



September 17, 2024

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
Lansing, MI 48909

Via E-File

RE: MPSC Case No. U-21534

Dear Ms. Felice:

Attached please find the enclosed documents for filing:

- Official Exhibits and Exhibit Lists of Citizens Utility Board of Michigan;
- Proof of Service;
- Note CUB-14 has a confidential version and will be filed under seal.

Sincerely,

Christopher M. Bzdok
chris@tropospherelegal.com

CC: Parties to Case No. U-21534

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of **DTE ELECTRIC COMPANY** for authority to increase its rates, amend its rate schedules and rules governing the distribution and supply of electric energy, and for miscellaneous accounting authority. Case No. U-21534

**EXHIBIT LIST OF
CITIZENS UTILITY BOARD OF MICHIGAN**

Exh #	Description
CUB-1	Resume of Matthew J. Bandyk
CUB-2	Total Private Nonfarm Business Multifactor Productivity Index Growth
CUB-3	Annual Percent Change in Michigan Nonfarm Business Labor Productivity Index Growth
CUB-4	"Rate of Return Regulation Revisited", Werner and Jarvis, August 2023
CUB-5	Cost of Capital
CUB-6	Equity Risk Premium and Corresponding Risk-Free Rates
CUB-7	Electric Sample Average Asset Beta Relevered at DTE Electric's Capital Structure with Market Value of Equity
CUB-8	CAPM Analysis
CUB-9	DCF Cost of Equity at DTE Electric's Capital Structure with Market Value of Equity
CUB-10	"The Hamada Beta Adjustment and the Cost of Capital for the Regulated Utilities, IAEE Energy Forum, 3rd Quarter 2022
CUB-11	Resume of Josh Denzler
CUB-12	U-12270 DTE Electric Annual Report, June 14, 2024
CUB-13	Response to MNSCDE-13.27
CUB-14C	Response to MNSCDE-13.2b with CONF Att Preliminary Estimated Net VSIP O&M Savings
CUB-15	<i>Reserved</i>
CUB-16	<i>Reserved</i>
CUB-17	Resume of Douglas B. Jester
CUB-18	<i>Reserved</i>
CUB-19	Electric Vehicle Charging Profiles

CUB-20	Resume of David L. Gard
CUB-21	8760-Hour Load Profiles for ResStock Single-Family and Multi-Family
CUB-22	CP and NCP Performance of ResStock Single-Family, ResStock Multi-Family, and DTE 2018 Residential
CUB-23	CP and NCP Radar Plots for ResStock Single-Family, ResStock Multi-Family, and DTE 2018 Residential
CUB-24	Description of Modeling Analysis to Investigate Increased Building Electrification and Other Measures on Residential Hourly Load
CUB-25	8760-Hour Load Profiles for Eight Scenarios
CUB-26	Annual Energy Results for Eight Scenarios
CUB-27	CP and NCP Performance for Eight Scenarios
CUB-28	CP Radar Plots for Eight Scenarios
CUB-29	NCP Radar Plots for Eight Scenarios
CUB-30	Resume of Graham Woolley
CUB-31	Relationship Between Temperature and Aging
CUB-32	Derivation of Power Losses Within a Transformer
CUB-33	Derivation of Loss of Life and Expected Lifetime

TROPOSPHERE LEGAL, PLLC
Counsel for MEC, NRDC, SC, and CUB

Date: September 17, 2024

By: _____
Christopher M. Bzdok (P53094)
Tracy Jane Andrews (P67467)
420 E. Front St.
Traverse City, MI 49686
Phone: 231-709-4000
Email: chris@tropospherelegal.com
tjandrews@tropospherelegal.com

Matthew J. Bandyk

Education

- **Master of Business Administration (MBA), University of Michigan Stephen M. Ross School of Business, Ann Arbor, MI, April 2018**
- **Passed CFA Level I exam, June 2015**
- **BA in political science, *cum laude*, Davidson College, Davidson, NC, May 2006**

Experience

Consultant, 5 Lakes Energy, September 2021-present

- Provides public policy recommendations and financial analysis for nonprofit energy advocacy clients
- Analyzes utility justifications of return on equity and other corporate finance issues for testimony in Michigan Public Service Commission rate cases

Clean Energy Consultant, Bandyk Consulting LLC, January 2019-September 2021

- Manages and writes social media, blog posts, op-eds that appear in newspapers like the Detroit Free Press and
- Serves as communications strategist for the Michigan Energy Innovation Business Council, including social media, blog posts on utility regulation and policy issues and enterprise articles in publications like Utility Dive

Financial Services Manager, Atwell LLC, Southfield, MI, May 2018-January 2019

- Purchased long-lived assets to support Atwell's work in environmental and engineering consulting for renewables and oil & gas sectors
- Performed financial analysis to overhaul company's asset leasing policies with goal of saving up to ~100k per year by improving asset life

Climate Corps Fellow, Environmental Defense Fund, Toledo, OH, Summer 2017

- Built financial valuation tool for payback, NPV and IRR of solar arrays planned by client, determining best ROI for about \$300,000 in solar investments
- Designed energy use tracking system for the largest private low-income housing provider in Toledo, Ohio; system saved hundreds of work hours annually

MBA Student Consultant, DTE Energy, Detroit, MI, March-April 2017

- Performed market and regulatory compliance research on original proposal for DTE to enter the corporate renewable energy space; presented to company leadership
- Designed tariff to add wind/solar and cut rates by 20% compared to DTE's green tariff

Reporter, S&P Global Market Intelligence/SNL Financial, Arlington, VA, June 2010-August 2016

- Used Excel analysis of power plant output and commodity price databases to create actionable intelligence about new trends in the energy industry for clients
- Wrote articles on utilities, power plants, energy efficiency and regulation for subscription website read daily by thousands of energy and investment professionals

Total Private Nonfarm Business Multifactor Productivity Index Growth¹

Year	Index Value	12- Month % Change
2013	98.065	
2014	98.738	0.69%
2015	99.489	0.76%
2016	99.364	-0.13%
2017	100	0.64%
2018	100.633	0.63%
2019	101.987	1.35%
2020	101.756	-0.23%
2021	105.053	3.24%
2022	103.343	-1.63%
2023	104.107	0.74%
Average:		0.61%

¹ Source: U.S. Bureau of Labor Statistics Data Finder. Accessed June 2024.

Annual Percent Change in Michigan Nonfarm Business Labor Productivity Index Growth¹

Year	Value
2013	-0.2
2014	0.2
2015	-0.6
2016	0.5
2017	0.1
2018	1
2019	1.2
2020	7.9
2021	0.3
2022	-3.8
2023	1.1
Average	0.70%

¹ Source: U.S. Bureau of Labor Statistics Data Finder. Accessed June 2024.



Energy Institute WP 329R

Rate of Return Regulation Revisited

Karl Dunkle Werner and Stephen Jarvis

Revised August 2023

Energy Institute at Haas working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to review by any editorial board. The Energy Institute acknowledges the generous support it has received from the organizations and individuals listed at <https://haas.berkeley.edu/energy-institute/about/funders/>.

© 2022 by Karl Dunkle Werner and Stephen Jarvis. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit is given to the source.

Rate of Return Regulation Revisited

Karl Dunkle Werner and Stephen Jarvis *



August 2023

Abstract

Utility companies recover their capital costs through regulator-approved rates of return. Using a comprehensive database of utility rate cases we estimate that utilities' current regulated returns on equity are significantly higher than various benchmarks would suggest. We show that regulated returns on equity respond more quickly to increases in benchmark measures of capital costs than they do to decreases. We then provide evidence that higher regulated returns on equity lead utilities to own more capital. A 1 percentage point rise in the return on equity increases capital investment by 5%. Overall we find excess costs to consumers of \$2–20 billion per year.

JEL Codes: Q4, L5, L9

Keywords: Utility, Rate of Return, Regulation, Electricity, Natural Gas, Capital Investment

*  Dunkle Werner: Economic Policy, US Treasury, karldw@berkeley.edu.
 Jarvis: Department of Geography and Environment, London School of Economics, s.jarvis@lse.ac.uk. The views and findings presented this research do not necessarily represent the views of the US Treasury or any other author affiliation. The authors thank seminar participants at the Berkeley Electricity Markets group, the LSE Workshop in Environmental Economics, the POWER Conference and the AERE Summer Conference. The authors wish to acknowledge the advice of Severin Borenstein, Jim Sallee, and Meredith Fowlie. All errors are, of course, our own. Karl is grateful for the generous support of the Alfred P. Sloan Foundation Pre-doctoral Fellowship on Energy Economics, awarded through the NBER.

1 Introduction

In the two decades from 1997 to 2017, real annual capital spending on electricity distribution infrastructure by major utilities in the United States has doubled (EIA 2018a). Over the same time period annual capital spending on electricity transmission infrastructure increased by a factor of seven (EIA 2018b). The combined total is now more than \$50 billion per year. This trend is expected to continue. Bloomberg New Energy Finance predicts that between 2020 and 2050, North and Central American investments in electricity transmission and distribution will likely amount to \$1.6 trillion, with a further \$1.7 trillion for electricity generation and storage (Henbest et al. 2020).¹

These large capital investments could be due to the prudent actions of utility companies modernizing an aging grid. They may also be a necessary response to the clean energy transition underway in much of the gas and electric utility sector. However, it is noteworthy that over recent years, utilities have earned sizeable regulated rates of return on their capital assets, particularly when set against the unprecedented low interest rate environment post-2008. When the economy-wide cost of capital fell, utilities' regulated rates of return did not fall nearly as much. This gap raises the prospect that at least some of the growth in capital spending could be driven by utilities earning excess regulated returns.

Utilities over-investing in capital assets as a result of excess regulated returns is an age old concern in the sector (Averch and Johnson 1962). The resulting costs from "gold plating" are then passed on to consumers in the form of higher bills. Capital markets and the utility industry have undergone significant changes over the past 50 years since the early studies of utility capital ownership (Joskow 1972, 1974). In this paper we use new data to revisit these issues. We do so by exploring

1. North and Central American generation/storage are reported directly. Grid investments are only reported globally, so we assume the ratio of North and Central America to global is the same for generation/storage as for grid investments.

four main research questions. First, to what extent are utilities being allowed to earn excess returns on equity by their regulators? Second, what possible mechanisms can explain this divergence? Third, how have excess returns on equity affected utilities' capital investment decisions? Fourth, what impact has this had on the costs paid by consumers?

To answer our research questions, we use data on the utility rate cases of all major electricity and natural gas utilities in the United States spanning the past four decades (Regulatory Research Associates 2021). We combine this with a range of financial information on credit ratings, corporate borrowing, and market returns. To examine possible sources of over-investment in more detail we also incorporate data from annual regulatory filings on individual utility capital spending.

We start our analysis by estimating the size of the gap between the allowed rate of return on equity (RoE) that utilities earn and some measure of the cost of equity they face. A central challenge here, both for the regulator and for the econometrician, is estimating the cost of equity. We proceed by considering a range of approaches: simulating the actual cost of equity based on available measures of capital market returns, the capital asset pricing model (CAPM), and a comparison with regulatory decisions in the United Kingdom. None of these are perfect comparisons; but taken together, our various estimation approaches result in a consistent trend of excess rates of return. These results are necessarily uncertain, and depending on our chosen benchmark the premium ranges from 0.5 to 5.5 percentage points. Importantly though, even our most conservative benchmarks come in below the allowed rates of return on equity that regulators set today.

The existence of a persistent gap between the return on equity that utilities earn and some measure of the cost of capital they face could have a number of explanations. Recent work by Rode and Fischbeck (2019) ruled out a number of financial reasons we might see increasing RoE spreads, such as changes to utilities' debt/equity ratio, asset-specific risk, or the market's overall risk premium. This

leaves them looking for other explanations – for example, they highlight that regulators seem to follow some ad-hoc approaches that make them reluctant to set RoE below a nominal 10%. Azgad-Tromer and Talley (2017) also find that allowed rates of return diverge significantly from what would be expected by a standard CAPM approach. They point to a range of non-financial factors that may play an important role, including political goals and regulatory capture. Using data from a field experiment they show that providing finance training to regulatory staff does have a moderate effect on moving rates of return closer to standard asset pricing predictions.

These insights point to the broader challenges inherent in the ratemaking process. Regulators face an information asymmetry with the utilities they regulate when determining whether costs are prudent and necessary (Joskow, Bohi, and Gollop 1989). Utilities have a clear incentive to request rate increases when their costs go up, but do not have much incentive to request a rate decrease when their costs go down. If regulators are too deferential to the demands of the utilities they regulate – perhaps due to a insufficient expertise or regulatory capture (Dal Bó 2006) – we would expect rates to become detached from underlying costs.

We explore this issue by drawing on the literature on asymmetric price adjustments. It has been documented in various industries that positive shocks to firms' input costs can feed through into prices faster than negative shocks (Bacon 1991; Borenstein, Cameron, and Gilbert 1997; Peltzman 2000). This is the so-called “rockets and feathers” phenomenon. We test this hypothesis by estimating a vector error correction model for the relationship between utilities' return on equity and some benchmark measures of the cost of capital (e.g. US Treasury Bond yields). Here we do indeed find evidence of asymmetric adjustment. Increases to the benchmark cost of capital lead to rapid rises in utilities' return on equity, while decreases lead to less rapid falls. This is the first instance we are aware of where this phenomenon has been identified in regulatory decisions regarding financial measures such as

the cost of capital.

Excess regulated returns on equity will distort the incentives for utilities to invest in capital. To consider the change in the capital base, we turn to a regression analysis. Here we aim to identify how a larger RoE gap translates into over-investment in capital. Identification is challenging in this setting, so we again employ several different approaches, with different identifying assumptions. In addition to a basic within-utility (fixed effects) comparison, we examine variables that provide instruments for changes in utilities' RoE. For our preferred approach we draw on the intuition that after a rate case is decided, the utility's RoE is *fixed* at a particular nominal percentage for several years. The cost of capital in the rest of the economy, and therefore the cost of equity for the utility, will shift over time. We use these shifts in the timing and duration of rate cases as an instrument for changes in the RoE gap. We also examine a second instrument that exploits an apparent bias of regulators rounding the RoE values they approve, though ultimately this instrument is too weak for us to use.

Across the range of specifications used, we find a broadly consistent picture. In our preferred specification, we find that increasing the RoE gap by one percentage point leads to a five percent increase in the approved change in the rate base. We observe similar effects for the overall size of the approved rate base and find an even larger effect on capital intensity. We therefore provide new potential evidence for the Averch–Johnson effect in the utility sector.

Combining our measures of the RoE gap with the distortions to capital investment, we estimate the cost to consumers from excess rates of return reached around \$2–20 billion per year by 2020, with the majority of these costs coming from the electricity sector. These costs have important distributional effects, representing a sizeable transfer from consumers to investors. Increasing the price of electricity also has important implications for environmental policy and efforts to encourage electrification (Borenstein and Bushnell 2022).

2 Background

Electricity and natural gas utility companies are typically regulated by government utility commissions, which allow the companies a geographic monopoly and, in exchange, regulate the rates the companies charge. These utility commissions are state-level regulators in the US. They set consumer rates and other policies to allow investor-owned utilities (IOUs) a designated rate of return on their capital investments, as well as recovery of non-capital costs. This rate of return on capital is almost always set as a nominal percentage of the installed capital base. For instance, with an installed capital base worth \$10 billion and a rate of return of 8%, the utility is allowed to collect \$800 million per year from customers for debt service and to provide a return on equity to shareholders. State utility commissions typically update these nominal rates every 3–6 years.

Utilities own physical capital (power plants, gas pipelines, repair trucks, office buildings, etc.). The capital depreciates over time, and the set of all capital the utility owns is called the rate base (the base of capital that rates are calculated on). Properly accounting for depreciation is far from straightforward, but we will not focus on that challenge in this paper. This capital rate base has an opportunity cost of ownership: instead of buying capital, that money could have been invested elsewhere. IOUs fund their operations through issuing debt and equity, typically about 50%/50%. For this paper, we focus on common stocks (utilities issue preferred stocks as well, but those form a very small fraction of utility financing). The weighted average cost of capital is the weighted average of the cost of debt and the cost of equity.

Utilities are allowed to set rates to recover all of their costs, including this cost of capital. For some expenses, like fuel purchases, it's easy to calculate the companies' costs. For others, like capital, the state public utilities commissions are left trying to approximate the capital allocation at a cost that competitive capital markets would provide if the utility had been a competitive company rather than a regulated

monopoly. The types of capital utilities own, and their opportunities to add capital to their books, varies depending on market and regulatory conditions. Utilities that are vertically integrated might own a large majority of their own generation, the transmission lines, and the distribution infrastructure. Other utilities are “wires only,” buying power from independent power producers and transporting it over their lines. Natural gas utilities are typically “pipeline only” – the utility doesn’t own the gas well or processing plant, but may still have a substantial rate base.

In the 1960s and 70s, state public utilities commissions (PUCs) began adopting automatic fuel price adjustment clauses. Rather than opening a new rate case, utilities used an established formula to change their customer rates when fuel prices changed. The same automatic adjustment has generally not been the norm for capital costs, despite large swings in the nominal cost of capital over the past 50 years. A few jurisdictions have introduced limited automatic updating for the cost of equity, and we discuss those approaches in more detail in section 4.1, where we consider various approaches of estimating the RoE gap.

Regulators typically employ a “test year,” a single 12-month period in the past or future that will be used as the basis for the rate case analysis. Expenses and capital costs in this test year, except those with automatic update provisions, are the values used for the entire rate case.

The cost of debt financing is easier to estimate than the cost of equity financing. For historical debts, it is sufficient to use the cost of servicing those debts. For forward-looking debt issuance, the cost is estimated based on the quantity and cost of expected new debt. Issues remain for forward looking decisions – e.g. what will bond rates be in the future test year? – but these are *relatively* less severe. In our data, we see both the utilities’ requested and approved return on debt. It’s notable that the requested and approved rates are very close for debt, and much farther apart for equity.

The cost of equity financing is more challenging. Theoretically, it’s the return

shareholders require in order to invest in the utility. The Pennsylvania Public Utility Commission's ratemaking guide notes this difficulty (Cawley and Kennard 2018):

Regulators have always struggled with the best and most accurate method to use in applying the [*Federal Power Commission v. Hope Natural Gas Company* (1944)] criteria. There are two main conceptual approaches to determine a proper rate of return on common equity: "cost" and "the return necessary to attract capital." It must be stressed, however, that no single one can be considered the only correct method and that a proper return on equity can only be determined by the exercise of regulatory judgment that takes all evidence into consideration.

