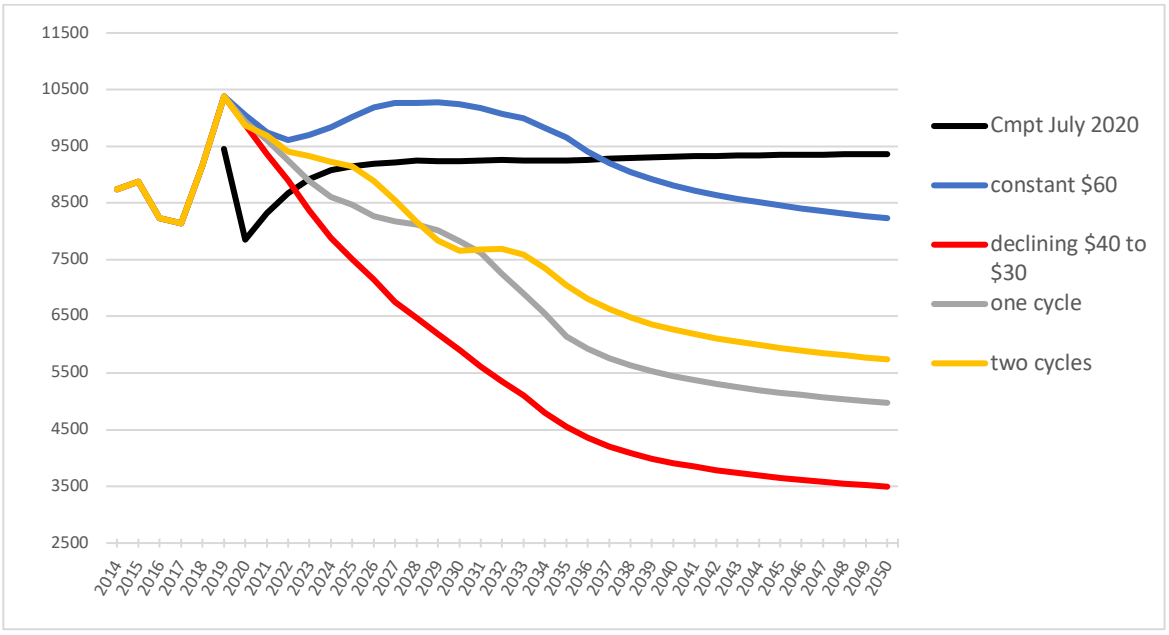
Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

Figure 3. HH Hub Gas Prices ($/mmBtu)



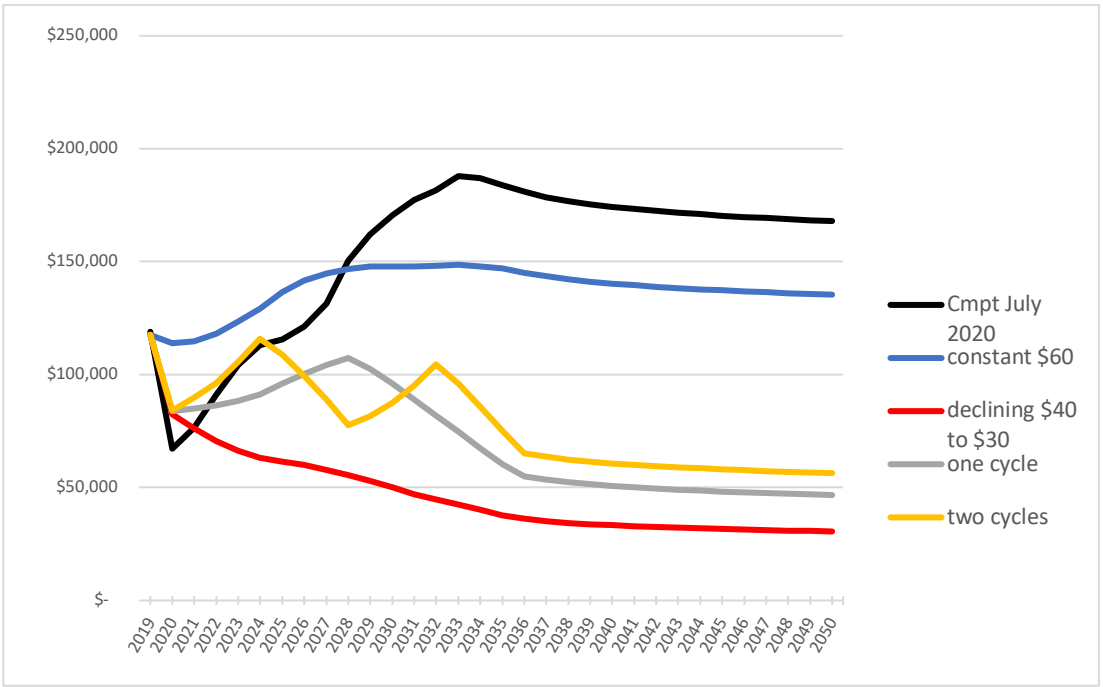
Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

Figure 4. Gas Production (billion cubic feet per year)



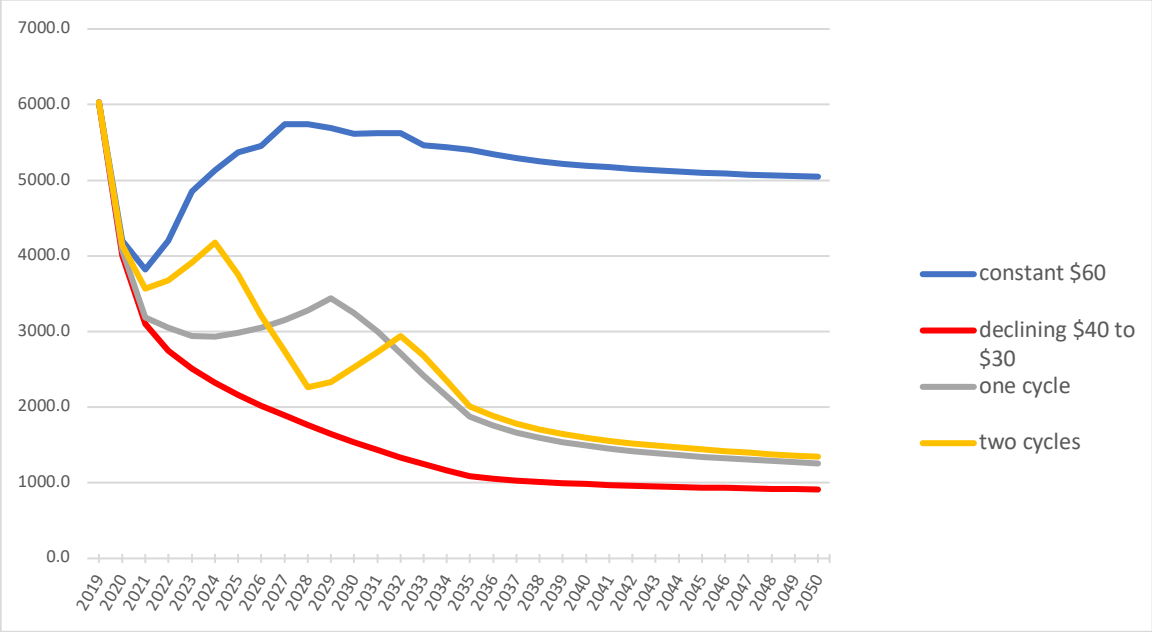
Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

Figure 5. Estimated Value of Total Oil and Gas Production ($ millions 2020)



Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

Figure 6. Number of Wells



Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

3. Forecasting Texas Employment and Gross State Product

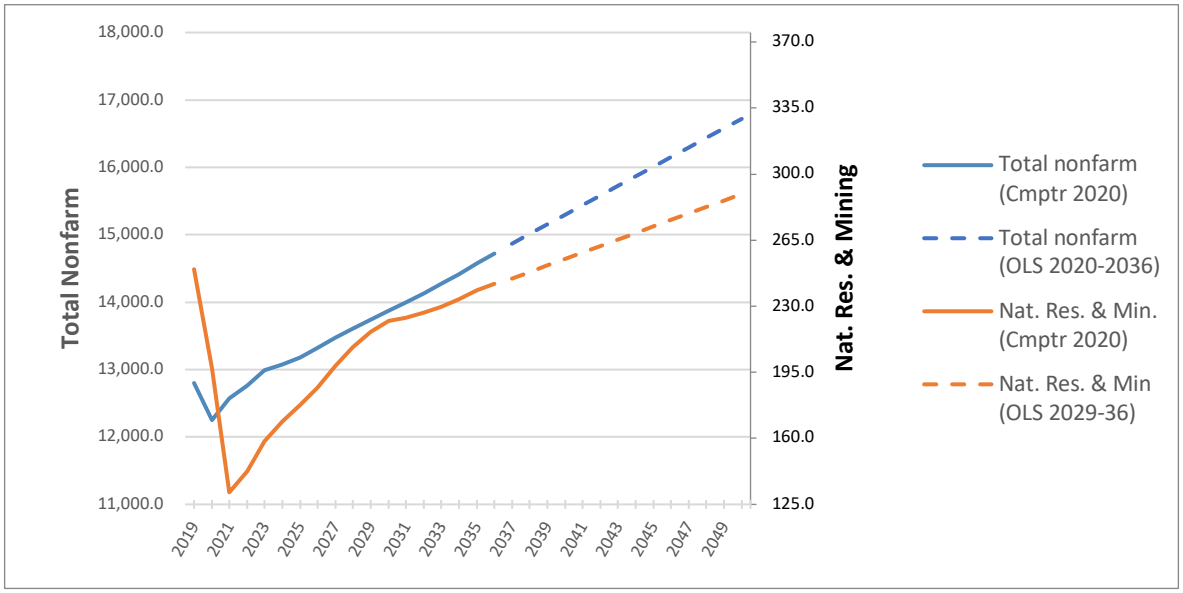
We follow CHF (2021) in using total Texas nonfarm employment and its subcategory of natural resource and mining employment (Figure 7) to calculate total Texas oil and gas employment (Figure 8).[4] This is done using historical percentages of natural resource and mining employment involved in extraction and support activities to calculate direct employment, as well as using multipliers from Torres (2015) to calculate the indirect employment in this industry.

The four Texas oil and gas employment scenarios in Figure 8 are determined by the oil and gas employment derived from the Texas Comptroller's July 2020 forecast, multiplied by the ratio of the total value of oil and gas production in the given scenario over the baseline oil and gas production value.

We use a linear extrapolation method to extend the gross state product forecast in Figure 9 from 2036 to 2050 due to the very linear trend in the data. The scenario forecasts for oil and gas exploration and production (E&P) gross state product in Figure 10 are derived as the 2020 value for the Comptroller's July 2020 forecast of E&P gross state product that grows at the same rate as the scenario forecast of oil and gas production amounts.

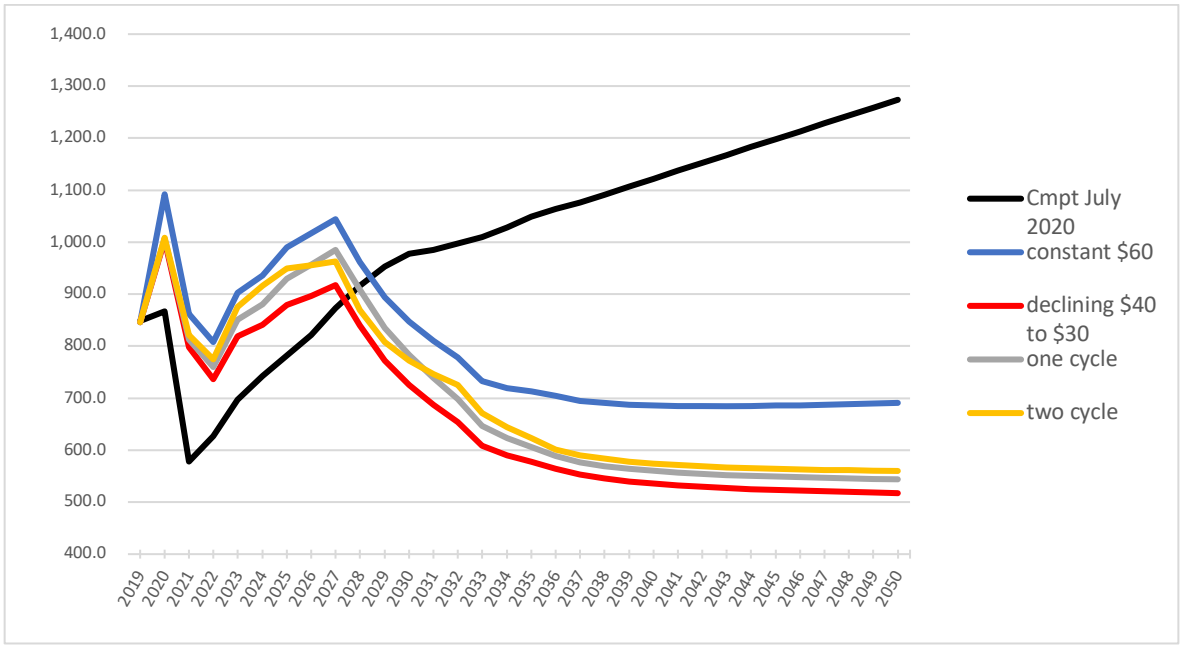
[4] We extend the forecasts of Texas total nonfarm employment and natural resources and mining employment using a fitted linear regression because the trend looks linear in both time series after 2030. Our extension of the employment and gross state product forecasts using linear regression are the only series for which we do not use the logarithmic function described in the Appendix.

Figure 7. Texas Total Nonfarm Employment and Texas Natural Resource and Mining Employment (based on Cmpt July 2020)



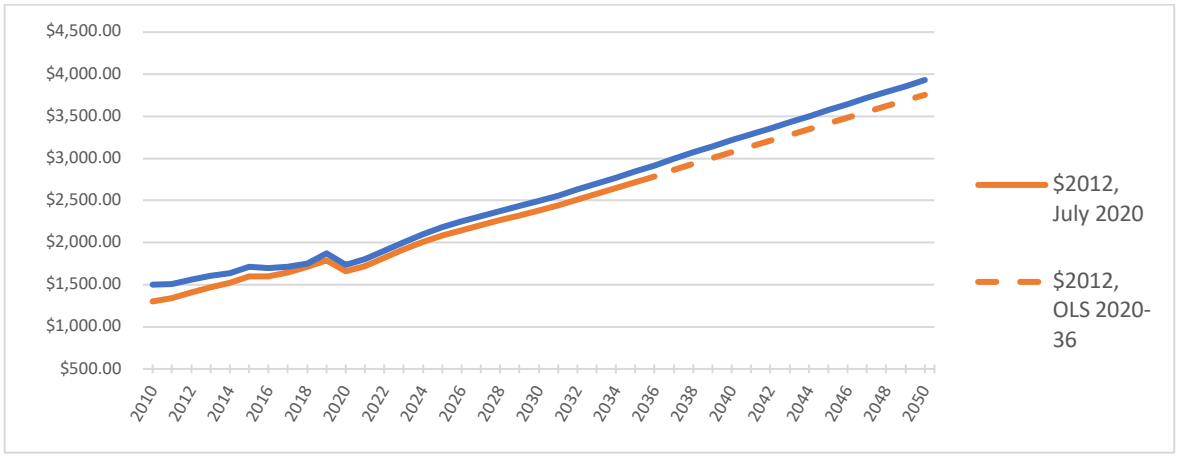
Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

Figure 8. Total Jobs for Oil and Gas E&P (000s)