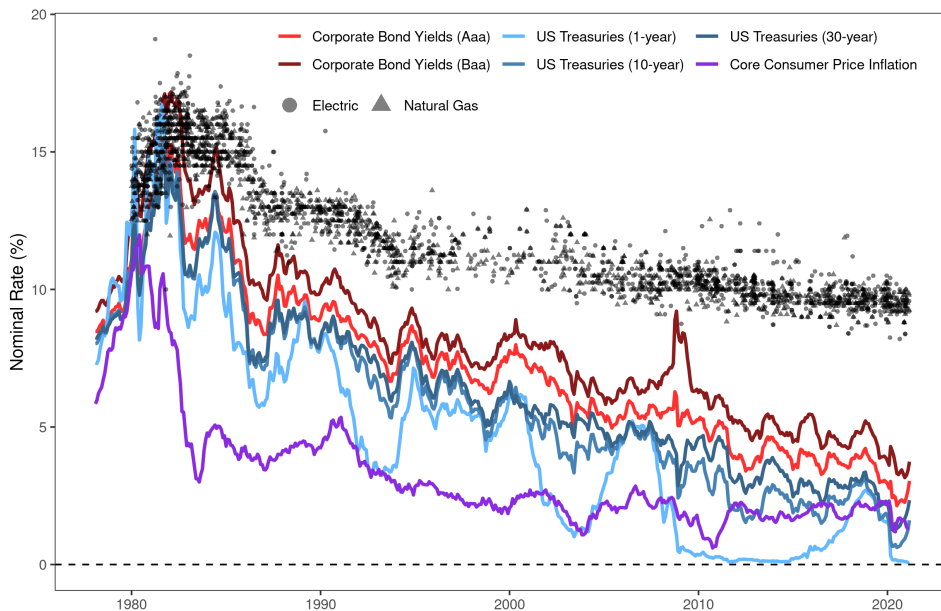
Unlike debt, where a large fraction of the cost is observable and tied to past issuance, the cost of equity is the ongoing, forward-looking cost of holding shareholders' money. Put differently, the RoE is applied to the entire rate base – unlike debt, there's typically no notion of paying a specific RoE for specific stock issues.

Regulators employ a mixture of models and subjective judgment. Typically, these approaches involve benchmarking against other US utilities (and often utilities in the same geographic region). There are advantages to narrow benchmarking, but when market conditions change and everyone is looking at their neighbors, rates will update very slowly.

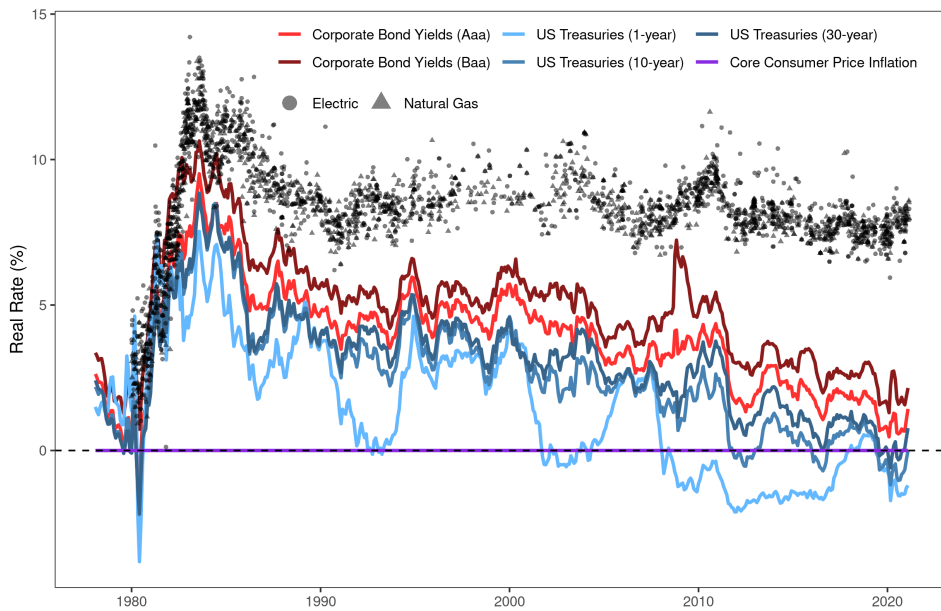
In Figure 1 we plot the approved return on equity over 40 years, with various risky and risk-free rates for comparison. The two panels show nominal and real rates.² Consistent with a story where regulators adjust slowly, approved RoE has fallen slightly (in both real and nominal terms), but much less than other costs of capital. This price stickiness by regulators also manifests in peculiarities of the rates regulators approve. For instance, Rode and Fischbeck (2019) note an apparent reluctance from to set RoE below a nominal 10%.

2. We calculate real values by subtracting the monthly core CPI.

Figure 1: Return on Equity and Financial Indicators



(a) Nominal



(b) Real

Notes: These figures show the approved return on equity for investor-owned US electric and natural gas utilities. Each dot represents the resolution of one rate case. Real rates are calculated by subtracting core CPI. Between March 2002 and March 2006 30-year Treasury rates are extrapolated from 1- and 10-year rates (using the predicted values from a regressing the 30-year rate on the 1- and 10-year rates).

SOURCES: Regulatory Research Associates (2021), Moody’s (2021a, 2021b), Board of Governors of the Federal Reserve System (2021a, 2021b, 2021c), and US Bureau of Labor Statistics (2021).

That paper, Rode and Fischbeck (2019), is the closest to ours in the existing literature. The authors use the same rate case dataset we do, and note a similar widening of the spread between the approved return on equity and 10-year Treasury rates. That paper, unlike ours, dives into the financial modeling, using the standard capital asset pricing model (CAPM) to examine potential causes of the increase the RoE spread. In contrast, we consider a wider range of financial benchmarks (beyond 10-year Treasuries) and ask more pointed questions about the implications of this growing RoE gap for utilities' investment decisions and costs for consumers.

Using CAPM, Rode and Fischbeck (2019) rule out a number of financial reasons we might see increasing RoE spreads. Possible reasons include utilities' debt/equity ratio, the asset-specific risk (CAPM's β), or the market's overall risk premium. They find that none of these possibilities are supported by the data. A pattern of steadily increasing debt/equity could explain an increasing gap, but debt/equity has fallen over time. Increasing asset-specific risk could explain an increasing gap, but asset risk has (largely) fallen over time. An increasing market risk premium could explain an increased spread between RoE and riskless Treasuries, but the market risk premium has fallen over time.

Prior research has highlighted the importance of macroeconomic changes, and that these often aren't fully included in utility commission ratemaking (Salvino 1967; Strunk 2014). Because rates of return are typically set in fixed nominal percentages, rapid changes in inflation can dramatically shift a utility's real return. This pattern is visible in figure 1 in the early 1980s. Until 2021, inflation has been lower and much more stable.

Many authors have written a great deal about modifying the current system of investor-owned utilities. Those range from questions of who pays for fixed grid costs to the role of government ownership or securitization (Borenstein, Fowlie, and Sallee 2021; Farrell 2019). For this project, we assume the current structure of investor-owned utilities, leaving aside other questions of how to set rates across

different groups of customers or who owns the capital.

3 Data

To answer our research questions, we use a database of resolved utility rate cases from 1980 to 2021 for every electricity and natural gas utility that either requested a nominal-dollar rate base change of \$5 million or had a rate base change of \$3 million authorized (Regulatory Research Associates 2021). Summary statistics on these rate cases can be seen in Table 1. Our primary variables of interest are the rates of return and the rate base.³ We also merge data on annual number of customers, quantity supplied and sales revenue for the electric utilities in our sample (US Energy Information Administration 2022).

We transform this panel of rate case events into an unbalanced utility-by-month panel, filling in the rate base and rate of return variables in between each rate case. There are some mergers and splits in our sample, but our SNL data provider lists each company by its present-day (2021) company name, or the company's last operating name before it ceased to exist. With this limitation in mind, we construct our panel by (1) not filling data for a company before its first rate case in a state, and (2) dropping companies five years after their last rate case. In contexts where a historical comparison is necessary, but the utility didn't exist in the benchmark year, we use average of utilities that did exist in that state, weighted by rate base size.

We match with data on S&P credit ratings, drawn from SNL's *Companies (Classic) Screener* (2021) and WRDS' *Compustat S&P legacy credit ratings* (2019). Most investor-owned utilities are subsidiaries of publicly traded firms. We use the former data to match as specifically as possible, first same-firm, then parent-firm, then same-ticker.

3. We focus here on proposed and approved rates of return. It is possible that utility's actual rate of return or return on equity might differ from the approved level. In general though, actual returns do tend to track allowed returns quite closely.

Table 1: Summary Statistics

Characteristic	N	Electric ¹	Natural Gas ¹
Rate of Return Proposed (%)	3,324	9.95 (1.98)	10.07 (2.07)
Rate of Return Approved (%)	2,813	9.59 (1.91)	9.53 (1.95)
Return on Equity Proposed (%)	3,350	13.22 (2.69)	13.06 (2.50)
Return on Equity Approved (%)	2,852	12.38 (2.40)	12.05 (2.24)
Return on Equity Proposed Spread (%)	3,350	6.72 (2.18)	6.95 (1.99)
Return on Equity Approved Spread (%)	2,852	5.62 (2.27)	5.68 (2.10)
Return on Debt Proposed (%)	3,247	7.48 (2.11)	7.47 (2.16)
Return on Debt Approved (%)	2,633	7.54 (2.06)	7.44 (2.16)
Equity Funding Proposed (%)	3,338	45 (7)	48 (7)
Equity Funding Approved (%)	2,726	44 (7)	47 (7)
Customers (thous)	1,177	693 (929)	NA (NA)
Quantity (TWh)	1,177	17 (21)	NA (NA)
Revenue (\$ mn)	1,177	1,469,519 (2,086,055)	NA (NA)
Rate Base Increase Proposed (\$ mn)	3,686	84 (132)	24 (41)
Rate Base Increase Approved (\$ mn)	3,672	40 (84)	12 (25)
Rate Base Proposed (\$ mn)	2,366	2,239 (3,152)	602 (888)
Rate Base Approved (\$ mn)	1,992	2,122 (2,991)	583 (843)
Case Length (yr)	3,364	3.11 (3.97)	3.01 (3.34)
Rate Case Duration (mo)	3,713	9.1 (5.1)	8.1 (4.3)

¹Mean (SD)

Notes: This table shows the rate case variables in our rate case dataset. Values in the Electric and Natural Gas columns are means, with standard deviations in parenthesis. Approved values are approved in the final determination, and are the values we use in our analysis. Some variables are missing, particularly the approved rate base. The RoE spread in this table is calculated relative to the 10-year Treasury rate.

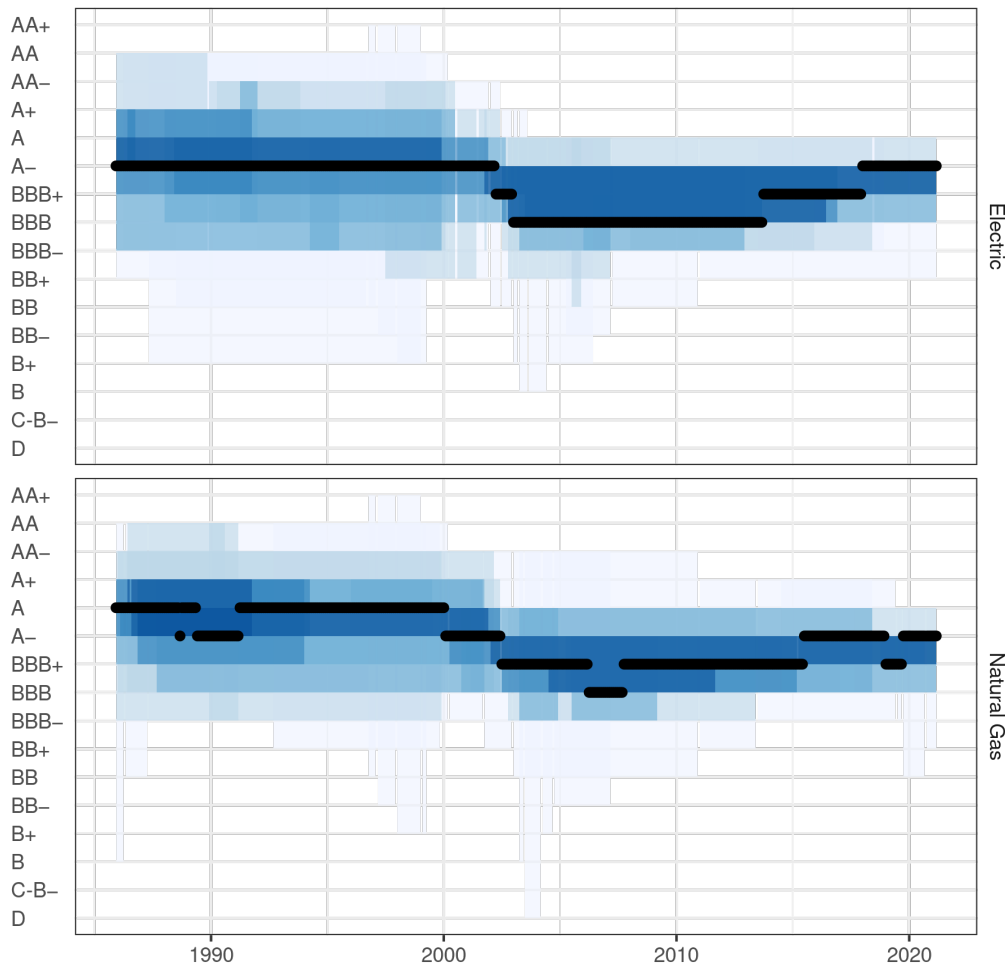
SOURCE: Regulatory Research Associates (2021), US Energy Information Administration (2022), and author calculations.

We match the latter data by ticker only. Then, for a relatively small number of firms, we fill forward.⁴ Between these two sources, we have ratings data available from December 1985 onward. Approximately 80% of our utility-month observations are matched to a rating. Match quality improves over time: approximately 89% of observations after 2000 are matched.

These credit ratings have changed little over 35 years. In figure 2 we plot the

4. When multiple different ratings are available, e.g. different ratings for subsidiaries trading under the same ticker, we take the median rating. We round down (to the lower rating) in the case of an even number of ratings.

Figure 2: Credit ratings have changed little in 35 years



NOTE: Black lines represent the median rating of the utilities active in a given month. We also show bands, in different shades of blue, that cover the 40–60 percentile, 30–70 percentile, 20–80 percentile, 10–90 percentile, and 2.5–97.5 percentile ranges. (Unlike later plots, these *are not* weighted by rate base.) Ratings from C to B– are collapsed to save space.

SOURCE: *Companies (Classic) Screener* (2021) and *Compustat S&P legacy credit ratings* (2019).

median (in black) and various percentile bands (in shades of blue) of the credit rating for utilities active in each month. We note that the median credit rating has seen modest movements up and down over the past decades. The distribution of ratings is somewhat more compressed in 2021 than in the 1990s. While credit ratings are imperfect, we would expect rating agencies to be aware of large changes in

riskiness.⁵ Instead, the median credit rating for electricity utilities is A–, as it was for all of the 1990s. The median credit rating for natural gas utilities is also A–, down from a historical value of A.

Beyond credit ratings, we also use various market rates pulled from FRED. These include 1-, 10-, and 30-year Treasury yields, the core consumer price index (CPI), bond yield indexes for corporate bonds rated by Moody’s as Aaa or Baa, as well as those rated by S&P as AAA, AA, A, BBB, BB, B, and CCC or lower.⁶

Matching these two datasets – rate cases and macroeconomic indicators – we construct the timeseries shown in Figure 1. A couple of features jump out, as we mentioned in the introduction. The gap between the approved return on equity and other measures of the cost of capital have increased substantially over time. At the same time, the return on equity has decreased over time, but much more slowly than other indicators. This is the key stylized fact that motivates our examination of the return on equity that utilities earn and the implications this may have for their incentives to invest in capital and the costs they pass on to consumers.

4 Empirical Strategy

4.1 The Return on Equity Gap

Knowing the size of the return on equity (RoE) gap is a challenge, and we take a couple of different approaches. In general, we are taking the difference between the return on equity observed in our data and some benchmark or hypothetical measure. When these are nominal rates, such as corporate bonds or US Treasuries,

5. For utility risk to drive up the firms’ cost of equity but not affect credit ratings, one would need to tell a very unusual story about information transmission or the credit rating process.

6. Board of Governors of the Federal Reserve System (2021a, 2021b, 2021c), US Bureau of Labor Statistics (2021), Moody’s (2021a, 2021b), and Ice Data Indices, LLC (2021b, 2021a, 2021f, 2021d, 2021c, 2021g, 2021e).

we compare against nominal RoE. None are perfect, but collectively, they shed light on the question.

4.1.1 Benchmarking to a Baseline Spread

We first consider a benchmark index of corporate bond yields. The goal of this benchmark is to answer the question: What would the RoE be today if the average spread against corporate bond yields had not changed since some baseline date? Here we compare all utilities to the corporate bond index that is closest to that utility's own, contemporaneous debt rating.⁷ To calculate the RoE gap we first find the spread between the approved return on equity and the bond index rate for each utility in each state in a baseline period. We then take this spread during the baseline period and apply it to the future evolution of the bond index rate to get an estimate of the baseline RoE. The RoE gap is the difference between a given utility's allowed return on equity at some point in time and this baseline RoE.

The choice of the baseline period influences the gap. Throughout our analysis we use January 1995 as the baseline period. The date chosen determines where the gap between utilities' RoE and baseline RoE is zero. Changing the baseline date will shift the overall magnitude of the gap. As long as the baseline date isn't in the middle of a recession, our qualitative results don't depend strongly on the choice. Stated differently, the baseline year determines when the average gap is zero, but this is a constant shift that does not affect the overall trend. While January 1995 is not special, we note that picking a much more recent baseline would imply that utilities were substantially and continuously under-compensated for their cost of equity for many years of our early sample.

7. We also examined a comparison against a single Moody's Baa corporate bond index. Moody's Baa is approximately equivalent to S&P's BBB, a rating equal to or slightly below most of the utilities in our data (see figure 2). This avoids issues where utilities' bond ratings may be endogenous to their rate case outcomes. Using a single index also faces fewer data quality challenges. The findings using the single Moody's Baa bond index are broadly equivalent to those using a same rated bond index and our later approach using US Treasuries.

Our second measure adopts a similar approach to the first but benchmarks against US Treasuries. The idea here is to ask: what would the RoE be today if the average spread against US Treasuries had not changed since some baseline date? This measure is calculated in exactly the same way as our first approach except the spread is measured against the 10-year Treasury bond yield in the baseline period, rather than the relevant corporate bond index.

Our third measure continues with using US Treasuries but does so using an RoE update rule. This rule is consistent with the approach taken by the Vermont PUC, and similar approaches have been used in the past in California and Canada. Relative to some baseline period the automatic update rule adjusts the RoE at half the rate that the yield on the 10-year US Treasury bond changes over that time period.⁸ The Vermont PUC uses 10-year US Treasuries and set the baseline period as December 2018, for their plan published in June 2019. (*Green Mountain Power: Multi-Year Regulation Plan 2020–2022* 2020). In our case we also use 10-year Treasuries and set the baseline to January 1995. We simulate the gap between approved RoE and what RoE would have been if every state’s utilities commission followed this rule from 1995 onward.⁹

4.1.2 Benchmarking to the Capital Asset Pricing Model

Our fourth and fifth measures draw directly on the capital asset pricing model (CAPM) approach. The CAPM approach is widely used by regulators to support their decisions on utility equity returns, alongside other methods such as discounted cash flow. In principle the CAPM provides an objective way to quantify the expected returns for an asset given the risk of that asset and the returns available in the market over-and-above some risk-free rate. In practice its application remains open

8. Define RoE' as the baseline RoE, B' as the baseline 10-year Treasury bond yield, and B_t as the 10-year Treasury bond yield in year t . RoE in year t is then: $RoE_t = RoE' + (0.5 \times (B_t - B'))$

9. Pre-1995 values are not particularly meaningful, but we can calculate them with the same formula.

to a significant degree of subjective interpretation, in large part through the choice of values for its key parameters. As such, even CAPM calculations can form part of the negotiation process between regulators and utilities, with the latter having a clear incentive to lobby for assumptions that result in the CAPM producing higher estimates of the cost of equity.