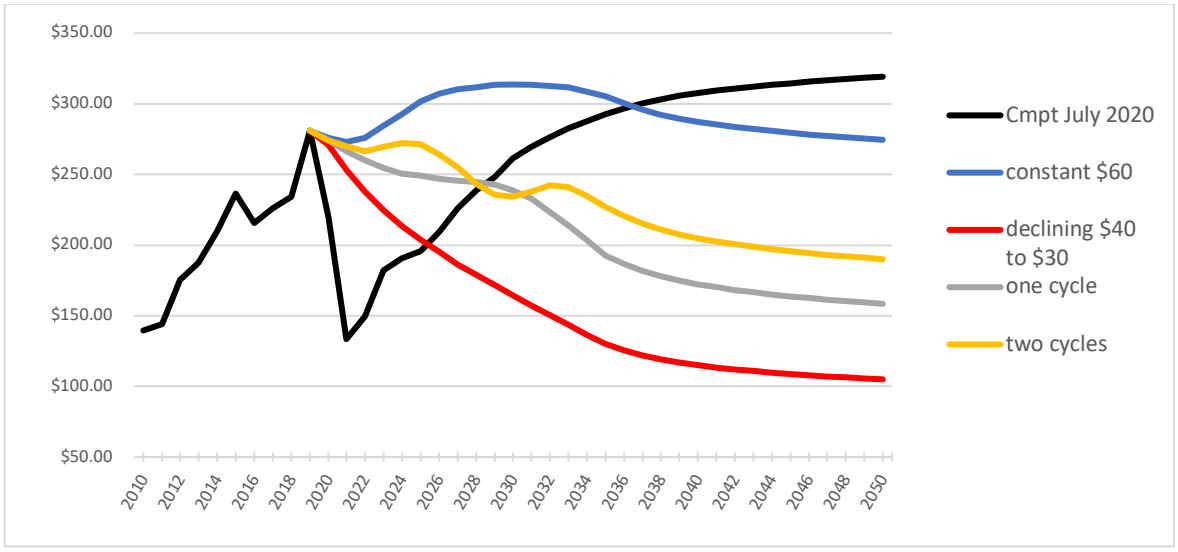
Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

Figure 9. Total Gross State Product ($ millions)



Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

Figure 10. Gross State Product from Exploration and Production (E&P) Industry ($ millions)

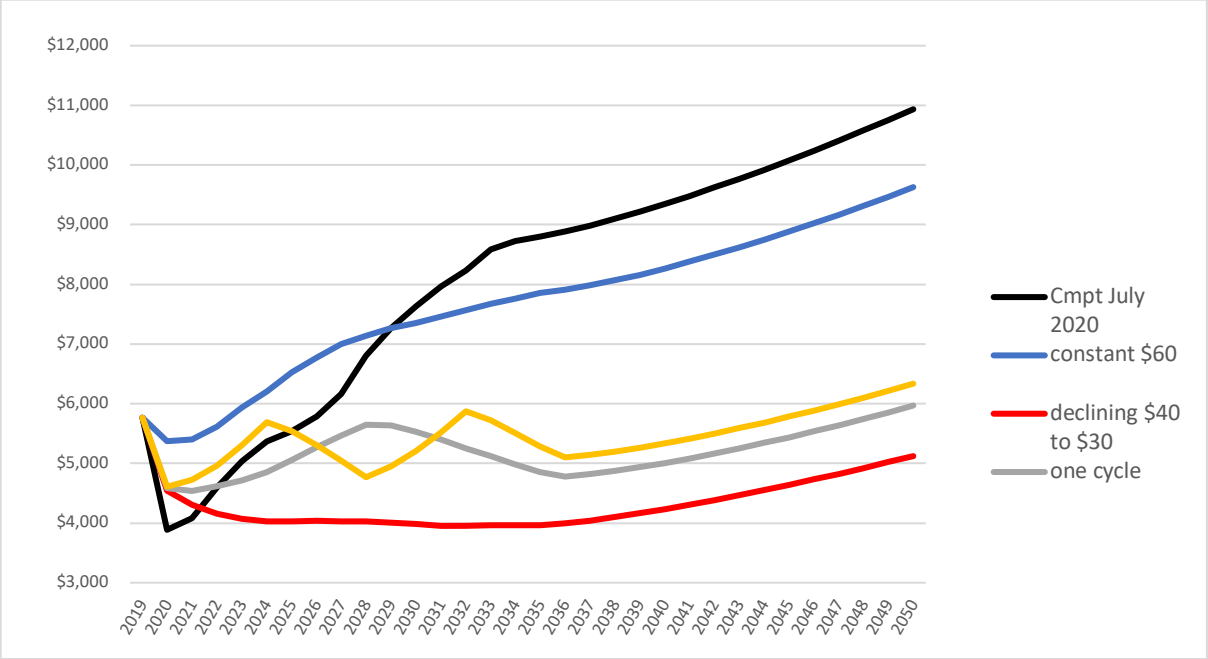


Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

4. Projected Revenues and Spending

CHF (2021) carefully details the different mechanisms through which Texas oil and gas industry prices, volumes, employment, and gross state product influence K-12 education funding. These multichannel flows are diagrammed in Figure 45 of CHF (2021) and implemented in the spreadsheet model for that report to forecast the years 2020 through 2036.

Figure 11. Total Funding from Oil and Gas E&P to K-12 Education in Texas ($ millions 2020)



Source: Values through 2036 are from CHF (2021). Forecasts from 2037 through 2050 are by the Center for Public Finance at Rice University's Baker Institute for Public Policy.

We extend those forecasts for K-12 education funding in Texas from oil and gas E&P by extending the forecasts for all the inputs to its model, as described in Sections 2 and 3 of this report. Figure 11 shows our extended forecasts of K-12 education funding in Texas from oil and gas E&P.

We define the funding gap as the difference between the Texas State Comptroller's 2020 forecast of K-12 education funding from oil and gas versus the four categories of forecasts from the CHF (2021) analysis. Figures 12 and 13 show the time series of the annual funding gap from the shift to low-carbon energy over the next 30 years. Table 2 presents the values of each year's funding gap for each of the scenarios as well as the total funding gap through 2050.

Figures 12 and 13 and Table 2 show that, in the best-case scenario of constant $60 per barrel oil prices, Texas K-12 education funding will decrease by nearly $13 billion over the next 30 years relative to the baseline (0.5% of total nonfederal K-12 baseline funding). In the most pessimistic scenario of a steady decline in oil prices from $40 to $30 per barrel between 2020 and 2036, that funding gap expands to nearly $120 billion over 30 years (3.0% of total nonfederal K-12 baseline funding). Annual deficits would start between 2022 and 2029, and the average annual shortfall across all scenarios is $2.5 billion, with the maximum annual funding shortfall in the worst-case scenario reaching $5.8 billion in 2050.

Figure 12. K-12 Revenues Funding Gap ($ millions): Scenario Minus Comptroller 2020 Forecast

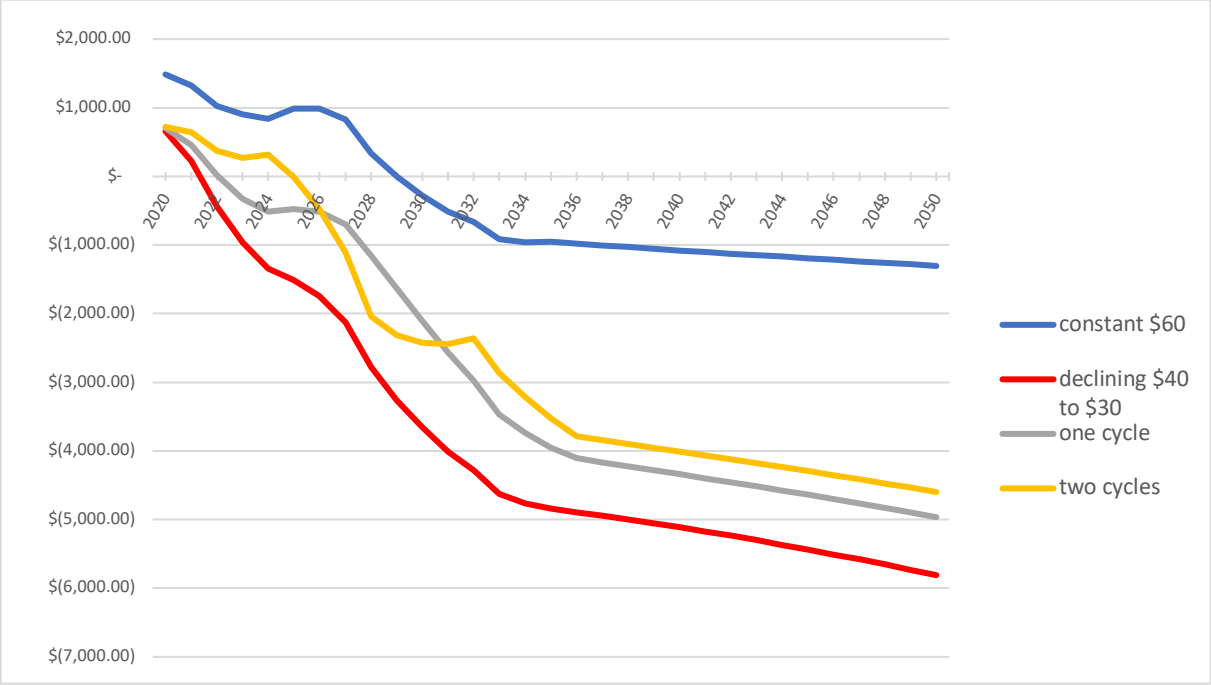


Figure 13. K-12 Revenues Funding Gap (percent of total Texas nonfederal K-12 funding): Scenario Minus Comptroller 2020 Forecast

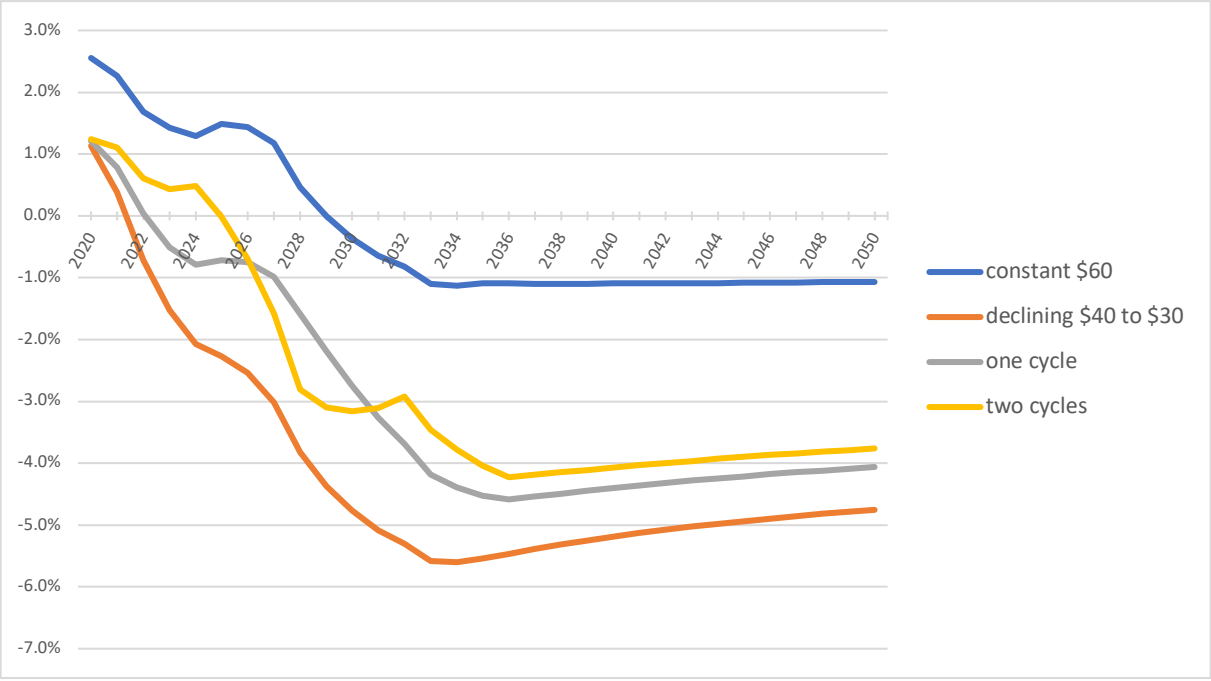


Table 2: K-12 Revenues Funding Gap by Year and Total ($ millions 2020)

Year	Constant $60	Declining $40 to $30	One cycle	Two cycles
2020	1,485.31	658.15	703.12	721.69
2021	1,325.95	222.47	458.90	647.47
2022	1,025.28	(436.38)	20.36	369.76
2023	901.12	(964.90)	(324.39)	272.37
2024	838.97	(1,343.59)	(512.45)	314.84
2025	988.87	(1,511.36)	(477.93)	(5.49)
2026	985.67	(1,742.81)	(515.54)	(478.41)
2027	831.95	(2,129.35)	(698.67)	(1,112.70)
2028	336.58	(2,781.31)	(1,155.73)	(2,037.99)
2029	(3.76)	(3,261.71)	(1,634.40)	(2,315.18)
2030	(282.72)	(3,653.62)	(2,106.49)	(2,427.04)
2031	(509.20)	(4,006.45)	(2,565.98)	(2,446.38)
2032	(660.88)	(4,278.29)	(2,976.92)	(2,357.84)
2033	(913.82)	(4,626.23)	(3,464.99)	(2,866.00)
2034	(960.81)	(4,765.33)	(3,739.30)	(3,217.06)
2035	(952.14)	(4,841.60)	(3,953.88)	(3,523.47)
2036	(978.66)	(4,896.91)	(4,106.69)	(3,785.32)
2037	(1,005.23)	(4,945.03)	(4,165.68)	(3,843.75)
2038	(1,030.58)	(4,997.70)	(4,223.63)	(3,900.27)
2039	(1,055.06)	(5,053.61)	(4,281.31)	(3,955.93)
2040	(1,078.90)	(5,112.15)	(4,339.16)	(4,011.33)
2041	(1,102.26)	(5,172.98)	(4,397.47)	(4,066.85)
2042	(1,125.27)	(5,235.91)	(4,456.43)	(4,122.72)
2043	(1,148.03)	(5,300.83)	(4,516.19)	(4,179.14)
2044	(1,170.59)	(5,367.68)	(4,576.87)	(4,236.25)
2045	(1,193.04)	(5,436.43)	(4,638.57)	(4,294.16)
2046	(1,215.41)	(5,507.07)	(4,701.37)	(4,352.97)
2047	(1,237.76)	(5,579.61)	(4,765.34)	(4,412.77)
2048	(1,260.11)	(5,654.06)	(4,830.55)	(4,473.62)
2049	(1,282.50)	(5,730.44)	(4,897.06)	(4,535.60)
2050	(1,304.96)	(5,808.79)	(4,964.94)	(4,598.76)
Total	**(12,752.02)**	**(119,261.50)**	**(90,805.56)**	**(83,230.87)**

5. Fiscal Policies to Replace Revenue

The Texas legislature has long wrestled with a contentious issue—how best to reform the state tax structure. Dramatic increases over time in the share of K-12 education financed by local property taxes, coupled with widespread discontent with the "Robin Hood" system of redistribution, have created significant political pressure for reductions in school property taxes and the use of an alternative method of supplementing education spending in poorer school districts. Reductions in state revenues related to the transition to low-carbon energy production will exacerbate these problems over time. Thus, more revenues for education finance will likely be raised at the state level, although the means of achieving this goal remain unclear. Piecemeal reform options provide one path forward, but an alternative is to implement a well-designed structural reform of the entire Texas tax system. The Texas Constitution prohibits certain types of taxes, such as income taxes and a state-level property tax. As a result, Texas relies on consumption and business taxation.