We calculate predictions of the equity returns for each utility using the standard CAPM formula.

$$RoE = R_f + (\beta \times MRP)$$

Here R_f is the risk-free rate, MRP is the market risk premium and β is the equity β for the asset in question – namely each utility in our sample. Our assumed values for each of these parameters are broadly in line with published data (Damodaran 2022a) and values used by regulators in the UK, Europe, Australia and at the federal level for the US (Australian Energy Regulator 2020; Economic Consulting Associates 2020; UK Regulatory Network 2020). The parameter values used by state PUCs in the US tend to fall at the higher end of the range we examine. We calculate the RoE gap by taking the contemporaneous difference between our CAPM estimate of RoE and each utility’s allowed RoE.

Risk-free rate

The risk-free rate, R_f , is intended to capture the base level of returns from an effectively zero risk investment. Yields on government bonds are the common source for this information, although practitioners can differ over the choice of maturity (e.g. 10-year or 30-year) and the use of forecast future yields instead of past or current rates. These decisions can significantly affect the final cost of equity.¹⁰ We use the contemporaneous yield on US Treasury Bonds for our measure of the risk-free rate. In our “low” case we use 10-year Treasuries and in our “high” case

10. For instance, in January 2018 the current yield on 10-year US Treasury Bonds was 2.58%, the average yield from the past 2 years was 2.09%, and the forecast yield from Wolters Klewler (2022) for the next 2 years was 2.97%.

we use 30-year Treasuries.

Market risk premium

The market risk premium, *MRP*, captures the difference between the expected equity market rate of return and the risk-free rate.¹¹ This is generally calculated by taking the average of the difference in returns for some market-wide stock index and the returns for the risk-free rate. While this appears relatively straightforward, the final value can vary significantly depending on numerous factors. These can include: the choice of stock market index (e.g. S&P 500, Dow Jones, Wilshire 5000 etc.); the choice of averaging period (e.g. previous 10, 20, 50 years etc.); the return frequency (e.g. monthly, quarterly or annual returns), and the method of averaging (arithmetic, geometric). These decisions can significantly affect the final cost of equity.¹² To capture the uncertainty in the market risk premium, in our “low” case we assume a constant *MRP* of 6 percent and in our “high” case we assume a constant *MRP* of 8 percent.

β

A firm’s equity *β*, is a measure of systematic risk and thus captures the extent to which the returns of the firm in question move in line with overall market returns.¹³ Regulated firms like gas and electricity utilities are generally viewed as low risk, exhibiting lower levels of volatility than the market as a whole. The calculation of *β* is subject to many of the same uncertainties mentioned above, including: the choice of stock market index; the choice of calculation period, and the return frequency.

It is also common to take *β* estimates from existing data vendors such as Merrill Lynch, Value Line and Bloomberg. The choice of *β* depends on the bundle of comparable firms used and how they are averaged. Furthermore, these vendors

11. $MRP = R_m - R_f$, where R_m is the market return and R_f is the risk-free return.

12. For instance, in January 2018 using annual returns for the S&P 500 compared to the 10-year US Treasury Bond and taking the arithmetic average over the past 5, 25 and 75 years produces market risk premiums of 14.8%, 5.2% and 7.3% respectively (Damodaran 2022b).

13. *β* is calculated by estimating the covariance of the returns for the firm in question, R_i , and the market returns, R_m , and then dividing by the variance of the market returns: $\beta = \frac{Cov(R_i, R_m)}{Var(R_m)}$

generally publish β values that incorporate the so-called Blume adjustment to deal with concerns about mean reversion.¹⁴ Because utilities generally have β s below one the adjustment serves to increase β and thus increase the estimated cost of equity produced by the CAPM calculation. Therefore, while the adjustment is plausible for many non-regulated firms, some authors have questioned its applicability to regulated firms like utilities (Michelfelder and Theodossiou 2013).

Lastly, the decision on setting β is complicated by the fact that betas calculated using observed stock returns are dependent on each firm's debt holdings and tax rate, which may differ from the particular utility being studied. To deal with this, an unlevered β can be estimated and then the corresponding levered β can be calculated for a specific debt-to-equity ratio, D/E , and tax rate, τ .¹⁵ Here we take τ to be the federal marginal corporate tax rate and we can directly observe the debt-to-equity ratio, D/E , in our data.

To capture the uncertainty in β , in our "low" case we assume a constant $\beta_{\text{unlevered}}$ of 0.3 and in our "high" case we assume a constant $\beta_{\text{unlevered}}$ of 0.5. This generally produces levered β s ranging from 0.6 to 0.9.

4.1.3 Benchmarking to UK utilities

Finally, our sixth measure involves benchmarking against allowed returns on equity for gas and electric utilities in the United Kingdom. Here we consider the contemporaneous gap in nominal allowed RoE between the US and UK. Of course many things are different between these countries, there's no particular reason to think the UK regulator is setting the correct RoE, and it's not fair to say all US utilities should adopt UK rate making, but we think this benchmark provides an interesting comparison. The data on UK RoE are taken from various regulatory reports published by the Office of Gas and Electricity Markets (Ofgem). We were

14. The Blume Adjustment equation is: $\beta_{\text{adjusted}} = 0.333(1) + 0.667(\beta)$

15. The Hamada equation relates levered to unlevered β as follows: $\beta = \beta_{\text{unlevered}} \times \left[1 + (1 - \tau) \frac{D}{E} \right]$

able to find information on allowed rates of return dating back to 1996. The relevant disaggregation into return on debt and return on equity was more readily available for electric utilities over this entire time period. For natural gas utilities we have this information from 2013 onwards. Importantly, UK rates are set in real terms and so we converted to nominal terms using the inflation indexes cited by the UK regulator.

4.2 Asymmetric Adjustment

The existence of a persistent gap between the return on equity that utilities earn and various measures of the cost of capital they face could have a number of explanations. One possibility is that utilities are able to present arguments that regulators find more compelling or urgent than the arguments from consumer advocates. One indication of this pattern is strongly asymmetric adjustments to increases or decreases in underlying costs. The asymmetric adjustment process we estimate will mechanically find that in the long run, cost increases or decreases have the same magnitude, so in this way, they do not explain very persistent gaps, but they do provide some insight to how the regulatory process plays out.

It has been documented in many industries that positive shocks to firms' input costs can feed through into prices faster than negative shocks. This pattern has been most extensively studied in the gasoline sector – see Kristoufek and Lunackova (2015) and Perdiguero-García (2013) for reviews of the literature. Building on early work by Bacon (1991) and Borenstein, Cameron, and Gilbert (1997), there are now a wealth of studies examining how positive shocks to crude oil prices lead to faster increases in retail gasoline prices than negative shocks to crude oil prices lead to decreases in retail gasoline prices. This is the so-called “rockets and feathers” phenomenon. A range of explanations for this have been explored, most notably tacit collusion and market power or the dynamics of consumer search.

In our setting we do observe that a change in some benchmark index (e.g. US Treasuries or corporate bonds) appears to feed through into the return on equity for utilities. This can be seen most clearly in Figure 1 where relatively short-run spikes in US Treasuries or corporate bond yields correlate strongly with corresponding spikes in allowed returns on equity. We have also already discussed the sluggish pace at which returns on equity have come down over the longer-term when compared to various benchmark measures of the cost of capital. It therefore seems plausible to think that this relationship may function differently depending on whether it is a positive or a negative shock. To test this we follow the literature on asymmetric price adjustments and estimate a vector error correction model.

Many studies of asymmetric price adjustments work with single time series of their variables of interest. In our case we have a panel of rates of return that are divided up across utilities and states. In our main specification we conduct our analysis at the state level as this allows us to have a usefully balanced panel, while still maintaining the resolution of where decisions are being made: state public utilities commissions. To do this we collapse our company-state panel to a state panel. We do this by averaging the returns on equity from any rate cases decided in a given state in a given month, and then filling forward for any months where there are no new rate cases decided in a state. We then include state fixed effects throughout our analysis, and estimate a set of adjustment coefficients common to all states. As a robustness check we also examine versions of the analysis at the original company-state panel level and find essentially the same core findings. See the appendix for further details.

To estimate the vector error correction model we first estimate the long-run relationship between the return on equity for unit i in period t ($RoE_{i,t}$) and a lagged benchmark index of the cost of capital ($Index_{i,t-1}$).¹⁶ We also include unit fixed

16. We also conduct unit root tests. Because of the panel setting we use a panel unit root test developed by Maddala and Wu (1999). Our tests fail to reject non-stationarity in levels and reject non-stationarity in first differences.

effects, σ_i , which in our preferred specification are at the state level.¹⁷

$$RoE_{i,t} = \phi Index_{i,t-1} + \sigma_i + \varepsilon_{i,t}$$

In the second step we then run a regression of the change in RoE on three sets of covariates: (1) m lags of the past changes in RoE, (2) n lags of the past change in the index, and (3) the residuals from the long-run relationship, $\hat{\varepsilon}_{i,t}$, lagged from the previous period. To examine potential asymmetric adjustment, each of these three sets of covariates is split into positive and negative components to allow the coefficients for positive changes to differ from the coefficients for negative changes. Once again we include unit fixed effects, σ_i .

$$\begin{aligned} \Delta RoE_{i,t} = & \sum_{j=1}^m \gamma_j^+ \Delta RoE_{i,t-j}^+ + \sum_{j=1}^m \gamma_j^- \Delta RoE_{i,t-j}^- \\ & \sum_{j=1}^n \beta_j^+ \Delta Index_{i,t-j}^+ + \sum_{j=1}^n \beta_j^- \Delta Index_{i,t-j}^- \\ & \theta^+ \hat{\varepsilon}_{i,t-1}^+ + \theta^- \hat{\varepsilon}_{i,t-1}^- + \sigma_i + v_{i,t} \end{aligned}$$

Statistical tests on these coefficients can reveal whether positive or negative shocks to the underlying index produce a more rapid adjustment in the dependent variable. However, a more intuitive way of presenting the results is by plotting a cumulative adjustment function. This shows how rates of return respond to a shock to the underlying benchmark index. To do this we rely on the methodology set out by Borenstein, Cameron, and Gilbert (1997) and use bootstrapping to derive 95% confidence intervals. We block bootstrap at the state level, using 1000 draws.

17. It is notable that the coefficient estimates we find for ϕ are generally close to the adjustment factors used in the automatic update rules employed by the Vermont PUC and California PUC (discussed earlier). This suggests these rules appear to largely formalize existing trends.

4.3 Rate Base Impacts

Next, we turn to the rate base the utilities own. To the extent a utility’s approved RoE is higher than their actual cost of equity, they will have a too-strong incentive to have capital on their books (the Averch–Johnson effect). In this section, we investigate the change in rate base utilities request and receive. The change is a flow variable while the total rate base is the stock of all previous rate base changes. It includes both new investment and depreciation of existing assets. We primarily focus on the effect on the *change* in the rate base, rather than the entire rate base, because the former is actively decided in each rate case and the data is more complete. However, we observe similar effect sizes when looking at the entire rate base. We consider both the requested change and the approved change, though the approved value is our preferred specification. We estimate $\hat{\alpha}$ from the following, where we regress the rate base increase (RBI) on the estimated RoE gap, various controls, and fixed effects.

$$\log(RBI_{i,t}) = \alpha RoE_{i,t}^{gap} + \delta X_{i,t} + \sigma_i + \lambda_t + \epsilon_{i,t} \quad (1)$$

where an observation is a utility rate case for utility i in year-of-sample t . The dependent variable, $RBI_{i,t}$, is the increase in the rate base, and we take logs.¹⁸ The ideal independent variable would be the gap between the allowed RoE and the utilities’ costs of equity. Because the true value is unobservable, we use $RoE_{i,t}^{gap}$, the gap between the allowed RoE and the baseline RoE. Unlike section 4.1, for this analysis we care about differences in the gap between utilities or over time, but do not care about the overall magnitude of the gap. For ease of implementation, we begin by considering the gap as the spread between the approved rate of return and the 10-year Treasury bond yield. We do not expect the actual cost of equity to be equal to the 10-year Treasury yield, but our fixed effects account for any constant

¹⁸. Cases where the rate base remains unchanged or shrinks are uncommon, representing around 12% of observations. We drop these cases, but note that we get qualitatively similar results when we do not drop these rows and estimate the regression in levels.

differences. We calculate $RoE_{i,t}^{gap}$ by taking the difference between the allowed RoE and the average of the time-varying baseline RoE, over the D years the rate case is in place.

$$RoE_{i,t}^{gap} = RoE_{i,t}^{allowed} - \frac{1}{D} \sum_t^{t+D} RoE_{i,t}^{benchmark} \quad (2)$$

4.3.1 Fixed Effects Specifications

Our goal is to make causal claims about $\hat{\alpha}$, so we are concerned about omitted variables that are correlated with both the estimated RoE gap and the change in rate base. We begin with a fixed-effects version of the analysis. Our preferred version includes time fixed effects, λ_t , at the year-of-sample level and the unit fixed effects, σ_i , are at the service type, utility company and state level. Utilities that operate in multiple states still file rate cases with each state’s utility regulator. Our state fixed effects account for constant differences across states, including any persistent differences in the regulator. Here, the identifying assumption is that after controlling for state and year effects, there are no omitted variables that would be correlated with both our estimate of the RoE gap and the utility’s change in rate base. The identifying variation is the differences in the RoE gap within the range of rate case decisions for a given utility, relative to the annual average across all utilities.

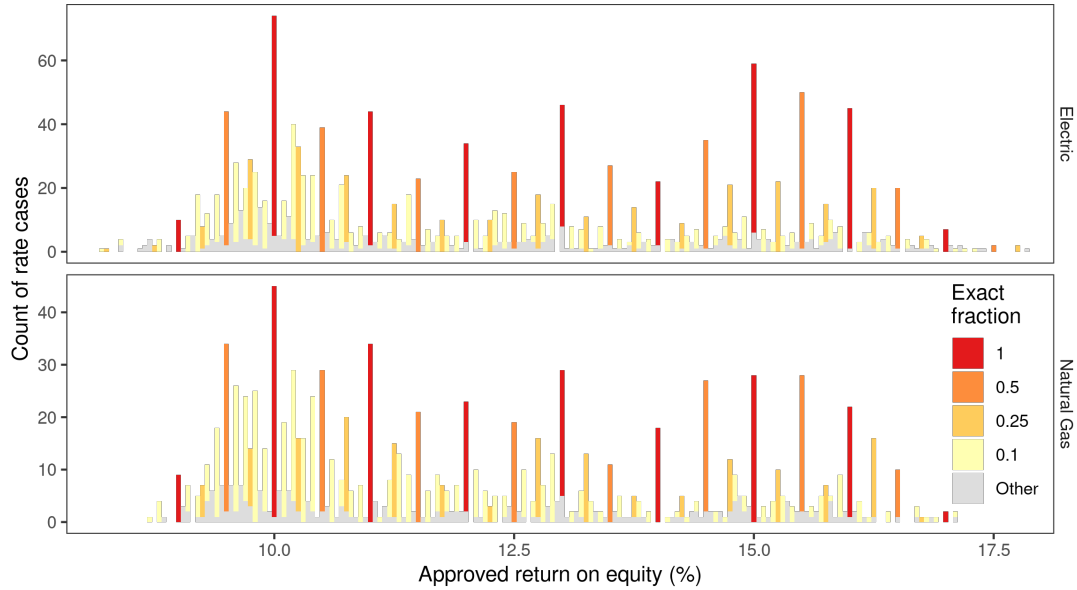
The fixed effects handle some of the most critical threats to identification, such as macroeconomic trends, technology-driven shifts in electrical consumption, or static differences in state PUC behavior. Of course, potential threats to causal identification remain. One possibility is omitted variables – perhaps regulators in some states change their posture toward utilities over time, in a way that is correlated with both the RoE and the change in rate base. Another possibility is reverse causation – perhaps the regulator pushes for more capital investment (e.g. aiming to increase local employment) and the utility, facing increasing marginal costs of capital, needs a higher RoE.

4.3.2 Instrumental Variables Specifications

To try and further deal with concerns regarding identification, we examine an instrumental variables approach based on the timing and duration of rate cases. The average utility has ten rate cases over the course of our sample period and the average rate case is in effect for about three years. Our IV analysis takes the idea that market measures of the cost of capital move around in ways that aren't always easy for the regulator to anticipate. For instance, if the allowed return on equity is set in year 0 and financial conditions change in year 2 such that the RoE gap increases, then we would expect the utility to increase their capital investments in ways that are unrelated to other aspects of the capital investment decision. For this instrument to work, it needs to be the case that these movements in capital markets are conditionally independent of decisions that the utility is making, except via this return on equity channel. We control for common year fixed effects, and then the variation that drives our estimate is that different utilities will come up for their rate case at different points in time.

A second IV strategy we consider is to exploit an apparent bias toward round numbers, where regulators tend to approve RoE values at integers, halves, quarters, and tenths of percentage points. Unfortunately this instrument does not produce a strong first-stage and so is not a core focus of our subsequent analysis. Even so, the existence of such an arbitrary phenomenon in our setting is relevant, and can be seen clearly in figure 3. Small deviations created by rounding have large implications for utility revenues and customer payments. If for instance, a PUC rounds in a way that changes the allowed RoE by 10 basis points (0.1%), the allowed revenue on the existing rate base for the average electric utility in 2019 would change by \$114 million (the median is lower, at \$52 million).

Figure 3: Return on equity is often approved at round numbers



Colors highlight values of the nominal approved RoE that fall exactly on round numbers. More precisely, values in red are integers. Values in dark orange are integers plus 50 basis points (bp). Lighter orange are integers plus 25 or 75 bp. Yellow are integers plus one of {10, 20, 30, 40, 60, 70, 80, 90} bp. All other values are gray. Histogram bin widths are 5 bp. Non-round values remain gray if they fall in the same histogram bin as a round value. In that case, the bars are stacked.

SOURCE: Regulatory Research Associates (2021).

5 Results

5.1 Return on Equity Gap Results

Beginning with the RoE gap analysis from section 4.1, we find there has been an increase in the gap between utilities' allowed return on equity and various measures of their estimated cost of capital. Our results on the RoE gap show this has increased over time and are summarized in Table 2. To explain these large gaps, one of three things must be true: (1) historically, utilities were under-compensated for their capital costs, (2) today, utilities are over-compensated for their capital costs, or (3) the structure of utilities' capital costs – and their relationship with other capital markets – has changed dramatically over time.

When benchmarking against changes in market measures of the cost of capital (e.g. 10-year US Treasury bonds or same-rated corporate bonds) the RoE gap is

Table 2: Return on Equity gap, by different benchmarks (percentage points)

A: Electric	Corp	UST	UST auto	CAPM low	CAPM high	UK
1985	0.693	0.415	1.39	1.50	-2.84	
1990	-0.238	0.459	0.412	1.36	-3.09	
1995	0.788	1.09	0.139	2.09	-2.49	
2000	0.666	1.41	0.153	2.42	-1.76	2.79
2005	2.99	2.84	0.722	3.91	-0.552	1.93
2010	3.04	3.21	0.517	4.50	-0.448	-0.585
2015	3.57	3.64	0.416	4.99	0.446	2.77
2020	4.25	4.49	0.706	5.60	0.786	1.88
B: Natural Gas						
1985	1.14	0.798	1.78	1.68	-2.35	
1990	-0.0272	0.848	0.819	1.59	-2.50	
1995	0.873	1.18	0.238	1.99	-2.27	
2000	0.757	1.35	0.0924	2.18	-1.65	
2005	2.85	2.70	0.623	3.54	-0.635	
2010	3.25	3.35	0.707	4.31	-0.516	
2015	3.98	4.01	0.850	5.04	0.646	2.43
2020	4.58	4.86	1.09	5.67	1.06	1.55

Note: Gap percentage figures are a weighted average across utilities, weighted by rate base. “Corp” compares to same-rated corporate bonds. “UST” compares to 10-year US Treasuries. “UST auto” compares to 10-year Treasuries with 50% passthrough. For cases where it’s relevant (Corp and USTs) the benchmark date is January 1995. See text for details of each benchmark calculation.

around 4–4.5 percentage points.