While we address reform of the Texas sales tax below, we do not consider reforming or replacing the Texas franchise tax. Such a reform would be politically contentious and would likely be part of a larger effort to alter the funding structure of Texas schools significantly as discussed in Zodrow and Diamond (2005). Instead, we focus on three sources of revenue to fund the estimated shortfall in Texas—one that we view as the most likely source of additional revenue, and two others that are sources of revenues in other states but not in Texas.

Given the projected state budget shortfall in education funding resulting from declining oil prices, this section explores fiscal alternatives to fill the gap. As shown in the previous section in Figures 12 and 13 and Table 2, the annual shortfall in education funding grows steadily with an average annual shortfall of $2.5 billion over the 30-year period. We take this budget shortfall as an approximate target level of revenue to raise and consider alternative options of taxing sales, marijuana, and gambling and gaming.

Sales Tax

Sales tax revenue is determined by both the tax rate and the tax base. The state of Texas currently levies a 6.25% statewide sales tax rate that generated $34 billion in revenue in 2020. That amounts to roughly $5.4 billion for each percentage point of the state sales tax, so increasing the sales tax rate by one percentage point would raise enough revenue to nearly offset the worst-case-scenario annual decline in revenue in 2050 and would raise twice as much revenue as the average revenue shortfall of $2.5 billion over the next 30 years.

Expanding the tax base to include exempt and excluded goods and services can also generate significant increases in tax revenue without changing the sales tax rate. Exempted items, such as magazines, boats, and healthcare supplies, are specifically shielded from taxation and would be taxed by the sales tax without specific provisions in the tax code. Exclusions are items such as physician services and child day care, which do not fall under the broad scope of the sales tax and, consequently, do not require a specific provision in

the tax code to be shielded from sales taxation. Estimates from the Texas Comptroller indicate that the state of Texas will forgo $42 billion in sales tax revenue in 2021 as a result of sales tax exemptions, exclusions, and discounts. Of that amount, roughly $14 billion of goods and services are exempted because they are subject to different taxes, leaving about $28 billion in goods and services that are entirely untaxed. A summary of these exemptions, exclusions, and discounts is provided in the Appendix.

Table 3. Sales Tax Exemptions, Exclusions, and Discounts

Item	Estimated Value (millions of dollars, 2021)
Exemptions	31,401.3
Exclusions	10,326.8
Discounts	275.6
Total	42,003.7

Source: Texas Comptroller of Public Accounts.

The existing sales tax structure exempts 95 different goods and services (87 fully untaxed), excludes 33 items—particularly services—and offers discounts for timely filing and prepayment. The extensive list of untaxed items offers policymakers a variety of options to offset the projected decline in revenue without adjusting the tax rate. Expanding the sales tax base could even generate greater equity across goods and services and remove any corresponding distortions. Adding certain items into the tax base, however, could create a more regressive tax structure. As a result, policymakers should carefully evaluate the distributional consequences of alternative proposals in resolving the projected fiscal shortfall.

The sales tax in Texas is not a uniform tax on final goods and services. Instead, roughly half of the base of the sales tax consists of business purchases, converting the tax into a haphazard tax on business income.[5] In addition, much consumption, especially of many consumer services, is not subject to tax. The resulting sales tax is highly distortionary and inequitable. Although expansion of the sales tax base to a more uniform base is theoretically desirable, exemptions often are justified as a means to relieve the burden on low-income households. An increase in the tax rate would exacerbate existing distortions and only further encourage tax-avoiding purchases over the Internet.

Marijuana Taxes

Several states have started implementing some form of decriminalization and taxation of recreational marijuana. Most notably, Colorado and Washington began this process several years ago by passing state legislation that approved the recreational use of marijuana.[6] Several states, including Alaska, Arizona, California, Illinois, Maine, Massachusetts, Michigan, Nevada, and Oregon, subsequently implemented some form of marijuana tax,

[5] See Phillips and Ibaid (2019).
[6] See Moore (2013).

and other states like Montana, New Jersey, New York, South Dakota, and Vermont have approved and plan to tax marijuana.[7] The experiences of these states serve as case studies for how marijuana taxation could be implemented in Texas and how much revenue could be raised.

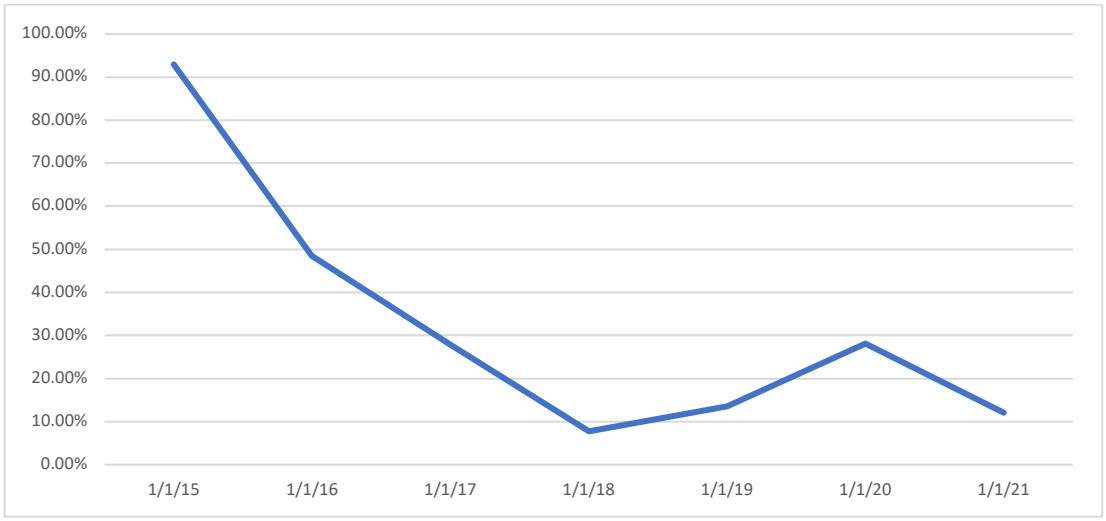
Excise taxes are often levied on units of sale, but variation in the consumption and properties of the marijuana plant result in variation in taxation across states. Some states, like Massachusetts, Michigan, Oregon, and Washington, implement a marijuana tax that is based on the retail price.[8] Alaska taxes marijuana based on the weight and properties of the plant. Finally, some states, like California, Illinois, and Maine, implement a mix of taxes based on both the plant's properties and the price of the product at the wholesale and/or retail level.

The state of Colorado, an early adopter of marijuana taxes, levies three different taxes on marijuana—a retail excise tax of 15%, a retail sales tax of 15%, and the standard state sales tax of 2.9%.[9] In 2020, Colorado raised nearly $400 million, and, at its current pace, revenue will increase another 10% in 2021. This amounts to per capita revenue of $76.15 in Colorado. Figure 14 shows Colorado marijuana tax revenue growth from 2015 to 2021. If the same amount of revenue were raised on a per capita basis in Texas, Colorado's tax system, implemented in Texas, would generate approximately $2.2 billion. This amount assumes that demand is the same in Texas as it is in Colorado, which may be unreasonable. If Texas demand is at least half of Colorado's, it could generate at least $1 billion in new revenue, which would fund nearly half of the average annual projected decline in revenue across scenarios resulting from declining oil prices.

An estimate of $1 billion exceeds some estimates of the potential tax revenue for the state of Texas under similar marijuana tax implementations. The Tax Foundation, for example, projects that marijuana excise taxes in Texas would raise around $400,000 in revenue.[10] However, the growing tax base in states like Colorado indicates that the corresponding tax revenue could have a higher ceiling. Shortly after legalizing marijuana and implementing the tax, Colorado experienced very high revenue growth in the subsequent first few years. Increased supply of cannabis drove down prices, but revenue growth remained elevated once prices stabilized (see Figure 15).