It is not clear that the cost of equity should necessarily move in a one-for-one manner with these two measures of bond yields. Using an automatic update rule that adjusts at *half* the rate of changes in bond yields, produces an RoE gap by 2020 of around 0.5–1 percentage points. Whether adjusting at 50% of the change in bond yields is the correct approach is unclear. For instance, Canada has used a 75% adjustment ratio in the past. What is clear is that even using this lower range, we still see a divergence between allowed equity returns today and changes in the benchmark cost of capital.

Benchmarking against changes in bond yields relative to some baseline year is necessarily quite simplistic. Our two implementations of the CAPM approach allow us to see how a standard method used in the industry performs. Our “low” version of the CAPM uses assumptions for the risk-free rate, β and market risk premium that are on the lower end of what has been historically used in the industry. This is particularly true when looking at the practices of US regulators, which appear to utilize higher values than regulators in the UK, Europe and Australia. The result is an RoE gap by 2020 of around 5.5 percentage points.¹⁹ Looking back to the 1980s and 1990s though, the RoE gap becomes much smaller, with predictions of the cost of equity from our “low” CAPM version only showing a 2 percentage point gap against allowed rates of return.

Our “high” version of the CAPM uses assumptions for the risk-free rate, β and market risk premium that are on the higher end of what has been historically used in the industry. This produces an RoE gap by 2020 of around 1 percentage points. Allowed rates of return are therefore still above the predictions from our “high” CAPM case, although much more closely aligned with the current approach of US state PUCs. Notably though, projecting this same approach back in time appears

¹⁹. At this point average allowed RoE for US utilities is around 10%, compared with a CAPM prediction for the cost of equity of 4–5%.

to suggest that past allowed returns in the 1980s and 1990s were well below the estimated cost of equity. This seems implausible given the large capital expenditures the industry has continued to engage in over the last four decades.

Lastly, when comparing against UK utilities we see a fairly consistent premium, with an RoE gap in 2020 of around 2 percentage points. A similar premium would likely emerge when comparing to utilities in other countries in Europe which have tended to approve similar rates of return to those we find for the UK. There are good reasons to think that US state PUCs should not simply adopt UK rates of return – there are many differences between the utility sector and investor environment in the US and UK. Even so, it is striking that other countries are able to attract sufficient investment in their gas and electric utilities while guaranteeing lower regulated returns than are available in the US context.

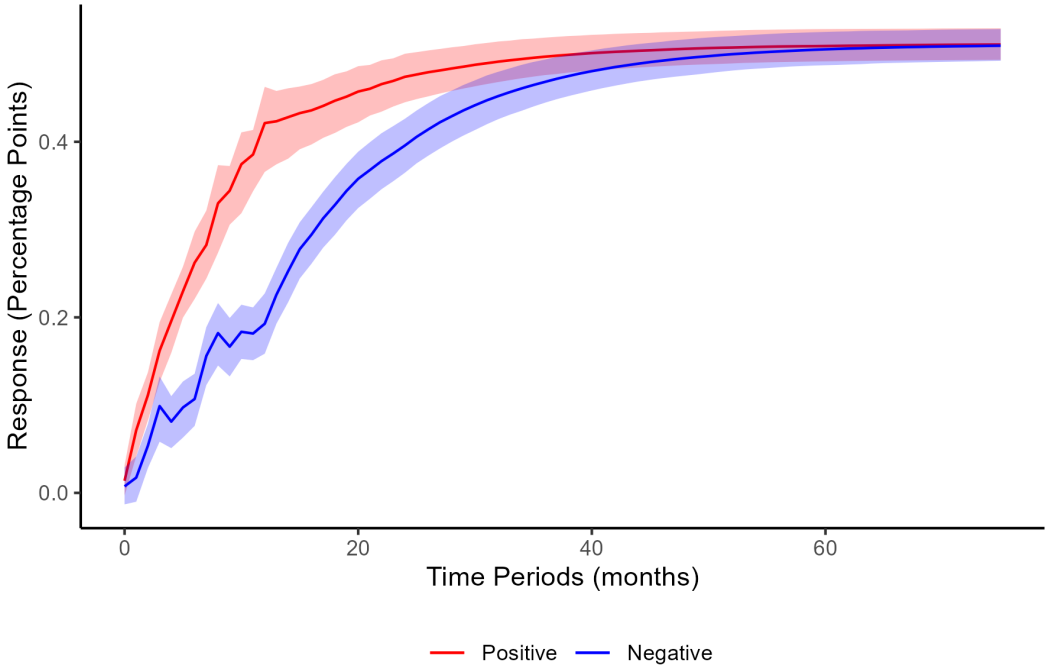
5.2 Asymmetric Adjustment Results

One pattern we document in allowed returns is an asymmetric adjustment of allowed return on equity to underlying benchmark rates of return. Figure 6 provides the results of this analysis.

Here we simulate the impact on the utility rate of return from a one percentage point shock to the underlying benchmark index. In this case we conduct our analysis at the state level using approved rates of return and nominal 10-year US Treasuries as our benchmark rate. The change in the nominal rate of return on equity is then plotted over the subsequent six years.

As can be seen in Figure 6, we do find evidence of asymmetric adjustment. Rates of return adjust faster to a positive shock (red line) than to a negative shock (blue line). In the long-run both converge to a roughly 50% pass-through rate, as noted previously. This pattern is consistent with the incentives firms face to increase their allowed return on equity where the opportunity arises (i.e. when benchmark indices

Figure 4: Asymmetric Cumulative Adjustment Path following Shock to Benchmark Index



Lines represents the cumulative adjustment path following a one percentage point change to the benchmark index. Red is for an increase in the index and blue is for a decrease. 95% confidence intervals are estimated via bootstrapping. The plotted results use approved rates of return and a benchmark index of 10-year US Treasuries. Analysis is conducted at the state level. See calculation details in section 4.2.

rise), and avoid decreases to their allowed return on equity when it may be justified (i.e. when benchmark indices fall). Further asymmetric adjustment results can be found in the appendix, including comparisons of the asymmetry in proposed versus approved rates and of different levels of panel aggregation.

5.3 Rate Base Impact Results

Table 3: Relationship Between Approved Rate of Return and Approved Rate Base Increase

Model:	Fixed effects specs.			IV
	(1)	(2)	(3)	(4)
Variables				
RoE gap (%)	0.0551*** (0.0200)	0.0752*** (0.0240)	0.0867*** (0.0225)	0.0523** (0.0252)
Fixed-effects				
Service Type	Yes	Yes	Yes	Yes
State	Yes	Yes	Yes	Yes
Year		Yes	Yes	Yes
Company			Yes	Yes
Fit statistics				
Observations	2,491	2,491	2,491	2,491
R ²	0.33	0.36	0.69	0.69
Within R ²	0.01	0.004	0.01	0.009
Wald (1st stage), RoE gap (%)				69.1
Dep. var. mean	38.63	38.63	38.63	38.63

Clustered (Year & Company) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

NOTES: The table uses approved RoE. The dependent variable is log of the utility's rate base increase in millions of \$. Columns 1–3 show varying levels of fixed effects. Column 4 is the IV discussed in section 4.3. Our preferred specification is column 4 of table 3. First-stage *F*-statistic is Kleibergen–Paap robust Wald test.

We next consider how the RoE gap affects capital ownership in Table 3. Across our fixed effects specifications (columns 1–3) we find broadly consistent results. A 1 percentage point increase in the approved RoE gap leads to a 5.6–8.7% higher

increase in approved rate base. Our IV specification using rate case timing (column 4) has a strong first stage (Kleibergen–Paap F -stat of 69).²⁰ Using this approach we find an effect of 5.3% which broadly aligns with our fixed effects estimates. This is our preferred specification.

Table 4: Relationship Between Approved Rate of Return and Approved Total Rate Base (both absolute and per MWh; electric utilities only)

Model:	Total, FE (1)	Total, IV (2)	per MWh, FE (3)	per MWh, IV (4)
Variables				
RoE gap (%)	0.0548*** (0.0199)	0.0774*** (0.0275)	0.1202** (0.0571)	0.1204 (0.0751)
Fixed-effects				
Service Type	Yes	Yes	Yes	Yes
State	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Company	Yes	Yes	Yes	Yes
Fit statistics				
Observations	1,878	1,878	706	706
R ²	0.85	0.85	0.84	0.84
Within R ²	0.006	0.005	0.02	0.02
Wald (1st stage), RoE gap (%)		24.0		21.2
Dep. var. mean	1,521.9	1,521.9	379.3	379.3

Clustered (Year & Company) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

NOTES: The table uses approved RoE. Dependent variables are the total rate base in millions of \$ (Columns 1–2) and the rate base per quantity delivered in \$ per MWh (Columns 3–4). The FE results correspond to the specification used for column 3 in table 3 and the IV results correspond to the specification used for column 4 in table 3. First-stage F -statistic is Kleibergen–Paap robust Wald test.

In addition to looking at the increase in the rate base, for electric utilities, we also look at the total rate base and the total rate base per megawatt-hour (MWh) delivered. These results are in Table 4. We find similar effects for the total rate base. The effects for total rate base per MWh are potentially even larger, indicating a

²⁰. Our IV specification using rounding has a weak first stage (Kleibergen–Paap F -stat of 2.1) and so is not presented here.

pronounced increase in capital intensity. However, in both cases these findings are less precisely estimated, in part due to data quality challenges.²¹ Overall we take these results as providing evidence that higher equity returns do lead utilities to increase their capital holdings.²²

As a caveat, we note that an utility can increase their capital holdings in two distinct ways. One option is to reshuffle capital ownership, either between subsidiaries or across firms, so that the utility ends up with more capital on its books, but the total amount of capital is unchanged. The second option is to actually buy and own more capital, increasing the total amount of capital that exists in the state's utility sector. We do not differentiate between these two cases. Because we don't differentiate, we consider excess payments by utility customers, but we remain agnostic about the socially optimal level of capital investment.

5.4 Excess Consumer Cost Results

Table 5 summarizes our estimates of the excess cost for utility customers. Here we multiply the rate base by the RoE gap to come up with a measure of the additional payments made to cover the premium in equity returns. We present results that take the observed rate base as a given – the “fixed” rows – and also present results that include the rate base with the additional increases estimated above – the “adjust” rows. The increment from the “fixed” to “adjust” rows is meaningful (billions of dollars in many specifications), but smaller than the gap documented in the “fixed” rows.

To ensure these excess costs are calculated for all utilities in our sample, we must remedy the missing rate base data for some utilities, particularly in the earlier

21. The total rate base data is less complete. Also when calculating on a per MWh basis, we are only able to merge quantity data for a subset of years for electric utilities.

22. The equivalent results from looking at the proposed changes to the rate base can be found in the appendix.

Table 5: Excess costs, by different benchmarks (2019\$ billion per year)

A: Electric		Corp	UST	UST auto	CAPM low	CAPM high	UK
Fixed	2000	1.03	2.37	0.250	4.21	-2.74	4.71
	2020	8.58	9.40	1.43	11.8	1.83	3.90
Adjust	2000	1.06	2.55	0.252	4.76	-2.48	5.42
	2020	10.5	11.7	1.49	15.4	1.91	4.29
B: Natural Gas							
Fixed	2000	0.165	0.371	0.0226	0.620	-0.415	
	2020	2.44	2.76	0.624	3.24	0.655	0.886
Adjust	2000	0.171	0.398	0.0227	0.693	-0.378	
	2020	3.05	3.48	0.661	4.23	0.692	0.959

Note: Excess payments are totals for all investor-owned utilities in the US, in billions of 2019 dollars per year. Missing rate base data for utilities in our sample was interpolated based on the estimated average growth rate of the rate base over time. The “fixed” rows take the observed rate base as fixed and estimates excess payments. The “adjust” rows also account for changes in the rate base size, as estimated in table 3 column 4. For cases where it’s relevant the benchmark date is January 1995. See text for details of each benchmark calculation.

years of our sample.²³ To do this we interpolate using an estimate of the average growth rate for the rate base over time.²⁴

Across our five benchmark measures and using the existing rate base we find excess costs to consumers in 2020 of \$2–15 billion per year. These excess costs, like the RoE gap, depend on the choice of baseline. The economic welfare loss is likely smaller than these excess cost measures – the excess capital provides non-zero benefit, and the ultimate recipients of utility revenues place some value on the

23. Approved rate base data is available for 95% of utilities in 2020 and 65% of utilities in 2000.

24. We regress approved rate base on time, controlling for utility by state by service type fixed effects. Within each grouping of utility, state and service type, we start with the first non-missing value and linearly interpolate backwards assuming the rate base changes from period to period according to our estimated growth rate.

additional income.²⁵

Accounting for the way the RoE gap can affect capital ownership increases our estimate of the excess cost to consumers to \$2–20 billion per year. The majority of these costs come from the electricity sector.²⁶

6 Conclusion

Utilities invest a great deal in capital, and need to be compensated for the opportunity cost of their investments. Getting this rate of return correct, particularly the return on equity, is challenging, but is a task of first-order importance for utility regulators.

Our analysis shows that the RoE that utilities are allowed to earn has changed dramatically relative to various financial benchmarks in the economy. We estimate that the current approved average return on equity is substantially higher than various benchmarks and historical relationships would suggest. These results are necessarily uncertain, and depending on our chosen benchmark for the cost of equity the premium ranges from 0.5–5.5 percentage points. Put another way, even our most conservative benchmarks come in below the allowed rates of return on equity that regulators set today.

We link this divergence to the apparent asymmetric adjustment of rates to changes in market measures of the cost of capital. Increases to benchmark measures of the cost of capital lead to faster rises in utility returns on equity than is the case for decreases. This is the so-called “rockets and feathers” phenomenon and could

25. The RoE gap will ultimately affect utility rates, including the costs of buying electricity, but the ultimate impact on consumption decisions will depend on each utility’s rate structure. Analyzing these is outside the scope of this paper.

26. For comparison, total 2019 electricity sales by investor owned utilities were \$204 billion, on 1.89 PWh of electricity (US Energy Information Administration 2020a). Natural gas sales to consumers are \$146 billion on 28.3 trillion cubic feet of gas US Energy Information Administration 2020b. These figures include sales to residential, commercial, industrial, and electric power, but not vehicle fuel. They also include all sales, not just those by investor owned utilities.

be indicative of regulators being more responsive to pressures from the utilities they regulate than from consumers' demands to keep prices down.

We then turned to the Averch–Johnson effect, and estimated the additional capital this RoE gap generates. In our preferred specification, we estimate that an additional percentage point in the RoE gap leads to 5% higher rate base increases. Depending on our chosen benchmark for the gap, the excess rates collected from consumers could amount to \$2–20 billion per year.

If utilities are earning excess equity returns, a key challenge is to identify what changes to the ratemaking process may help remedy this. Regulators have taken numerous steps over the past few decades to improve the way costs are passed through into rates. For instance, explicit benchmarking and automatic update rules were introduced for fuel costs decades ago. It seems plausible that they could also be used to help equity costs adjust more quickly to changing market conditions, and do so in ways that are less prone to the subjective negotiations of the ratemaking process.

However, the cost of equity is unlikely to perfectly track any single benchmark in the same way as the cost of fuel. Also the automatic update rules for equity returns that have already been put in place by some PUCs have done little to prevent the trends we highlight.²⁷ As such, a significant degree of regulatory judgment is inevitable in this area.

A clear first step for improving the decisions regulators make over the cost of equity is to avoid some of the arbitrary “rules of thumb” that have been employed to date – see for instance the evidence we find of whole number rounding, or the reluctance to set rates below a nominal 10% that Rode and Fischbeck (2019) highlight.

27. For instance, regulators at the California PUC feel that the rule, called the cost of capital mechanism (CCM), performed poorly. “The backward looking characteristic of CCM might have contributed to failure of ROEs in California to adjust to changes in financial environment after the financial crisis. The stickiness of ROE in California during this period, in the face of declining trend in nationwide average, calls for reassessment of CCM.” (Ghadessi and Zafar 2017)

Bolstering the financial expertise of regulators is another promising path forward.²⁸ Seemingly objective methods like the capital asset pricing model cannot provide a definitive answer on the cost of equity. As we have documented, a range of plausible input assumptions can lead to widely divergent estimates of the cost of equity. When incorporating evidence from these methods regulators need to have the expertise to understand their limitations and push back on the assumptions utilities put forward when using them.

Lastly, process reforms may also be beneficial. In most rate case proceedings, utilities submit their planned expenditures and then regulators decide whether they are prudent. This relies on the notion that utilities are best placed to forecast their detailed needs for labor, materials and equipment (e.g. numbers of new transformers needed and where). However, it is less clear that utilities possess the same unique level of insight when it comes to the cost of equity, especially given that this is so dependent on wider market forces, the performance of peer companies and general investor sentiment. For this component of utility costs the regulator could conduct its own independent internal analysis of the cost of equity first, and then consult on their proposals. In this way it is the regulator that is anchoring the starting point of the discussion, not the utility.

Our findings have important implications beyond just the additional cost they place on consumers. From a distributional standpoint, higher rates create a transfer from ratepayers to utility stockholders. A high rate of return for *regulated* utilities may also lead to a reshuffling of which assets are owned by regulated versus non-regulated firms. Finally, efficiently pricing energy has important implications for environmental policy, particularly with regard to encouraging electrification which is a key component of efforts to tackle climate change.

²⁸ Azgad-Tromer and Talley (2017) found that providing finance training to regulatory staff did have a moderate effect on moving rates of return closer to standard asset pricing predictions.

References

- Averch, Harvey, and Leland L Johnson. 1962. "Behavior of the firm under regulatory constraint." *The American Economic Review* 52 (5): 1052–1069.
- Azgad-Tromer, Shlomit, and Eric L. Talley. 2017. "The Utility of Finance." *Columbia University School of Law Working Paper*, <https://doi.org/http://dx.doi.org/10.2139/ssrn.2994314>.
<https://ssrn.com/abstract=2994314>.
- Bacon, Robert W. 1991. "Rockets and feathers: the asymmetric speed of adjustment of UK retail gasoline prices to cost changes." *Energy Economics* 13 (3): 211–218. [https://doi.org/https://doi.org/10.1016/0140-9883\(91\)90022-R](https://doi.org/https://doi.org/10.1016/0140-9883(91)90022-R). <https://www.sciencedirect.com/science/article/pii/014098839190022R>.
- Borenstein, Severin, and James Bushnell. 2022. "Do Two Electricity Pricing Wrongs Make a Right? Cost Recovery, Externalities, and Efficiency." Forthcoming, *American Economic Journal: Economic Policy*, <https://doi.org/10.1257/pol.20190758>.
- Borenstein, Severin, A. Colin Cameron, and Richard Gilbert. 1997. "Do Gasoline Prices Respond Asymmetrically to Crude Oil Price Changes?*" *The Quarterly Journal of Economics* 112, no. 1 (February): 305–339. <https://doi.org/10.1162/003355397555118>. eprint: <https://academic.oup.com/qje/article-pdf/112/1/305/5291684/112-1-305.pdf>. <https://doi.org/10.1162/003355397555118>.
- Borenstein, Severin, Meredith Fowlie, and James Sallee. 2021. *Designing Electricity Rates for An Equitable Energy Transition*. Technical report 314. February. <https://haas.berkeley.edu/wp-content/uploads/WP314.pdf>.
- Cawley, James H, and Norman J Kennard. 2018. *A Guide to Utility Ratemaking*. Technical report. Pennsylvania Public Utility Commission. https://www.puc.pa.gov/General/publications_reports/pdf/Ratemaking_Guide2018.pdf.
- Dal Bó, Ernesto. 2006. "Regulatory Capture: A Review." *Oxford Review of Economic Policy* 22, no. 2 (July 1, 2006): 203–225. Accessed August 13, 2022. <https://doi.org/10.1093/oxrep/grj013>.
- EIA. 2018a. *Major utilities continue to increase spending on U.S. electric distribution systems*. Report, Today In Energy. Energy Information Administration. <https://www.eia.gov/todayinenergy/detail.php?id=36675>.

- EIA. 2018b. *Utilities continue to increase spending on transmission infrastructure*. Report, Today In Energy. Energy Information Administration. <https://www.eia.gov/todayinenergy/detail.php?id=34892>.
- Farrell, John. 2019. "Power Plant Securitization: Coming to a State Capitol Near You." *Institute for Local Self-Reliance* (May 13, 2019). <https://ilsr.org/power-plant-securitization-coming-to-a-state-capitol-near-you/>.
- Ghadessi, Maryam, and Marzia Zafar. 2017. *An Introduction to Utility Cost of Capital*. Technical report. April 18, 2017. [https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_\(2014_forward\)/PPD-An-Introduction-to-Utility-Cost-of-Capital.pdf](https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/PPD-An-Introduction-to-Utility-Cost-of-Capital.pdf).
- Green Mountain Power: Multi-Year Regulation Plan 2020–2022*. 2020. Technical report. September 3, 2020. Accessed March 17, 2021. https://puc.vermont.gov/sites/psbnew/files/doc_library/green-mountain-power-multi-year-regulation-plan.pdf.
- Henbest, Seb, Matthias Kimmel, Jef Callens, Tifenn Brandily, Meredith Annex, Julia Attwood, Melina Bartels, et al. 2020. *New Energy Outlook 2020 Executive Summary*. Technical report. October. Accessed April 1, 2021. https://assets.bbhub.io/professional/sites/24/928908_NEO2020-Executive-Summary.pdf.
- Joskow, Paul L. 1972. "The Determination of the Allowed Rate of Return in a Formal Regulatory Hearing." *The Bell Journal of Economics and Management Science* 3 (2): 632–644. <https://doi.org/10.2307/3003042>.
- . 1974. "Inflation and Environmental Concern: Structural Change in the Process of Public Utility Price Regulation." *The Journal of Law and Economics* 17, no. 2 (October): 291–327. <https://doi.org/10.1086/466794>.
- Joskow, Paul L., Douglas R. Bohi, and Frank M. Gollop. 1989. "Regulatory Failure, Regulatory Reform, and Structural Change in the Electrical Power Industry." *Brookings Papers on Economic Activity: Microeconomics* 1989:125–208. Accessed August 13, 2022. <https://doi.org/10.2307/2534721>.
- Kristoufek, Ladislav, and Petra Lunackova. 2015. "Rockets and feathers meet Joseph: Reinvestigating the oil–gasoline asymmetry on the international markets." *Energy Economics* 49:1–8. <https://doi.org/10.1016/j.eneco.2015.01.013>. <https://www.sciencedirect.com/science/article/pii/S0140988315000274>.

- Maddala, G. S., and Shaowen Wu. 1999. "A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test." *Oxford Bulletin of Economics and Statistics* 61 (S1): 631–652. <https://doi.org/https://doi.org/10.1111/1468-0084.0610s1631>. eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/1468-0084.0610s1631>. <https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-0084.0610s1631>.
- Michelfelder, Richard A., and Panayiotis Theodossiou. 2013. "Public Utility Beta Adjustment and Biased Costs of Capital in Public Utility Rate Proceedings." *The Electricity Journal* 26 (9): 60–68. <https://doi.org/https://doi.org/10.1016/j.tej.2013.09.017>. <https://www.sciencedirect.com/science/article/pii/S1040619013002340>.
- Peltzman, Sam. 2000. "Prices rise faster than they fall." *Journal of Political Economy* 108 (3): 466–502. <https://doi.org/10.1086/262126>.
- Perdiguero-García, Jordi. 2013. "Symmetric or asymmetric oil prices? A meta-analysis approach." *Energy Policy* 57:389–397. <https://doi.org/https://doi.org/10.1016/j.enpol.2013.02.008>. <https://www.sciencedirect.com/science/article/pii/S0301421513000931>.
- Rode, David C., and Paul S. Fischbeck. 2019. "Regulated equity returns: A puzzle." *Energy Policy* 133 (October): 110891. <https://doi.org/10.1016/j.enpol.2019.110891>.
- Salvino, S. M. 1967. "Rate of Return Dilemma of Public Utilities under Rising Cost of Money Conditions." *Financial Analysts Journal* 23 (6): 45–49. <http://www.jstor.org/stable/4470243>.
- Strunk, Kurt G. 2014. *The Decoupling of Treasury Yields and the Cost of Equity for Public Utilities*. Technical report. June 13, 2014. [https://www.nera.com/content/dam/nera/publications/archive2/PUB_Equity_Risk_Premium_Utilities_0614\(1\).pdf](https://www.nera.com/content/dam/nera/publications/archive2/PUB_Equity_Risk_Premium_Utilities_0614(1).pdf).

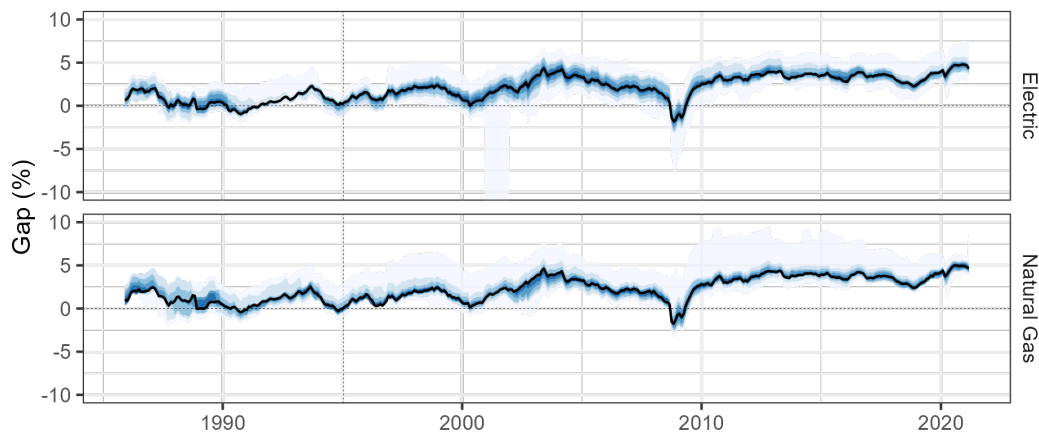
Online Appendix

A Detail on RoE gap benchmarks

For each of the strategies we utilize, we plot the timeseries of the RoE gap. These are plotted in figures 5, 6, 7, 8, 9, and 10.

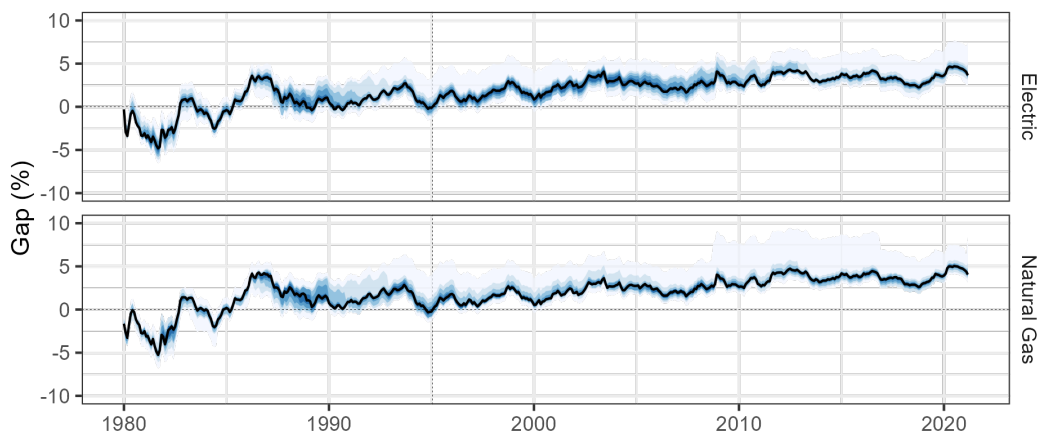
In each plot, we present the median of our RoE gap estimates, weighting by the utility's rate base (in 2019 dollars). Our goal is to show the median of rate base dollar value, rather than the median of utility companies, as the former is more relevant for understanding the impact of the RoE gap. We also show bands, in different shades of blue, that cover the 40–60 percentile, 30–70 percentile, 20–80 percentile, 10–90 percentile, and 2.5–97.5 percentile (all weighted by rate base).

Figure 5: Return on equity gap, benchmarking to same-rated corporate bonds



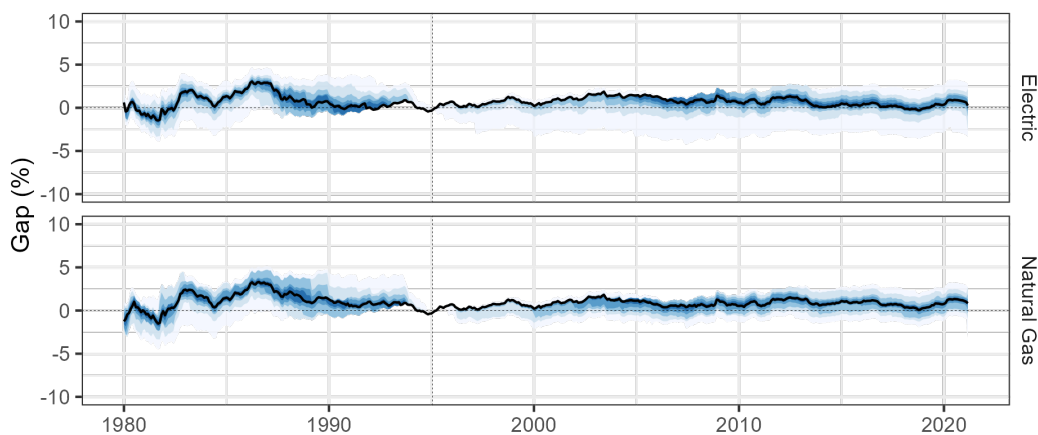
Base year is 1995. Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total investor-owned utility rate base. See calculation details in section 4.1.

Figure 6: Return on equity gap, benchmarking to 10-year Treasuries



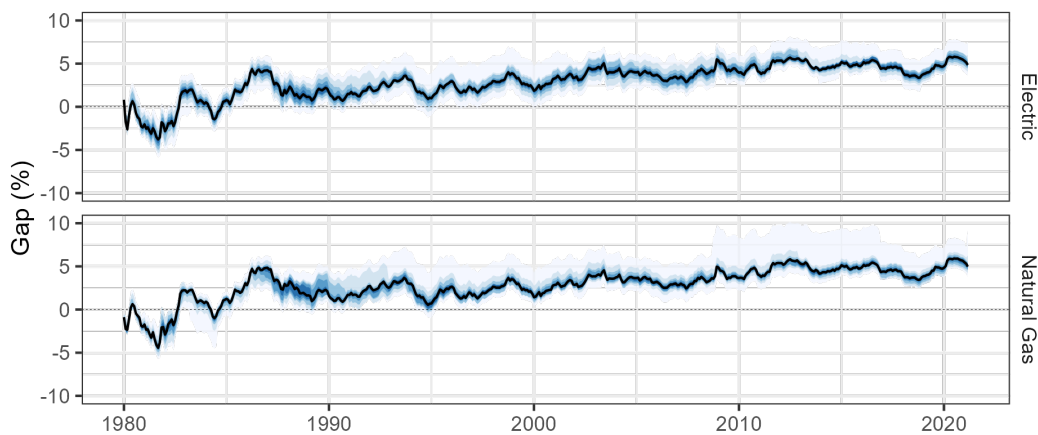
Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total investor-owned utility rate base. See calculation details in section 4.1.

Figure 7: Return on equity gap, using automatic update rule



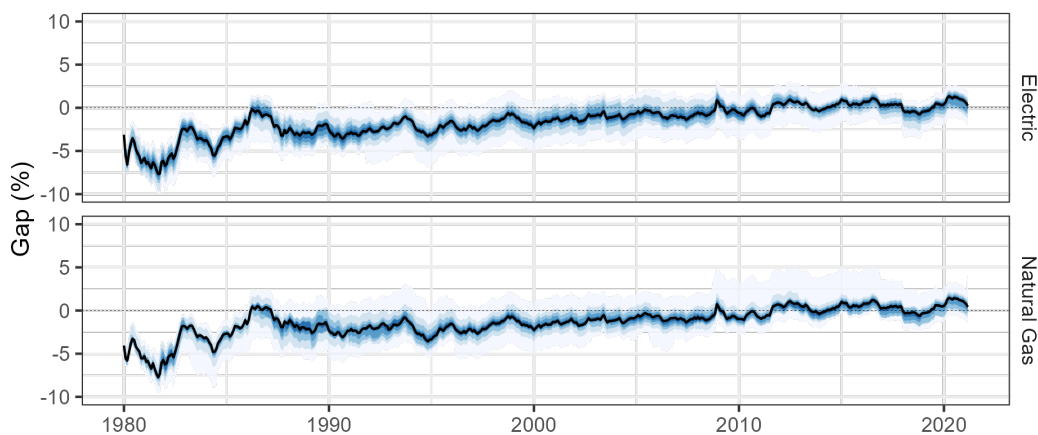
Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total investor-owned utility rate base. See calculation details in section 4.1.

Figure 8: Return on equity gap, benchmarking to CAPM (low)



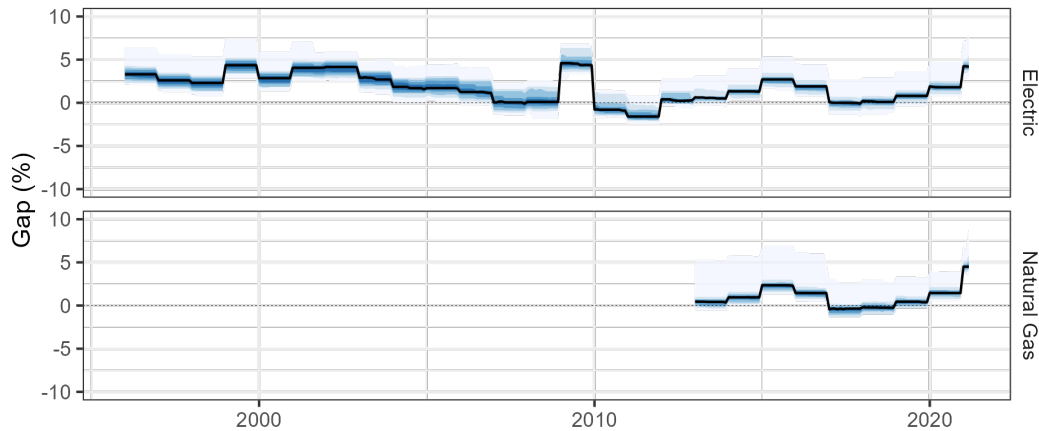
Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total investor-owned utility rate base. See calculation details in section 4.1.

Figure 9: Return on equity gap, benchmarking to CAPM (high)



Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total investor-owned utility rate base. See calculation details in section 4.1.

Figure 10: Return on equity gap, compared to UK utilities



Line represents median; shading represents ranges that cover the central 20, 40, 60, 80, and 95% of total investor-owned utility rate base. See calculation details in section 4.1.

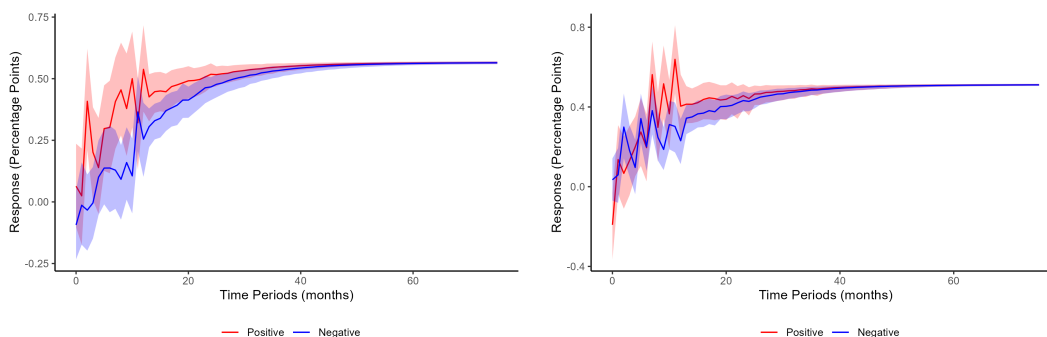
B Detail on Asymmetric Adjustment

Here we include additional information on the asymmetric adjustment analysis. The preferred specification presented in the main paper uses approved rates of return, a benchmark index of 10-year US Treasuries, and aggregates rate case decisions to the state level. Two key sources of variation in the results come from the use of proposed or approved rates of return, and the level of aggregation of the panel dataset. To illustrate this we present here robustness analysis across both proposed and approved rates and at three different levels of panel aggregation.

Figure 11 presents the same results as Figure 4 but across a range of specifications. Analysis across the three panel rows is conducted at varying levels of panel aggregation. Analysis across the two panel columns is conducted with either proposed or approved rates of return.