[7] See Boesen (2021).
[8] See Boesen (2020).
[9] "Marijuana Tax Reports," Colorado Department of Revenue, State of Colorado, https://cdor.colorado.gov/data-and-reports/marijuana-data/marijuana-tax-reports.
[10] See Boesen (2021).

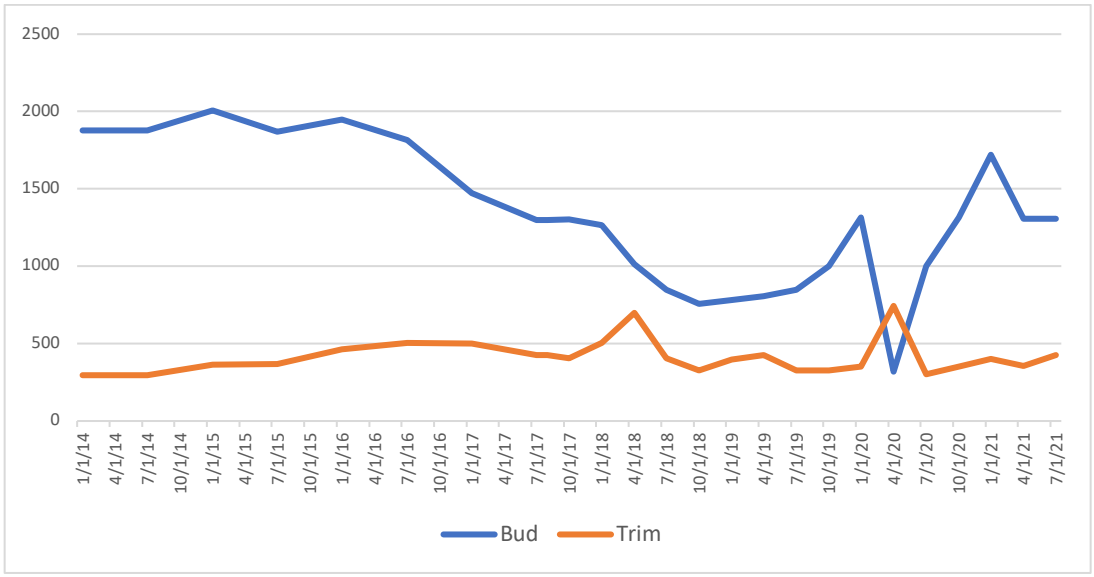
Figure 14. Colorado Marijuana Tax Revenue Growth Rate



Note: Colorado marijuana tax revenue growth rate since inception (2021 value is estimated).

Source: Colorado Department of Revenue.

Figure 15. Colorado Marijuana Prices ($/lb)



Note: Marijuana prices since legalization.

Source: Colorado Department of Revenue, https://tax.colorado.gov/sites/tax/files/AMR_PriorRates_Jul2021.pdf.

The outlook for marijuana tax revenue in the state of Texas remains uncertain and contingent on several factors. One of these factors is the demand for marijuana. If demand for marijuana is low, relative to states like Colorado, Texas would only realize a fraction of revenue per capita. Second is the ability of the legal market to overcome the illicit market.

For example, after legalizing marijuana in California, the illicit market actually grew.[11] Such an outcome could result from California's shared border with Mexico—a market feature that is also present in the state of Texas. Finally, since other states have built up and established marijuana production, Texas could see adoption and corresponding revenue increase more rapidly, relative to the early-adopting states. For these reasons, both revenue growth and potential long-term revenue remain somewhat uncertain.

Despite the variability in projected tax revenue, several states experienced the same growth pattern as Colorado, indicating lags in reaching revenue stabilization.[12] If Texas seeks to ensure that a share of the projected education funding shortfall is resolved by marijuana taxation, it should start implementing the tax several years before the projected decline. Doing so will allow the market to form and revenue to reach its long-term potential. Given that such stabilization could take as long as a decade, the time horizon could coincide with the trajectory of declining oil prices.

Gambling and Gaming Revenue

The prospect of gambling and gaming in the state of Texas could introduce a significant flow of revenue if aggressively implemented. Each of its neighboring states currently have various forms of legalized gambling, causing Texas to forgo potential government revenue opportunities across state lines. According to one estimate, gaming-related spending by Texans in these adjacent states was $2.96 billion in 2012.[13] As with marijuana taxation, implementation of most types of gambling and gaming in the state of Texas would require modifications to existing legal barriers.

Across the entire United States, gaming generated over $10 billion in revenue to state and local governments.[14] The state of Nevada, which has the largest casino gaming market, generated one of highest revenue flows, with $969 million in tax revenue from commercial casinos. This provides some indication of a high-end value, with Texas possibly generating a portion of that revenue. Proper estimates depend on several variables, including the number of casino licenses issued and the potential size of the market.

In 2019, a bill was filed in the Texas House of Representatives (H.B. 494) that would authorize casino gaming. The implementation would have been limited to nine casino licenses throughout the state. The corresponding fiscal note created by the Legislative Budget Board indicated that the bill would generate around $600 million annually upon full implementation.[15] With more licenses, the projected revenue could be higher.

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[11] See Williams (2019).
[12] See Bieber (2021).
[13] See report by Weinstein, Clower & Associates (2013).
[14] See report by the American Gaming Association and Gambling Compliance (2020).
[15] Legislative Budget Board, Fiscal Note, 86th Legislative Regular Session, April 29, 2019, https://capitol.texas.gov/Search/DocViewer.aspx?ID=86RHB004941F&QueryText=gaming&DocType=F.

As with the implementation of marijuana legalization and taxation, revenue from gambling and gaming would take time to materialize and reach its potential. Consequently, if policymakers choose to offset a decline in revenue with gambling and gaming revenue, they should consider the timeline. By initiating the revenue stream sooner, the timeline for establishing gambling and gaming revenue could coincide with the timeline for the projected decline in oil prices.

6. Conclusion

This report assesses the projected state budget shortfall in education funding through 2050 resulting from declining oil prices corresponding to the shift toward low-carbon energy. We explore three broad fiscal reforms to fill the gap. We build our forecast from four broad oil price scenarios proposed by an expert panel in CHF (2021). We predict that education funding will decrease by between $13 billion and $120 billion over the next 30 years because of the shift toward renewable energy. Annual deficits would start between 2022 and 2029, and the average annual shortfall across all scenarios is $2.5 billion, with the maximum annual funding shortfall in the worst-case scenario reaching $5.8 billion in 2050.

Policymakers will need to enact policy changes that raise more revenue or reduce spending to balance the Texas budget. We evaluate three potential reform options—sales tax expansion, marijuana legalization and taxation, and gambling and gaming revenue. We discuss the extent to which each of these sources could fill the projected shortfalls. We are not advocating for any single option, and we recognize that there are many other options available to fill the projected shortfalls, such as more fundamental reforms of the franchise tax or increasing excise tax rates. Indeed, more research on the economic effects of the various options is needed and will help policymakers determine the most efficient and equitable policy response. We are prepared to examine these options in more detail.

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Appendix: Forecasting Methods

Logarithmic function

For time series with exponential growth or decay, we forecast the series from 2036 to 2050 by fitting a three-parameter natural logarithm function to the existing series. The equation below gives the form of the function followed by the three conditions that pin down the values of the three parameters a, b, and c. Let t be the year of the time series observation, and let y_t represent the period-t observation of the time series. We have data and forecasted data from Center for Houston's Future's (2021) study for the years 2020 through 2036.

$$\ln y_t = a \ln(t + b) + c \quad \text{for } t \geq 2036$$

$$\text{such that} \quad \text{(i)} \quad \ln y_{2036} = a \ln(2036 + b) + c$$

$$\text{(ii)} \quad \ln y_{2036} - \ln y_{2035} = \frac{a}{2036 + b}$$

$$\text{(iii)} \quad 0.2(\ln y_{2036} - \ln y_{2035}) = \frac{a}{2048 + b}$$

We state the logarithmic functional form on the right-hand side of the equation as a function of the natural log of the time series (left-hand side) so that the growth rates are going to a constant level (the slope of the growth rate is going to zero). The limit of the slope of the natural log of x is zero as x goes to infinity. We want the growth rates to be stabilizing in the long run at a constant rate instead of the levels stabilizing at a constant rate.