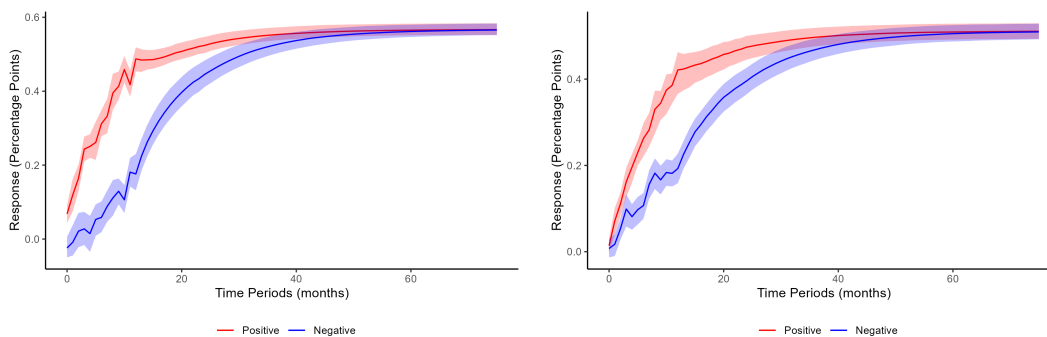
Consistently the results show a divergence, with rates of return adjusting more quickly to positive shocks to the benchmark index than is the case for negative shocks. The divergence is potentially more pronounced when looking at adjustments to proposed rates than approved rates. This seems consistent with firms being quick

Figure 11: Asymmetric Cumulative Adjustment Path following Shock to Benchmark Index by Aggregation Level



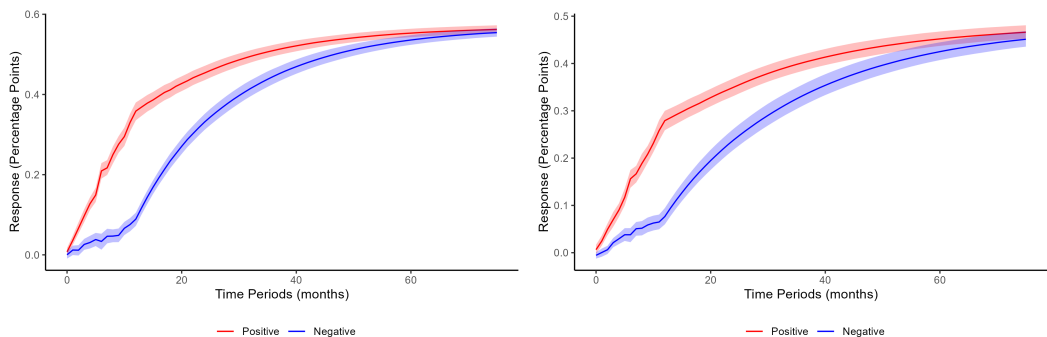
(a) National Time Series, Proposed Rates

(b) National Time Series, Approved Rates



(c) State Panel, Proposed Rates

(d) State Panel, Approved Rates



(e) Utility-State Panel, Proposed Rates

(f) Utility-State Panel, Approved Rates

Lines represents the cumulative adjustment path following a one percentage point change to the benchmark index. Red is for an increase in the index and blue is for a decrease. 95% confidence intervals are estimated via block bootstrapping on states, with 1000 replications. The plotted results use a benchmark index of 10-year US Treasuries. Analysis across the three panel rows is conducted at varying levels of panel aggregation. Analysis across the two panel columns is conducted with either proposed or approved rates of return. See calculation details in section 4.2.

to request upward adjustments to their return on equity while being relatively slow to request downward adjustments. Regulators do appear to somewhat moderate this divergence, but clearly do not come close to eliminating it.

The main specification was conducted on a panel that had been aggregated to the state level, and these results are reproduced in the second panel row of Figure 11. Here we provide the results of repeating the analysis with the original monthly utility-state panel dataset in the third panel row of Figure 11. As with the state-level approach, unit root tests fail to reject non-stationarity in levels and reject non-stationarity in first differences. Using the original utility-state panel also does not radically alter the core findings, with the asymmetric adjustment clearly visible. In fact, because this approach captures both the state-level nature of PUC decision-making and the utility-level variation in how and when rate case decisions are made, the slower pace of adjustment we observe makes sense.

Lastly, we also provide results from repeating the analysis after fully aggregating the original monthly utility-state panel to a single national monthly time series. As with the state-level approach, unit root tests fail to reject non-stationarity in levels and reject non-stationarity in first differences. Using a single national time series implies a faster speed of adjustment with less of a pronounced divergence between positive and negative shocks. However, such an approach effectively imagines a situation where rates of return are decided by a single federal regulator for a single national utility, which is clearly not realistic.

For further detail on the results, Table 6 provides various summary information on the different regression specifications. The coefficients are too numerous to be presented here, and are better summarized through their combined effect on the cumulative adjustments plotted in the earlier figures. Nevertheless, the table still provides useful information, including a number of *F*-tests on the different types of coefficients in the vector error correction model.

Table 6: Asymmetric Adjustments in Return on Equity

Model:	(1)	(2)	(3)	(4)	(5)	(6)
Prop. or Appr.	Prop.	Appr.	Prop.	Appr.	Prop.	Appr.
Group (State)			Yes	Yes	Yes	Yes
Group (Company)					Yes	Yes
ϕ	0.5658	0.5116	0.5669	0.5111	0.5695	0.4832
$\sum \beta_+ = \sum \beta_-$ Fstat	23.18	3.267	14.28	18.21	12.89	14.75
$\sum \beta_+ = \sum \beta_-$ pval	2.05×10^{-6}	0.0714	0.0002	1.99×10^{-5}	0.0003	0.0001
$\sum \gamma_+ = \sum \gamma_-$ Fstat	0.4560	1.231	3.188	1.835	0.7992	2.170
$\sum \gamma_+ = \sum \gamma_-$ pval	0.4999	0.2678	0.0742	0.1756	0.3713	0.1407
$\theta_+ = \theta_-$ Fstat	8.201	0.0032	2.781	4.637	0.6221	11.12
$\theta_+ = \theta_-$ pval	0.0044	0.9548	0.0954	0.0313	0.4303	0.0009
Fit statistics						
Observations	482	482	23,452	23,452	106,847	106,847
R ²	0.49	0.47	0.07	0.06	0.03	0.02

Clustered (Year) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

NOTES: “Group” refers to the level of panel aggregation used for the analysis, and fixed effects are always included at this level where relevant. β coefficients are those on the lagged differenced index terms. γ coefficients are those on the lagged differenced rate of return terms. θ coefficients are those on the error correction term. “Fstat” and “pval” refers to the results of an F-test on the relevant coefficients. ϕ refers to the long-run coefficient from the initial first step regression. See calculation details in section 4.2.

C Detail on Rate Base Impacts

Here we include additional information on our analysis of rate base impacts. We present two sets of tables: using proposed (rather than approved) return on equity, and some heterogeneity across utilities.

The proposed values shed some light on the bargaining process between the utility and PUC, though it's the approved values that ultimately matter for capital investment and revenues. Tables 7 and 8 mirror the main text tables 3 and 4, except 7 and 8 use utilities' proposed changes in the rate base and proposed return on equity. The results tend to be broadly similar, and often larger, than our main results, though the preferred IV specification of table 7 is smaller and statistically insignificant.

Tables 9 and 10 examine potential heterogeneity across utilities. Here, we interact various indicator variables with the RoE gap, which allows us to examine whether the effect of the RoE gap on rate base increase differs across these groups. For the most part, the coefficients we estimate are small (relative to the overall average effect) and statistically insignificant.

“Electric” captures whether a utility provides electric or gas service. “Vertically Integrated” captures whether a utility is vertically integrated, with the alternatives being ones that operate solely in distribution or transmission. “PUC Ranking” captures whether a state PUC is rated as having a constructive, lower risk regulatory environment for investors.²⁹ “Litigated” captures whether a rate case decision was fully litigated. “Lengthy Case” captures whether a rate case decision takes longer than average.³⁰

29. This is based on a rating system produced by S&P RRA. It rates state PUCs in a manner similar to a credit rating, with three categories of Below Average, Average and Above Average. There are three step levels (1, 2 or 3) within each rating category. The final ratings produce a roughly normal distribution. This is converted to a binary variable that equals one where a state PUC scores above Average level 2.

30. This is a binary variable that equals one if a rate case takes longer than the median rate case duration.

Table 7: Relationship Between Proposed Rate of Return and Proposed Rate Base Increase

Model:	Fixed effects specs.			IV
	(1)	(2)	(3)	(4)
Variables				
RoE gap (%)	0.0670*** (0.0134)	0.0436* (0.0217)	0.0672*** (0.0151)	0.0353 (0.0215)
Fixed-effects				
Service Type	Yes	Yes	Yes	Yes
State	Yes	Yes	Yes	Yes
Year		Yes	Yes	Yes
Company			Yes	Yes
Fit statistics				
Observations	3,210	3,210	3,210	3,210
R ²	0.37	0.39	0.73	0.73
Within R ²	0.02	0.002	0.01	0.008
Wald (1st stage), RoE gap (%)				50.9
Dep. var. mean	63.69	63.69	63.69	63.69

Clustered (Year & Company) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

NOTES: The table uses proposed RoE. The dependent variable is log of the utility's rate base increase in millions of \$. Columns 1–3 show varying levels of fixed effects. Column 4 is the IV discussed in section 4.3. First-stage *F*-statistic is Kleibergen–Paap robust Wald test.

Table 8: Relationship Between Proposed Rate of Return and Proposed Total Rate Base (both absolute and per MWh)

Model:	Total, FE (1)	Total, IV (2)	per MWh, FE (3)	per MWh, IV (4)
Variables				
RoE gap (%)	0.0354 (0.0237)	0.0600* (0.0341)	0.1487** (0.0708)	0.1555** (0.0720)
Fixed-effects				
Service Type	Yes	Yes	Yes	Yes
State	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Company	Yes	Yes	Yes	Yes
Fit statistics				
Observations	2,262	2,262	927	927
R ²	0.82	0.82	0.82	0.82
Within R ²	0.002	0.001	0.03	0.03
Wald (1st stage), RoE gap (%)		20.6		15.4
Dep. var. mean	1,589.4	1,589.4	401.8	401.8

Clustered (Year & Company) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

NOTES: The table uses proposed RoE. Dependent variables are the total rate base in millions of \$ (Columns 1–2) and the rate base per quantity delivered in \$ per MWh (Columns 3–4). The FE results correspond to the specification used for column 3 in table 3 and the IV results correspond to the specification used for column 4 in table 3. First-stage *F*-statistic is Kleibergen–Paap robust Wald test.

These variables could affect several parts of the ratemaking process simultaneously. For instance, a PUC that has a high rating on the S&P RRA scale may increase or reduce the Averch–Johnson effect, but may also influence RoE and the utility’s rate base in other ways.

Table 9: Relationship Between Approved Rate of Return and Approved Rate Base Increase with Differential Effects

Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
RoE gap (%)	0.0811*** (0.0243)	0.1017*** (0.0286)	0.0743*** (0.0239)	0.1075 (0.1064)	0.0780** (0.0300)	0.0879*** (0.0270)
RoE gap (%) × Electric		-0.0314 (0.0229)				
RoE gap (%) × Vertically Integrated			-0.0020 (0.0208)			
RoE gap (%) × PUC Ranking				-0.0271 (0.0493)		
RoE gap (%) × Litigated					0.0037 (0.0263)	
RoE gap (%) × Lengthy Case						-0.0071 (0.0190)
Fixed-effects						
Service Type	Yes	Yes	Yes	Yes	Yes	Yes
State	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Company	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	2,617	2,617	2,617	2,101	2,617	2,617
R ²	0.69	0.69	0.70	0.69	0.69	0.69
Within R ²	0.009	0.01	0.03	0.010	0.009	0.01
Dep. var. mean	39.18	39.18	39.18	39.09	39.18	39.18

Clustered (Year & Company) standard-errors in parentheses
 Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

NOTES: The table uses approved RoE. The dependent variable is log of the utility’s rate base increase in millions of \$ All specifications use the same preferred set of fixed effects. Columns each capture differential effects for a range of interactions. “Electric” captures whether a utility provides electric or gas service. “Vertically Integrated” captures whether it is an electric utility, rather than a gas utility. “PUC Ranking” captures whether a state PUC is rated as having a constructive, lower risk regulatory environment for investors. “Litigated” captures whether a rate case decision was fully litigated. “Lengthy Case” captures whether a rate case decision takes longer than average.

*Table 10: Relationship Between Proposed Rate of Return
 and Proposed Rate Base Increase with Differential Effects*

Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
RoE gap (%)	0.0625*** (0.0167)	0.0842*** (0.0207)	0.0665*** (0.0178)	0.0766*** (0.0280)	0.0726*** (0.0206)	0.0699*** (0.0178)
RoE gap (%) × Electric		-0.0356* (0.0177)				
RoE gap (%) × Vertically Integrated			-0.0108 (0.0174)			
RoE gap (%) × PUC Ranking				-0.0210 (0.0187)		
RoE gap (%) × Litigated					-0.0107 (0.0222)	
RoE gap (%) × Lengthy Case						-0.0076 (0.0151)
Fixed-effects						
Service Type	Yes	Yes	Yes	Yes	Yes	Yes
State	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Company	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	3,402	3,402	3,402	2,776	3,402	3,402
R ²	0.73	0.73	0.74	0.72	0.73	0.73
Within R ²	0.009	0.01	0.04	0.008	0.01	0.01
Dep. var. mean	65.53	65.53	65.53	65.12	65.53	65.53

Clustered (Year & Company) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

NOTES: The table uses approved RoE. The dependent variable is log of the utility’s rate base increase in millions of \$. All specifications use the same preferred set of fixed effects. Columns each capture differential effects for a range of interactions. “Electric” captures whether a utility provides electric or gas service. “Vertically Integrated” captures whether it is an electric utility, rather than a gas utility. “PUC Ranking” captures whether a state PUC is rated as having a constructive, lower risk regulatory environment for investors. “Litigated” captures whether a rate case decision was fully litigated. “Lengthy Case” captures whether a rate case decision takes longer than average.

Data

- Australian Energy Regulator. 2020. *International regulatory approaches to rate of return - Pathway to Rate of Return 2022*. December 16, 2020. Accessed August 13, 2022. <https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/international-regulatory-approaches-to-rate-of-return-pathway-to-rate-of-return-2022>.
- Board of Governors of the Federal Reserve System. 2021a. *1-Year Treasury Constant Maturity Rate*. FRED, Federal Reserve Bank of St. Louis, April 1, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/GS1>.
- . 2021b. *10-Year Treasury Constant Maturity Rate*. FRED, Federal Reserve Bank of St. Louis, April 1, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/GS10>.
- . 2021c. *30-Year Treasury Constant Maturity Rate*. FRED, Federal Reserve Bank of St. Louis, April 1, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/GS30>.
- Companies (Classic) Screener*. 2021. S&P Global Market Intelligence, January. Accessed March 17, 2021. <https://platform.marketintelligence.spglobal.com/web/client?auth=inherit#office/screener>.
- Compustat S&P legacy credit ratings*. 2019. Wharton Research Data Service, October 18, 2019. Accessed March 12, 2021.
- Damodaran, Aswath. 2022a. *Cost of Capital by Industry*. Stern School of Business at New York University, August 13, 2022. Accessed August 13, 2022. https://pages.stern.nyu.edu/~adamodar/New_Home_Page/dataarchived.html.
- . 2022b. *Historical Returns on Stocks, Bonds and Bills*. Stern School of Business at New York University, August 13, 2022. Accessed August 13, 2022. https://pages.stern.nyu.edu/~adamodar/New_Home_Page/dataarchived.html.
- Economic Consulting Associates. 2020. *Methodologies and parameters used to determine the allowed or target revenue of transmission system operators - Report for ACER*. December 16, 2020. Accessed August 13, 2022. <https://www.eca-uk.com/2018/11/05/acer-publishes-eca-report-on-eu-revenue-setting-approaches-for-gas-transmission/>.
- Ice Data Indices, LLC. 2021a. *ICE BofA AA US Corporate Index Effective Yield*. FRED, Federal Reserve Bank of St. Louis, April 6, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/BAMLC0A2CAAAY>.
- . 2021b. *ICE BofA AAA US Corporate Index Effective Yield*. FRED, Federal Reserve Bank of St. Louis, April 6, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/BAMLC0A1CAAAY>.
- . 2021c. *ICE BofA BB US High Yield Index Effective Yield*. FRED, Federal Reserve Bank of St. Louis, April 6, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/BAMLH0A1HYBBEY>.
- . 2021d. *ICE BofA BBB US Corporate Index Effective Yield*. FRED, Federal Reserve Bank of St. Louis, April 6, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/BAMLC0A4CBBBEY>.
- . 2021e. *ICE BofA CCC & Lower US High Yield Index Effective Yield*. FRED, Federal Reserve Bank of St. Louis, April 6, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/BAMLH0A3HYCEY>.
- . 2021f. *ICE BofA Single-A US Corporate Index Effective Yield*. FRED, Federal Reserve Bank of St. Louis, April 6, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/BAMLC0A3CAEY>.

- Ice Data Indices, LLC. 2021g. *ICE BofA Single-B US High Yield Index Effective Yield*. FRED, Federal Reserve Bank of St. Louis, April 6, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/BAMLH0A2HYBEY>.
- Moody's. 2021a. *Moody's Seasoned Aaa Corporate Bond Yield*. FRED, Federal Reserve Bank of St. Louis, April 1, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/AAA>.
- . 2021b. *Moody's Seasoned Baa Corporate Bond Yield*. FRED, Federal Reserve Bank of St. Louis, April 1, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/BAA>.
- Regulatory Research Associates. 2021. *Rate Case History*. S&P Global Market Intelligence, March. Accessed March 18, 2021. <https://platform.marketintelligence.spglobal.com/web/client?auth=inherit#industry/pastRateCases?Type=1>.
- UK Regulatory Network. 2020. *UKRN Cost of Capital Annual Report 2020*. December 16, 2020. Accessed August 13, 2022. <https://www.ukrn.org.uk/publications/ukrn-cost-of-capital-annual-report-2020/>.
- US Bureau of Labor Statistics. 2021. *Consumer Price Index for All Urban Consumers: All Items in U.S. City Average*. FRED, Federal Reserve Bank of St. Louis, March 10, 2021. Accessed April 7, 2021. <https://fred.stlouisfed.org/series/CPIAUCSL>.
- US Energy Information Administration. 2020a. *2019 Utility Bundled Retail Sales – Total*. October 2, 2020. Accessed April 28, 2021. https://www.eia.gov/electricity/sales_revenue_price/xls/table10.xlsx.
- . 2020b. *Summary Statistics for Natural Gas in the United States, 2015–2019*. September 30, 2020. Accessed April 28, 2020. https://www.eia.gov/naturalgas/annual/csv/t2019_01.csv.
- . 2022. *Annual Electric Power Industry Report Form EIA-861*. August 29, 2022. Accessed August 29, 2022. <https://www.eia.gov/electricity/data/eia861/>.
- Wolters Kluwer. 2022. *Blue Chip Economic Indicators*. Wolters Kluwer, August 13, 2022. Accessed August 13, 2022. <https://www.wolterskluwer.com/en/solutions/vitallaw-law-firms/blue-chip>.

Software Citations

- Bache, Stefan Milton, and Hadley Wickham. 2020. *magrittr: A Forward-Pipe Operator for R*. 2.0.1. <https://cran.r-project.org/package=magrittr>.
- Dowle, Matt, and Arun Srinivasan. 2021. *data.table: Extension of 'data.frame'*. 1.14.0. <https://cran.r-project.org/package=data.table>.
- Fabri, Antoine. 2020. *safejoin: Join safely and Deal with Conflicting Columns*. 0.1.0. August 19, 2020.
- François, Romain, Jeroen Ooms, Neal Richardson, and Apache Arrow. 2021. *arrow: Integration to 'Apache' 'Arrow'*. 3.0.0. <https://cran.r-project.org/package=arrow>.
- Gaure, Simen. 2013. "lfe: Linear group fixed effects." User documentation of the 'lfe' package, *The R Journal* 5, no. 2 (December): 104–117. <https://journal.r-project.org/archive/2013/RJ-2013-031/RJ-2013-031.pdf>.
- Grolemund, Garrett, and Hadley Wickham. 2011. "Dates and Times Made Easy with lubridate." *Journal of Statistical Software* 40 (3): 1–25. <https://www.jstatsoft.org/v40/i03/>.
- Henry, Lionel, and Hadley Wickham. 2020a. *purrr: Functional Programming Tools*. 0.3.4. <https://cran.r-project.org/package=purrr>.