The three conditions following the equation have the following intuition. The first condition states that the forecasted series from 2036 on must equal the data in the last year of the data t = 2036. The second condition (ii) states that the slope of the extrapolating function must equal the slope of the data in the last year of the data t = 2036. And finally, the third condition (iii) states that the slope of the extrapolating function must have decayed to 20% of the slope at t = 2036 by the year 2048. This results in the forecasts seen in Figures 1–6 and 8.

Some simple algebra shows that the forecasting equation above with the three conditions has the following closed-form solution for each of the parameters.

$$b = \frac{0.2(2048) - 2036}{1 - 0.2}$$

$$a = (2036 + b)(\ln y_{2036} - \ln y_{2035})$$

$$c = \ln y_{2036} - a \ln(2036 + b)$$

Appendix: Sales Tax Exemptions, Exclusions, and Discounts

The tables below are excerpts from the December 2020 Tax Exemptions & Tax Incidence Report to the Governor and the 86th Legislature produced by the Texas Comptroller of Public Accounts (CPA).[16] Estimates of annual amounts in this report are derived from the 2023 estimates, in accordance with the methods used by the CPA.

[16] Texas Comptroller of Public Accounts, *Tax Exemptions & Tax Incidence Report to the Governor and the 86th Legislature*, December 2020, https://comptroller.texas.gov/transparency/reports/tax-exemptions-and-incidence/.

Table 2

Value of Sales Tax Exemptions

Fiscal 2021 to 2026 – In millions of dollars

Tax Code Section	Exemption	2021	2022	2023	2024	2025	2026
151.302	Sales for resale	cbe	cbe	cbe	cbe	cbe	cbe
151.3021	Packaging supplies and wrapping (dry cleaning)	*	*	*	*	*	*
151.303	Previously taxed items	cbe	cbe	cbe	cbe	cbe	cbe
151.304	Occasional sales	cbe	cbe	cbe	cbe	cbe	cbe
151.305	Coin-operated machine sales	*	*	*	*	*	*
151.3051	Sales through certain vending machines	*	*	*	*	*	*
151.306	Transfers of common interests in property	cbe	cbe	cbe	cbe	cbe	cbe
151.307	Exemptions required by prevailing law	cbe	cbe	cbe	cbe	cbe	cbe
151.3071	Installation of certain equipment for export	*	*	*	*	*	*
151.308	Items taxed by other law						
	Crude oil	0.0	0.0	0.0	0.0	0.0	0.0
	Motor vehicles	3,730.6	4,602.2	4,689.1	4,734.5	4,781.1	4,828.4
	Motor fuels	2,459.0	2,580.8	2,746.6	2,888.9	3,044.4	3,209.5
	Mixed beverages	327.5	499.2	525.9	549.5	577.3	606.5
	Cement	*	*	*	*	*	*
	Aviation fuel	120.8	133.6	148.0	158.9	167.5	181.2
	Oil well servicing	67.0	90.0	103.5	112.9	118.5	124.4
	Insurance premiums	7,583.1	7,847.9	8,207.1	8,620.1	9,086.0	9,577.2
	Total for items taxed by other law	14,287.9	15,753.7	16,420.1	17,064.8	17,774.8	18,527.2
151.309	Governmental entities	425.3	438.0	457.8	485.4	508.1	526.1
151.310	Religious, educational and public service organizations						
	Sales to nonprofits	36.5	39.0	41.1	42.8	42.4	44.4
	One-day sales	8.4	9.0	9.5	9.9	9.8	10.2
151.3101	Amusement services	cbe	cbe	cbe	cbe	cbe	cbe
151.3102	Sale by nonprofit organization at county fair	*	*	*	*	*	*
151.3105	Bingo equipment purchased by certain organizations	0.3	0.3	0.3	0.3	0.3	0.4
151.311	Taxable items incorporated into or used for improvement of realty of an exempt entity	31.4	32.3	33.8	35.8	37.5	38.8
151.3111	Services on certain exempted personal property	cbe	cbe	cbe	cbe	cbe	cbe
151.312	Periodicals and writings of religious, philanthropic, charitable, historical, scientific and similar organizations	5.3	5.6	5.9	6.2	6.5	6.8
151.313	Health care supplies						
	Prescription medicine and devices	740.1	766.3	793.2	821.0	878.9	909.3
	Over-the-counter drugs	289.9	300.2	310.8	321.7	332.9	344.5
151.314	Food and food products						
	Food for home consumption	3,314.7	3,431.3	3,539.1	3,649.9	3,770.0	3,902.3
	School lunches and certain food sales	64.6	67.7	70.8	74.1	77.5	81.1
151.3141	Food stamp purchases	25.2	25.6	26.0	26.4	26.8	27.3
151.315	Water	383.6	390.8	401.5	412.0	423.0	435.2
151.316	Agricultural items						
	Agricultural feed, seed, chemicals and supplies	315.7	318.1	319.6	322.0	324.5	326.7
	Livestock for food	22.4	23.0	23.5	24.2	24.9	25.6
	Agricultural machinery and equipment	77.9	78.5	78.9	79.5	80.1	80.6
	Horses, mules and work animals	19.5	20.1	20.5	21.1	21.8	22.4
	Commercial fishing ice	0.3	0.3	0.3	0.3	0.3	0.3
151.3162	Timber items	31.8	32.5	33.2	33.9	34.7	35.4
151.317	Gas and electricity						
	Manufacturing	524.6	530.9	537.4	544.0	550.7	557.5
	Residential	1,029.1	1,038.3	1,047.7	1,057.1	1,066.7	1,076.3
	Agricultural	23.5	23.6	23.8	24.0	24.1	24.3
	Mining	55.7	56.0	56.4	56.8	57.1	57.5
	Timber	2.3	2.3	2.3	2.3	2.3	2.3
151.3171	Sulphur	*	*	*	*	*	*
151.318	Property used in manufacturing						
	Materials used in manufacturing	7,236.4	7,909.0	8,605.7	9,302.7	9,860.0	10,408.3
	Manufacturing machinery and equipment	990.9	1,043.1	1,098.5	1,154.5	1,205.1	1,250.6
	Packaging and wrapping supplies	223.8	244.6	266.2	287.7	304.9	321.9