- Henry, Lionel, and Hadley Wickham. 2020b. *rlang: Functions for Base Types and Core R and 'Tidyverse' Features*. 0.4.10. <https://cran.r-project.org/package=rlang>.
- . 2020c. *tidyselect: Select from a Set of Strings*. 1.1.0. <https://cran.r-project.org/package=tidyselect>.
- Hester, Jim. 2020. *glue: Interpreted String Literals*. 1.4.2. <https://cran.r-project.org/package=glue>.
- Iannone, Richard, Joe Cheng, and Barret Schloerke. 2020. *gt: Easily Create Presentation-Ready Display Tables*. 0.2.2. <https://cran.r-project.org/package=gt>.
- Köster, Johannes, and Sven Rahmann. 2018. "Snakemake—a scalable bioinformatics workflow engine." *Bioinformatics* 34, no. 20 (May): 3600–3600. <https://doi.org/10.1093/bioinformatics/bty350>.
- Kuhn, Max. 2020. *caret: Classification and Regression Training*. 6.0-86. <https://cran.r-project.org/package=caret>.
- Microsoft Corporation and Steve Weston. 2020. *doParallel: Foreach Parallel Adaptor for the 'parallel' Package*. 1.0.16. <https://cran.r-project.org/package=doParallel>.
- Müller, Kirill. 2020. *here: A Simpler Way to Find Your Files*. 1.0.1. <https://cran.r-project.org/package=here>.
- Müller, Kirill, and Hadley Wickham. 2021. *tibble: Simple Data Frames*. 3.1.0. <https://cran.r-project.org/package=tibble>.
- Neuwirth, Erich. 2014. *RColorBrewer: ColorBrewer Palettes*. 1.1-2. <https://cran.r-project.org/package=RColorBrewer>.
- Ooms, Jeroen. 2019. *curl: A Modern and Flexible Web Client for R*. 4.3. <https://cran.r-project.org/package=curl>.
- Pebesma, Edzer. 2018. "Simple Features for R: Standardized Support for Spatial Vector Data." *The R Journal* 10 (1): 439–446. <https://doi.org/10.32614/RJ-2018-009>. <https://doi.org/10.32614/RJ-2018-009>.
- R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. 4.0.3. Vienna, Austria: R Foundation for Statistical Computing. <https://www.r-project.org/>.
- Robinson, David, Alex Hayes, and Simon Couch. 2021. *broom: Convert Statistical Objects into Tidy Tibbles*. 0.7.5. <https://cran.r-project.org/package=broom>.
- Teetor, Nathan. 2018. *zeallot: Multiple, Unpacking, and Destructuring Assignment*. 0.1.0. <https://cran.r-project.org/package=zeallot>.
- Ushey, Kevin. 2021. *renv: Project Environments*. 0.13.0. <https://cran.r-project.org/package=renv>.
- Wickham, Hadley. 2016. *ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag New York. <https://ggplot2.tidyverse.org>.
- . 2019. *stringr: Simple, Consistent Wrappers for Common String Operations*. 1.4.0. <https://cran.r-project.org/package=stringr>.
- . 2020. *tidyr: Tidy Messy Data*. 1.1.2. <https://cran.r-project.org/package=tidyr>.
- Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Golemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. <https://doi.org/10.21105/joss.01686>.
- Wickham, Hadley, and Jennifer Bryan. 2019. *readxl: Read Excel Files*. 1.3.1. <https://cran.r-project.org/package=readxl>.

Wickham, Hadley, Romain François, Lionel Henry, and Kirill Müller. 2021. *dplyr: A Grammar of Data Manipulation*. 1.0.4. <https://cran.r-project.org/package=dplyr>.

Wickham, Hadley, and Jim Hester. 2020. *readr: Read Rectangular Text Data*. 1.4.0. <https://cran.r-project.org/package=readr>.

Wickham, Hadley, Jim Hester, Winston Chang, Kirill Müller, and Daniel Cook. 2021. *memoise: Memoisation of Functions*. 2.0.0. <https://cran.r-project.org/package=memoise>.

Zeileis, Achim, and Gabor Grothendieck. 2005. “zoo: S3 Infrastructure for Regular and Irregular Time Series.” *Journal of Statistical Software* 14 (6): 1–27. <https://doi.org/10.18637/jss.v014.i06>.

Cost of Capital¹

	Amount (\$,000)	Percent of Permanent Capital	Percent of Total Capital	Cost Rate (%)	Weighted Total Cost (%)	Conversion Factor	Pre-Tax Return (%)
Long-Term Debt	8,663,922	50.0000%	39.1891%	4.2400%	1.6616%	1	1.6616%
Preferred Stock							
Common Shareholders Equity	8,673,528	50.0000%	39.2326%	9.3000% ²	3.6486%	1.3496	4.9242%
Total Permanent Capital	17,337,450						
Short-Term Debt	509,454		2.3044%	5.7600%	0.1327%	1	0.1327%
ITC Debt	15,742		0.0700%	4.2400%	0.0000%		
ITC Equity	15,742		0.7000%	9.3000%	0.0100%	1.3496	0.0135%
Deferred Income Taxes (Net)	4,229,600		19.1315%				
Total	22,107,988	100.0000%	100.6276%		5.4530%		6.7320%

¹ Except where noted, source is Exhibit A-14, Schedule D1, p. 1.

² Recommended ROE from Bandyk testimony.

Equity Risk Premium and Corresponding Risk-Free Rates

	Equity Risk Premium	Risk-Free Rate
a) Damodaran ¹	4.11%	4.40%
b) IESE ²	5.5%	4.1%
c) Kroll ³	5.0%	3.5%

ERP Average **4.87%**

Risk-Free Rate Average **4.00%**

¹ Aswath Damodaran. "Price and Value to Book Ratio by Sector (US)," https://pages.stern.nyu.edu/~adamodar/New_Home_Page/home.htm. Accessed July 2024.

² Pablo Fernandez, Teresa García De Santos and Javier Fernandez Acin. "Survey: Market Risk Premium and Risk-Free Rate used for 96 countries in 2024," March 10, 2024. Accessed July 21, 2024, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4754347.

³ Carla Nunes, James P. Harrington, Anas Aboulamer and Roger J. Grabowski, FASA. "Kroll Recommended U.S. Equity Risk Premium and Corresponding Risk-Free Rates to be Used in Computing Cost of Capital: January 2008 – Present." Kroll LLC, June 5, 2024. Accessed July 21, 2024, available at <https://www.kroll.com/en/insights/publications/cost-of-capital/recommended-us-equity-risk-premium-and-corresponding-risk-free-rates>.

Electric Sample Average Asset Beta Relevered at DTE Electric's Capital Structure With Market Value of Equity

a)	b)	c)	d)	e)	f)
Asset Beta (with taxes) ¹	Assumed Debt Beta ²	Debt (%) ³	5-Year Average Common Equity to Market Value Ratio (%) ⁴	DTE Electric Tax Rate ⁵	Estimated Equity Beta ⁶
0.64	0.1	42.00%	58.00%	25.70%	0.930539

¹ Exhibit A_14, Schedule D5.14

² Id.

³ 1 - d.

⁴ Exhibit A-14, Schedule D5.11

⁵ Exhibit A_14, Schedule D5.14

⁶ $a + c \cdot (1 - e) / d \cdot (a - b)$

CAPM Analysis

a)	b)	c)	d)
Equity Risk Premium ¹	Risk-Free Rate ²	Beta ³	ROE ⁴
4.87%	4.00%	0.93	8.53%

¹ Exhibit CUB-6.

² Id.

³ Exhibit CUB-7.

⁴ $= b + (a \cdot c)$

DCF Cost of Equity at DTE Electric's Capital Structure With Market Value of Equity

a)	b)	c)	d)	e)	f)
Overall After-Tax Cost of Capital ¹	Debt (%) ²	Representative Cost of BBB Rated Utility Debt ³	DTE Electric's Representative Income Tax Rate ⁴	5-Year Average Common Equity to Market Value Ratio (%) ⁵	Estimated Cost of Equity ⁶
6.80%	42.00%	5.70%	25.70%	58.00%	8.66%

¹ Exhibit A-14, Schedule D5.8

² 1 – e.

³ Exhibit A-14, Schedule D5.8

⁴ Id.

⁵ Exhibit A_14, Schedule D5.14

⁶ $(a - b * c * (1 - d)) / e$.

The Hamada Beta Adjustment and the Cost of Capital for the Regulated Utilities

BY SCOTT LINN AND ZHEN ZHU

I. Introduction

Despite many issues with the Capital Asset Pricing Model (CAPM), it is still one of main methods that is used to estimate the expected rate of return on equity for regulated utilities in rate proceedings in the United States. A primary underpinning of the model is that investors require compensation for bearing undiversifiable systematic risk. A product of the theory is that the degree of systematic risk (beta risk) an investor bears for investing in any equity security is measured by how closely the stock's price changes (returns) covary with the overall market, proxied by the returns on a market index. The expected cost of equity is the sum of two parts: a risk-free rate and a risk premium which is the product of the beta of the company's stock and a market risk premium. A key ingredient of course is the stock's beta, which depends upon the nature of the business as well as how the business is financed. Our focus in this note is on the latter relation between beta and how a company is financed (specifically the debt/equity ratio), and how this relation if not considered correctly can lead to incorrect estimates of a company's required return on equity, and consequently to incorrect rate adjustments.

Technical Box A: CAPM

$$R = R_f + \beta (R_m - R_f),$$

Where R is the required or expected return on equity for the utility, R_f is the risk-free rate, β is the company beta, and R_m is the market return. $(R_m - R_f)$ is the market risk premium.

In the practice of a rate proceeding, various methods have been utilized to model each of the three components of the CAPM: the risk-free return, the market risk premium, and the beta. Some rate-setting commissions have specific requirements regarding how to model each component. For example, the Federal Energy Regulatory Commission (FERC) requires the risk-free interest rate to be a long-term Treasury Bond yield, the company stock beta is the beta value provided by Value Line, and the market risk premium is measured by the difference between the market return based on a one-step DCF model applied to the dividend paying S&P 500 companies and the risk-free rate. The rules however are not uniform across state commissions, so that an estimate in one jurisdiction could potentially deviate from an estimate in another for the same company. At the same time there has been increasing advocacy for methods designed to adjust beta. The point of this note is to consider one such adjustment and to high-

light how that adjustment can lead to a biased estimate of a company's beta and hence the required return on equity.

Theory tells us that beta as generally measured, is under certain conditions, positively related to the company's debt to equity ratio, where the ratio is measured using the total market values of a company's debt and equity. It is important to recognize that the beta computed by most popular commercial services, such as Value Line and Bloomberg, is based upon market returns. What does this mean? Specifically, the returns on a stock are based upon the assessment by capital market participants of changes in the stock's value which are then reflected in changes in its market price. Changes in valued reflect market participants' interpretation of fundamental information about the company, including how it is financed. The market value debt to equity ratio reflects the extent to which the shareholders share the total value of the company with the debtholders, and hence the shareholders' exposure to debt financing. Recognize that the total value of a company equals, in usual parlance, the total market value of the debt and equity, which would only by accident equal the book value of debt plus the book value of equity. In other words, market participants know this information and condition changes in prices on knowledge of a company's market value debt to equity ratio.

Hence, the implied cost of capital, whether the equity required return or the weighted average cost of capital, is a number based upon the market values of debt and equity not book values.¹ This leads us to an important issue confronting rate setting commissions. One common practice on the side of the ROE requesting utilities is to use what is commonly referred to as the Hamada equation to make an adjustment to the beta value obtained from an investment service. The argument for this so-called leverage adjustment is that the capital structure use in calculating the weighted average cost of capital is based on book value but the return on equity is based on the market value, and in addition, the rate base is based on book value.

Setting aside how the weighted average cost of capital is computed, whether using book value or market value weights, we explore the implications of adjusting beta using the book value versus market value debt to equity ratio. As the market value of most utility's equity nowadays is typically higher than the book value of the equity, the book value debt ratio will typically be larger than if the market value debt/equity ratio is employed. As the beta computed using market returns reflects the market debt/equity ratio, if instead it is

Scott Linn is Professor of Finance Emeritus at the University of Oklahoma. **Zhen Zhu** is an Economist with Guernsey and can be reached at zhen.zhu@guernsey.us

International Association for Energy Economics

adjusted to conform to a book value debt/equity ratio, the resulting beta will be larger than the observed beta provided by say Value Line. Such an adjustment would lead to higher beta values and thus a higher calculated expected rate of return on equity given the estimate of the risk-free rate and the market risk premium.

II. What is the Hamada equation?

Professor Hamada, once the dean of the famed Booth College of Business at the University of Chicago, was the first to derive the relation between a company's stock's beta and the company's market value debt/equity ratio. Specifically he shows that beta increases as the market debt/equity ratio increases. Hamada defines two different betas for a company's stock. One beta is what we usually obtain from the investment services such as Value Line, and this beta is called the levered beta as it is derived from the market data reflecting the company's existing capital structure, that is, its market value debt/equity ratio. In contrast, suppose the same company used no debt financing, then the corresponding beta would be what we would observe for an unlevered (no debt financing) company, and is typically referred to as the unlevered beta. The levered beta exceeds the unlevered beta which the company uses debt financing. Note that all terms are measured in market values.

The equation shown nearby shows how a company's beta changes as the company's market value debt/equity ratio changes. The higher the market value debt/equity ratio (leverage), the higher the financial risk and thus the higher is beta. For example, if a company's unlevered beta is 1.0, the market value debt/equity ratio is 0.5, and the marginal tax rate is 21%, then the levered beta would be 1.395, an increase of 39.5%.

Technical Box B – The Hamada Equation:

$$\beta_L = \beta_U^* [1 + (1-t) D/E],$$

where β_L is the levered beta, which measures the firm's systematic risk with the impact of debt and β_U is the unlevered beta, which measures the firm's systematic risk without the impact of debt, t is the marginal tax rate, D/E is the company's debt-to-equity ratio which measures the company's financial leverage.

The beauty of the Hamada Equation is that it can be used to infer what a company's beta would equal for any assumed debt/equity ratio, including what an analyst might argue is the debt/equity ratio that goes with an 'optimal' capital structure for the company.² The process of finding a new levered beta involves what is often referred to as first unlevering and then relevering. The starting levered beta is observed by consulting an investment service such as Value Line. The unlevered beta is not directly observable but can be backed out of the Hamada formula if other information such as the tax rate and an estimate of the market value debt ratio are available. This process is called unlevering. The unlevered beta can then be relevered

to obtain the new levered beta estimate that is conditional on an assumed debt/equity ratio which could be the one that goes with the optimal capital structure. This process of course makes the explicit assumption that the current debt/equity ratio is not what is desired and that shortly in the future the company will rearrange its financing to reflect a better mix and a new debt/equity ratio.

Take the example of finding the beta for a company's stock assuming the current debt/equity ratio is not the best but the analyst believes she knows what the best debt/equity ratio equals. Suppose the current observable beta or levered beta is 0.8 for a utility that has a debt ratio of 1.25. With a tax rate of 0.21, the unlevering process would generate an unlevered beta of 0.40. Conceptually, if the company used no debt financing the beta would be 0.40.

Suppose the optimal capital structure is 50% debt and 50% equity, so the debt-to-equity ratio would equal 1.0, then the relevered beta would equal 0.716. Specifically with the optimal capital structure, the company's beta would equal 0.716, a value less than the current levered beta value of 0.8.

Two important assumptions underlying the Hamada equation are first that the beta of the company's debt is zero, and second that the CAPM model is valid.

III. How is the Hamada equation used to adjust the beta in rate proceedings?

Sometimes, the Hamada equation is used in rate proceedings to adjust the unlevered beta using the book value debt/equity ratio. If the book value of equity is less than the total market value of equity, which is typical nowadays, this will lead to a beta that is inflated more than it should be, and consequently a required return on equity computed using the CAPM that is larger than it should be. The argument goes that such a "book value leverage adjustment" is necessary because the required rate of return on equity will be used to compute a weighted average cost of capital using weights based upon the book values of debt and equity. According to advocates of this suggested adjustment, beta based on a market value capital structure mis-represents the financial risk of the company, and therefore, the conventionally available betas cannot be used directly in the CAPM, unless the cost of equity developed using these betas is applied to the computation of a weighted average cost of capital in which the weights are based upon market values. The market value capital structure of a utility and the company's book value capital structure typically are not the same. The argument that there is a need to make the so-called leverage adjustment to adjust the beta to reflect the utility's risk based on book value capital structure, is simply incorrect as true risk is not based upon historic book values. The reason is that the book value of the assets of the company is not a true reflection of the assets' market value and it is the market value of the assets which indicates the true support for the company's debt.

The following example illustrates how the Hamada equation used incorrectly leads to a cost of capital that is too large.

Assume a utility with a market value debt/equity ratio³ of 0.8 has a Value Line reported beta of 0.75. Suppose the company's marginal tax rate equals 21% , then the company's unlevered beta can be computed as shown earlier, and will equal 0.46.

Utility total equity market values are usually significantly higher than the book values, leading to a significantly higher book value debt/equity ratio than would be the case for the market value debt/equity ratio. This comparison is typically the reason why some analysts claim that the financial risk represented by the book value is higher than the financial risk represented by the market value.⁴ But this is inherently a flawed argument as we have just commented.

Assume for our example company that the book value debt/equity ratio is 1.0. The unlevered beta value of 0.46 is then relevered by the book value capital structure to arrive at an adjusted estimate of beta that would for our illustration, equal 0.82, a 9% increase in the beta to be used in the cost of capital calculation

The book value relevered beta value when used in the CAPM model will therefore lead to a required return on equity that is larger than it should be.

IV. Is the Hamada adjustment reasonable?

In summary we repeat the limitations of the book value debt/equity adjustment process as well as a more general limitation of the Hamada model.

First, unlike the process of unlevering and relevering the market value beta to obtain a levered market value beta that reflects the optimal market value capital structure, relevering the market value unlevered beta using the book value debt/equity ratio, yields a beta estimate that cannot be interpreted, and therefore cannot legitimately be used in the estimation of the cost of capital in the CAPM model.

Second, the Hamada adjustment process assumes, even if we are using the correct market value debt/equity ratio, that the beta of the company's debt is zero. This assumption is simply not strictly met, although academic studies that present estimates of bond betas generally find that they are small but nevertheless positive.⁵ Thus the formula is invalid for any levering or unlevering operations in general if the company's debt beta is not zero or the risk is systematic⁶.

V. Conclusions

We have demonstrated in this short note what the Hamada leverage adjustment is and how it should be applied. We also pointed out that one of the applications of this formula is in the context of capital cost estimation in the rate case proceedings for public utilities. That application involves an adjustment based upon the book values of debt and equity of the utility. We illustrate how such an adjustment leads to an incorrect estimate of the beta used in the Capital Asset Pricing Model formula, which in turns leads to an estimated required return on equity that is too large. While this

adjustment is used to justify the higher requested return on equity by utilities, this is an incorrect use of the Hamada equation adjustment. We have pointed out the invalidity of the adjustment process using book values for debt and equity as the theory underlying the Hamada equation requires a debt/equity ratio based upon market values. In other words, if the adjustment is to be correct there is no room for the use of book values.