Table 2 *(continued)*

Value of Sales Tax Exemptions

Fiscal 2021 to 2026 – In millions of dollars

Tax Code Section	Exemption	2021	2022	2023	2024	2025	2026
151.3182	Certain property used in research and development activities	215.6	227.5	240.0	253.1	267.1	281.7
151.3185	Property used in media production, recording and broadcasting	95.7	100.4	105.9	111.2	115.8	119.6
151.3186	Property used in cable television, internet access or telecommunications services	50.0	50.0	50.0	50.0	50.0	50.0
151.319	Newspapers and property used in newspaper publication						
	Newspapers	37.5	37.9	38.3	38.7	39.1	39.5
	Newspaper inserts	4.7	4.4	4.2	4.0	3.8	3.6
151.320	Magazines	14.7	14.5	14.4	14.3	14.1	14.0
151.321	University and college student organizations	*	*	*	*	*	*
151.322	Containers	236.3	249.0	262.1	275.3	286.5	296.9
151.323	Certain telecommunications services	cbe	cbe	cbe	cbe	cbe	cbe
151.324	Equipment used elsewhere for mineral exploration or production	41.4	46.4	56.4	59.1	60.6	64.8
151.326	Clothing and footwear for a limited period	68.3	70.6	74.3	77.8	81.7	86.1
151.327	School supplies and school backpacks before start of school	15.2	15.5	16.4	17.2	18.0	18.9
151.328	Aircraft						
	Certain aircraft	cbe	cbe	cbe	cbe	cbe	cbe
	Repair equipment and services for certain aircraft	27.2	37.1	44.0	55.2	62.4	66.6
151.329	Certain ships and ship equipment	64.7	67.9	69.9	73.0	76.1	79.3
151.3291	Boats and boat motors	64.4	67.7	71.2	74.3	78.2	82.4
151.330	Interstate shipments, common carriers and services across state lines	cbe	cbe	cbe	cbe	cbe	cbe
151.331	Rolling stock; train fuel and supplies						
	Railroad fuel and supplies	28.9	34.2	38.0	41.1	42.7	44.3
	Rolling stock and locomotives	22.6	23.8	25.1	26.3	27.3	28.2
151.332	Certain sales by senior citizen organizations	*	*	*	*	*	*
151.333	Energy-efficient products for a limited period	4.6	4.8	4.9	5.1	5.2	5.4
151.3335	Water-efficient products	5.8	6.0	6.2	6.4	6.6	6.8
151.334	Components of tangible personal property used in connection with sequestration of carbon dioxide	*	*	*	*	*	*
151.336	Certain coins and precious metals	cbe	cbe	cbe	cbe	cbe	cbe
151.337	Sales by or to Indian tribes	cbe	cbe	cbe	cbe	cbe	cbe
151.338	Environment and conservation services	cbe	cbe	cbe	cbe	cbe	cbe
151.340	Official state coin	*	*	*	*	*	*
151.341	Items sold to or used by development corporations	*	*	*	*	*	*
151.3415	Items sold to or used to construct, maintain, expand, improve, equip, or renovate media production facilities at media production locations	0.0	0.0	0.0	0.0	0.0	0.0
151.342	Agribusiness items	0.5	0.5	0.6	0.6	0.6	0.6
151.343	Animals sold by nonprofit animal shelters	*	*	*	*	*	*
151.344	Post exchanges on state military property	*	*	*	*	*	*
151.346	Intercorporate services	cbe	cbe	cbe	cbe	cbe	cbe
151.347	Certain lawn and yard services	*	*	*	*	*	*
151.348	Cooperative research and development ventures	cbe	cbe	cbe	cbe	cbe	cbe
151.350	Labor to restore certain property	cbe	cbe	cbe	cbe	cbe	cbe
151.3501	Labor to restore, repair or remodel historic sites	*	*	*	*	*	*
151.351	Information services and data processing services	145.2	159.1	165.6	181.5	197.0	209.1
151.353	Court reporting services	*	*	*	*	*	*
151.354	Services by employees of property management companies	*	*	*	*	*	*
151.355	Water-related exemptions	8.3	8.5	8.8	9.0	9.2	9.5
151.356	Offshore spill response containment property	*	*	*	*	*	*
151.3565	Emergency preparation supplies for limited period	1.4	1.4	1.5	1.5	1.6	1.6
151.359	Property used in certain data centers; temporary exemption	30.4	28.7	35.7	29.9	29.1	27.5
151.3595	Property used in certain large data centers; temporary exemption	**	**	**	**	**	**
151.429	Enterprise projects (refunds)	50.7	52.8	54.9	57.1	59.3	61.7
151.4291	Defense readjustment projects (refunds)	cbe	cbe	cbe	cbe	cbe	cbe
151.431	Job retention in enterprise zones (refunds)	*	*	*	*	*	*
Total		**31,401.3**	**33,888.9**	**35,612.1**	**37,321.8**	**38,977.8**	**40,641.4**

** Amount is negligible.*
*** Included in the estimate of property used in certain data centers under Sec. 151.359.*
cbe: cannot be estimated.
Note: Totals may not sum due to rounding.

Table 3

Value of Selected Service Exclusions from the Sales Tax

Fiscal 2021 to 2026 – In millions of dollars

Construction Labor

Service Exclusion	2021	2022	2023	2024	2025	2026
New residential construction	$167.2	$176.5	$186.8	$197.5	$208.9	$220.3
New nonresidential construction	505.6	533.7	564.7	597.3	631.6	666.1
Residential repair and remodeling	128.4	133.4	138.0	143.1	147.8	152.4

Personal Services

Service Exclusion	2021	2022	2023	2024	2025	2026
Hair, nail and skin care services	$93.6	$96.2	$101.2	$106.1	$111.3	$117.3
Death care services	73.6	75.6	79.5	83.4	87.4	92.2
Child day care	188.2	193.4	203.5	213.3	223.7	235.7
Coin-operated amusement and personal services	45.4	47.6	50.2	52.4	55.1	58.2
Miscellaneous personal services	69.0	70.9	74.6	78.2	82.0	86.4

Business and Professional Services

Service Exclusion	2021	2022	2023	2024	2025	2026
Physician services	$1,377.1	$1,414.9	$1,488.7	$1,560.4	$1,636.4	$1,724.8
Dental services	572.7	588.5	619.2	649.0	680.6	717.4
Other health care	928.2	953.7	1,003.4	1,051.7	1,102.9	1,162.6
Legal services	540.1	570.1	603.3	638.1	674.7	711.6
Accounting and audit services	356.4	376.2	398.0	421.0	445.2	469.5
Architectural and engineering services	465.0	490.8	519.4	549.4	580.9	612.7
Specialized design services	19.0	19.5	20.6	21.5	22.6	23.8
Management consulting and public relations	460.7	486.2	514.5	544.2	575.4	606.9
Computer systems design and custom programming	854.1	901.4	953.9	1,008.9	1,066.8	1,125.2
Research and development services	275.6	290.9	307.8	325.5	344.2	363.0
Marketing research and public opinion polling	36.2	38.2	40.4	42.7	45.2	47.6
Testing labs	123.8	130.7	138.3	146.2	154.6	163.1
Outdoor display advertising	24.9	26.3	27.8	29.4	31.1	32.8
Employment agency services	85.9	90.6	95.9	101.4	107.3	113.1
Temporary labor supply	532.9	562.4	595.2	629.5	665.6	702.0
Financial securities brokerage	244.7	258.3	273.3	289.1	305.7	322.4
Other financial services	336.1	354.7	375.3	397.0	419.8	442.7
Real estate brokerage and agency	378.4	399.4	422.6	447.0	472.7	498.5
Freight hauling (intrastate)	310.7	327.9	347.0	367.0	388.1	409.3
Other transportation (except scheduled passenger)	70.5	74.4	78.7	83.3	88.1	92.9
Veterinary services	137.0	140.8	148.1	155.3	162.8	171.6

Other Services

Service Exclusion	2021	2022	2023	2024	2025	2026
Automotive maintenance and repair	$728.1	$748.1	$787.1	$825.0	$865.2	$912.0
Car washes	52.2	53.7	56.5	59.2	62.1	65.4
Private vocational education	78.5	80.7	84.9	89.0	93.3	98.3
Other educational services	67.1	68.9	72.5	76.0	79.7	84.0

Total	2021	2022	2023	2024	2025	2026
Value of Selected Service Exclusions	**$10,326.8**	**$10,774.5**	**$11,371.0**	**$11,978.1**	**$12,618.5**	**$13,302.1**

Note: Totals may not sum due to rounding.

Table 4

Sales Tax Discounts

Fiscal 2021 to 2026 – In millions of dollars

Discount	2021	2022	2023	2024	2025	2026
Timely Filer Discount	$142.0	$150.4	$159.4	$168.0	$176.5	$185.3
Prepayment Discount	133.6	141.6	150.0	158.1	166.1	174.4
Total	**$275.6**	**$292.0**	**$309.3**	**$326.1**	**$342.5**	**$359.6**

Note: Totals may not sum due to rounding.