Many analysts in the past rate proceedings have pointed out various issues with the application of the Hamada leverage adjustment; however, to our knowledge, there is no clear demonstration of how this Hamada leverage adjustment application is invalid in its process. It is our hope that practitioners engaged in the estimation of utility cost of capital recognize the issues we raise and the biases that can arise from the incorrect application of the Hamada adjustment. Our second objective with this note is to inform the many jurisdictional authorities faced with the task of deciding on rate adjustments of the potential biases we have highlighted. Perhaps, these decision makers have recognized the potential problems we outline as no such Hamada adjustment has yet been allowed in any utility rate proceedings to our knowledge. However, this is not to say that cost of capital witnesses have not been advocating the type of book value debt/equity adjustment we have illustrated which makes the information we provide both timely and of potentially important. In our opinion, due to its lack of theoretical support and the upward bias it introduces, the idea of making the so-call book value leverage adjustment to beta should be put to rest.

Footnotes

¹ The general practice in the rate making process, however, is to use book value capital structure in weighting the cost of capital, for some reasons, see, for example, Roger A. Morin, *New Regulatory Finance, Public Utilities Reports, Inc.*, 2006, page 452. This has been another important and interesting issue in the practice. However, it goes beyond the scope of this note.

² We do not take up the issue of what an 'optimal' capital structure might be for any particular utility. Some argue this can be inferred by looking at industry averages, but that presumes the industry participants are themselves choosing optimally. Needless to say, the concept of what is an optimal capital structure is by no means a resolved issue.

³ The market value of equity can be based on the market capitalization. Utility debt instruments are frequently not traded and so do not have observable market prices. However, under current reporting requirements, fair value estimates of a utility's debt can be obtained from the utility's 10K report.

⁴ Again, the notion of two different financial risks is dubious as a company cannot have two different measures of financial risks that are not the same.

⁵ See a study of bond returns by Backaert and De Santis, "Risk and return in international corporate bond markets", *Journal of International Financial Markets, Institutions & Money*, Vol. 72, 2021.

⁶ By systematic we mean that the returns on the bond vary with the returns on a market index the way the returns on a stock vary with an index. Conine demonstrated that the Hamada formula is not compatible with the assumption of issuing risky debt. See Conine, T. (1980) *Corporate Debt and Corporate Taxes: An Extension*. The *Journal of Finance*, 35(4), 1033-1037.



Joshua Denzler

He | Him | His

Consultant

jdenzler@5lakesenergy.com

Expertise

Electric utility distribution system planning and operations, distribution system costs, allocation of all utility costs, and incremental revenues and costs associated with new loads.

Selected Projects

- Expert witness testimony and supporting analyses in regulatory dockets before the Michigan Public Service Commission (MPSC) with a focus on evaluating overall utility performance relative to rates, conducting cost/benefit analysis of utility investments, applying various analytical methodologies to assess reasonableness of estimates used in ratemaking, reviewing cost-of-service studies for equity and fairness of cost allocations, and ensuring that the reactive savings generated from capital investments are reflected in rate design.

Past Employment

- Director, Sales Innovation (Data Science/Utility Sector) | E Source | Boulder, CO | 2023-2024
- Senior Strategist, Corporate Strategy | DTE Energy | Detroit, MI | 2022-2023
- Senior Strategist, Electric Distribution Operations | DTE Energy | Detroit, MI | 2021-2022
- Strategist, Electric Distribution Operations | DTE Energy | Detroit, MI | 2019-2021
- Apprentice Planner (Distribution Lines Designer) | DTE Energy | Detroit, MI | 2017-2019

Education

- Bachelor of Business Administration | University of Michigan, Ross School of Business | 2017

Awards, Affiliations, and Service

- Member, Staff-Parish Relations Committee | Berkley/Birmingham United Methodist Church | Berkley, MI | 2023-Present
- Trustee, Board of Education | Lake Shore Public Schools | Beverly Hills, MI | 2017-2022

DTE Electric Company
One Energy Plaza, 1635 WCB
Detroit, MI 48226-1279



Paula Johnson-Bacon
(313) 235-7052
paula.bacon@dteenergy.com

June 14, 2024

Ms. Lisa Felice
Executive Secretary
Michigan Public Service Commission
7109 West Saginaw Hwy.
Lansing, MI 48917

Re: In the matter on the Commission's own motion of the investigation into methods to improve the reliability of electric service in Michigan
MPSC Case No. U-12270

Dear Ms. Felice:

Pursuant to the Commission's December 20, 2022 Order in the above-referenced matter, attached please find DTE Electric Company's 2023 MPSC Service Quality and Reliability Standards for Electric Utilities R460.731 Annual Report.

Very truly yours,

**Paula Johnson-
Bacon**

Digitally signed by Paula
Johnson-Bacon
Date: 2024.06.14 16:16:38 -04'00'

Paula Johnson-Bacon

PJB/cdm
Attachment

MPSC Service Quality and Reliability Standards for Electric Utilities
 R460.731 Annual Report

Utility or Cooperative:	DTE Energy Co.
Year:	2023

SUMMARY TABLE R460.732(a)

	Meter Reading Factor R460.732 (a)	New Service Installation Factor R460.732(b)	Wire Down Relief Factor R460.732 (c)		All Conditions R460.732 (d)	Outage Restoration			CEMII	
			The percentage of the first responder guarded down wires that are relieved by an electric utility representative within 120 minutes after notification in MSAs.	The percentage of the first responder guarded down wires that are relieved by an electric utility representative within 180 minutes after notification in non-MSAs.		Normal Conditions R460.732 (e)	Gray-Sky Conditions R460.732 (f)	Catastrophic Conditions R460.732 (g)	Sustained Interruptions R460.732 (h)(i)	Number of Customers Experiencing 4 or More Sustained Interruptions
Utility or cooperative performance during year	98.95%	95.00%	85.15%	85.15%	85.18%	93.00%	81.93%	81.64%	13.38%	301,244
MPSC Annual Performance Standard	95% or more	90% or more completed within 15 business days	90% or more within 120 minutes in MSAs	90% or more within 180 minutes in non-MSAs	90% or more customers restored in 36 hours or less	90% or more customers restored in 8 hours or less	90% or more customers restored in 24 hours or less	90% or more customers restored in 48 hours or less	6% or less before 20:00; 5% or less in 20:00 or later	
Did utility or cooperative comply with performance standard (Yes/No)	Yes	Yes	No	No	No	Yes	No	No	No	

A detailed explanation of the steps the electric utility or cooperative is taking to bring its performance to an acceptable level. If more than 6% of customers experienced 4 or more sustained interruptions during the year, and that number is greater than 20,000, the utility must provide a description of all catastrophic conditions experienced during the year. If more than 6% of customers experienced 4 or more sustained interruptions within the year and that year was 2030 or a future year, a description of all catastrophic conditions experienced during the year is also required. (Can be put on a separate page.) R 460.732 (h)(i) and R 460.732 (h)(ii).

See Appendix 1 for Actions to Improve Reliability Performance
 See Appendix 2 for Description of Catastrophic Conditions

CUSTOMER CREDITS PROVIDED DURING THE YEAR

Item	Sector	Number of credits provided	Total Customer Credits (S)
Customer Credits Provided for Failure to Restore Service within 96 Hours of the Start of Sustained Interruption during Catastrophic Conditions R460.732(i)	Residential	35,977	350,099
	Commercial	2,218	7,630
	Industrial	0	0
Customer Credits Provided for Failure to Restore Service within 48 Hours of the Start of Sustained Interruption during Gray Sky Conditions R460.732(j)	Residential	11,417	408,211
	Commercial	1,006	34,160
	Industrial	0	0
Customer Credits Provided for Failure to Restore Service within 16 Hours of the Start of Sustained Interruption during Normal Conditions R460.732(k)	Residential	23,719	981,974
	Commercial	2,294	94,026
	Industrial	1	0
Customer Credits Provided to Individual Customers Who Experienced 6 or more Sustained Interruptions. R460.732(l)	Residential	123,671	3,824,838
	Commercial	7,701	187,566
	Industrial	0	73

WORST PERFORMING CIRCUITS DURING THE YEAR

1. For each electric utility with 1,000,000 or more customers, a list of its 10 worst performing circuits for the prior year in terms of SAIDI and SAIFI. For each listed circuit, provide the following information below. R460.732(m) and R 460.732 (o). Please see the definition of "circuit" below in (8).
 2. For each electric utility or cooperative with less than 1,000,000 customers, a list of the worst performing 1% of circuits for the prior year in terms of SAIDI and SAIFI. For each listed circuit, provide the following information below. R460.732(n) and R 460.732 (o). Please see the definition of "circuit" below in (8).

Worst performing circuits by SAIDI excluding major event days (MEDs) (7), (8), (11)										
Circuit Name	Circuit 1	Circuit 2	Circuit 3	Circuit 4	Circuit 5	Circuit 6	Circuit 7	Circuit 8	Circuit 9	Circuit 10
YPSIL0317	YPSIL0317	KNGSV0330	ARGO 0326	SNQVR0302	APLGT0311	LEXTN0770	NBOST0305	PULFD2155	SNQVR0301	DEAVR2004
0317	0317	0330	0326	0302	0311	0770	0305	2155	0301	2004
48198	48130	48103	48103	48472	48401	48450	48164	48214	48472	48230
11,997	48,731	8,004	8,004	28,331	28,331	131,348	11,997	7,711	20,116	5,774
2,373,722	2,292,419	1,875,499	1,826,883	1,692,591	1,520,611	1,595,941	1,520,611	1,505,443	1,464,118	1,454,669
SAIDI excluding MEDs										
SAIFI excluding MEDs	1.06	2.25	6.26	5.06	1.52	1.76	5.08	1.66	4.80	3.16
SAIDI all conditions	3,107.39	9,126.67	7,786.53	1,826.84	1,705.40	1,601.86	5,128.29	4,223.11	1,464.69	3,317.31
SAIFI all conditions	2.04	5.03	9.66	5.06	1.53	1.77	8.12	2.67	4.82	4.16
Number of Customers Served	1,392	657	409	415	463	3,221	454	497	188	357
Substation Name	YPSIL	KNGSY	ARGO	SNQVR	APLGT	LEXTN	NBOST	PULFD	SNQVR	DEAVR
Last Circuit Trim (year) (3)	2022	2023	2018	2014	2021	2022	2023	2023	2014	2021
List of Outages and Causes (can be put on a separate page) (4)	See Appendix 5	See Appendix 5	See Appendix 5	See Appendix 5	See Appendix 5	See Appendix 5	See Appendix 5	See Appendix 5	See Appendix 5	See Appendix 5
Corrective action to improve performance (can be put on a separate page)	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3
Worst performing circuits by SAIFI excluding MEDs (7), (8), (11)										
Circuit Name	Circuit 1	Circuit 2	Circuit 3	Circuit 4	Circuit 5	Circuit 6	Circuit 7	Circuit 8	Circuit 9	Circuit 10
CROWN9832	CROWN9832	ARGO 0326	HASKL1625	SNQVR0302	SNQVR0302	SDF012641	ARMAD0302	SNQVR0301	SDF39897	CABOT9490
9832	9832	0326	1625	0302	0302	2641	0302	0301	9897	9490
48197	48103	48103	48101	48472	48427	48427	48062	48172	48103	48162
34,321	8,004	4,791	4,791	53,511	21,311	28,991	28,991	20,116	10,691	3,741
SAIFI excluding MEDs	6.46	6.26	5.30	5.08	5.06	5.01	4.94	4.80	4.60	4.51
SAIDI excluding MEDs	767,516	1,875,499	1,134,776	1,520,611	1,826,883	1,392,721	861,141	1,464,118	444,591	334,776
SAIFI all conditions	9.48	9.66	7.69	8.12	5.06	5.02	6.28	4.82	8.65	9.46
SAIDI all conditions	2,623,691	7,786,531	7,689,971	5,128,291	1,826,884	1,403,261	3,159,271	1,464,691	7,593,201	2,470,581
Number of Customers Served	2,006	409	580	451	415	105	358	188	358	154
Substation Name	CROWN	ARGO	HASKL	SNQVR	SNQVR	SDF01	ARMAD	SNQVR	SDF33	CABOT
Last Circuit Trim (year) (3)	2022	2018	2019	2023	2014	2021	2020	2014	2020	2020
List of Outages and Causes (can be put on a separate page) (4)	See Appendix 6	See Appendix 6	See Appendix 6	See Appendix 6	See Appendix 6	See Appendix 6	See Appendix 6	See Appendix 6	See Appendix 6	See Appendix 6
Corrective action to improve performance (can be put on a separate page)	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3	See Appendix 3
CEM10	CEM10	CEM11	CEM12	CEM13	CEM14	CEM15	CEM16	CEM17	CEM18	CEM19
2,252,226	1,649,256	1,025,675	574,830	301,244	155,456	76,753	41,648	21,684	11,333	6,660
CEM10 Reporting R460.732(p) (5)	CEM10 Reporting R460.732(p) (5)	CEM11 Reporting R460.732(p) (5)	CEM12 Reporting R460.732(p) (5)	CEM13 Reporting R460.732(p) (5)	CEM14 Reporting R460.732(p) (5)	CEM15 Reporting R460.732(p) (5)	CEM16 Reporting R460.732(p) (5)	CEM17 Reporting R460.732(p) (5)	CEM18 Reporting R460.732(p) (5)	CEM19 Reporting R460.732(p) (5)
CEM10 Reporting R460.732(p) (6)	CEM10 Reporting R460.732(p) (6)	CEM11 Reporting R460.732(p) (6)	CEM12 Reporting R460.732(p) (6)	CEM13 Reporting R460.732(p) (6)	CEM14 Reporting R460.732(p) (6)	CEM15 Reporting R460.732(p) (6)	CEM16 Reporting R460.732(p) (6)	CEM17 Reporting R460.732(p) (6)	CEM18 Reporting R460.732(p) (6)	CEM19 Reporting R460.732(p) (6)
1,008,012	636,393	291,042								
CEM10 Reporting R460.732(p) (7)	CEM10 Reporting R460.732(p) (7)	CEM11 Reporting R460.732(p) (7)	CEM12 Reporting R460.732(p) (7)	CEM13 Reporting R460.732(p) (7)	CEM14 Reporting R460.732(p) (7)	CEM15 Reporting R460.732(p) (7)	CEM16 Reporting R460.732(p) (7)	CEM17 Reporting R460.732(p) (7)	CEM18 Reporting R460.732(p) (7)	CEM19 Reporting R460.732(p) (7)
1,008,012	636,393	291,042								
MOMENTARY INTERRUPTIONS										
Number of Non-Residential Customers Experiencing Momentary Interruptions R460.732(r)	N/A									

Year	System-wide SAIDI, SAIFI, and CAIDI (9)						Excludes MEDs (11)											
	All conditions			SAIFI			CAIDI			SAIDI			SAIFI			CAIDI		
	Annual	5 year average	SAIFI	Annual	5 year average	SAIFI	Annual	5 year average	CAIDI	Annual	5 year average	SAIDI	Annual	5 year average	SAIFI	Annual	5 year average	CAIDI
2019	466	506	1.37	1.22	340	396	189	0.99	1.14	202	189	0.99	1.14	178	190			
2020	352	521	1.29	1.28	274	396	180	1.02	1.01	142	180	1.02	1.02	140	177			
2021	927	659	1.40	1.40	587	465	171	1.02	0.92	136	171	1.02	0.92	147	167			
2022	584	563	1.25	1.37	467	405	161	0.98	0.98	146	161	0.98	0.98	149	157			
2023	1542	774	1.72	1.44	895	513	157	0.86	0.86	157	157	0.86	0.86	183	159			

Power Quality Information (10)

<p>Power quality information shall contain data on:</p> <p>a) all power quality investigations conducted in the past year for industrial customers who have requested a power quality investigation as a result of an event originating from utility equipment; and</p> <p>b) power quality investigations conducted in the past year into any power quality event. For purposes of this form, a power quality event is defined as an event that affected customers on a single circuit or substation; resulted in damage to customer appliances, equipment, or wiring; and occurred within a 24-hour period. (Can be put on a separate page or pages.)</p>	<p>See Appendix 4</p>
---	-----------------------

DEFINITIONS AND NOTES

- (1) "Total customer credits" means the dollar amount of customer credits provided on customer bills during the year.
- (2) "Location of Circuit - Zip codes" refers to the zip codes where spans of the circuit are located.
- (3) "Last circuit trim (year)" is the last year there was trimming on the circuit as part of a normal tree trim cycle (not reactive trimming)
- (4) "List of outages and causes" - please discuss outages that meet the definition of a "major interruption" as defined by R. 460.3102(i)
- (5) For CEM10+ reporting, please provide percentages. Reporting should be all conditions.
- (6) For CELID reporting, please provide percentages. Reporting should be all conditions and follow the definition of CELID Single Interruption Duration per IEEE 1366-2022 section 4.2.8. Do not double count multiple outages of that fall within the same time bracket. For example, a customer experiencing two nine-hour outages should only be reported once in CELID8hrs. Longer outages may qualify for inclusion in multiple CELID metrics. For example, a customer experiencing a 30-hour outage may be reported in CELID8hrs and CELID24hrs.
- (7) For the worst performing circuits sections, SAIDI and SAIFI should be calculated on a system basis. Worst performing circuits operated by utilities and cooperatives with less than 1,000,000 customers should not be compared to worst performing circuits that are operated by utilities with 1,000,000 or more customers.
- (8) For the worst performing circuits sections, a circuit is defined as a substation feeder or line exit from a substation serving at least 10 metered customers.
- (9) The system-wide SAIDI, SAIFI, and CAIDI data is requested pursuant to MCL 460.65 and the July 7, 2023 order in Case No. U-12270.
- (10) Power quality information is being requested pursuant to the July 7, 2023 order in Case No. U-12270.
- (11) Major event day, or MED, is defined according to IEEE 1366-2022.
- * A customer shall be defined as a "metered electric service."
- ** Interruptions that occur as a result of outages on customer-owned facilities, or loss of supply from another utility, should not be included in IEEE reliability index calculations.

Appendix 1 - Actions to Improve Reliability Performance

In 2023, the performance of the Company's system missed several Service Quality and Reliability metrics, including Wire Down Relief Factor, Outage Restoration under all but normal conditions, and CEMI4. The metrics are reported in the standard template.

The primary contributing factor to performance below the standard for these metrics in 2023 was multiple catastrophic storms. In particular, the Company experienced three storms that were catastrophic by the MPSC's definition (>10%) of customers impacted, including an ice storm that started in February and extended into March, as well as two severe thunderstorms, one each in July and August.

The company has taken several actions to improve the Wire Down Relief Factor metrics, including increasing the number of resources both across the Company and through external contractors that can be mobilized to secure downed wires, and increasing the capacity to dispatch resources to downed wires, including enhancing technology to optimize dispatch. The Company's investments in Distribution Automation and the associated ground detection benefits can reduce the number of energized downed wires. Maintain the improved direct communication/reporting process with fire departments.

The Company has filed a comprehensive plan to modernize and strengthen the grid with a portfolio of both near- and longer-term initiatives as part of its 2023 Distribution Grid Plan (DGP). This plan will improve both reliability and safety for our customers and improve performance relative to the Service Quality and Reliability Standards' metrics.

In general, the goals of the investments over the next five years are to:

- Stabilize the system with equipment hardening programs to eliminate outages in the face of more frequent and extreme storms. These programs will drive down the volume of wire down events, improving the Wire Down Relief Factor metric. A reduction in outage events will improve both the CEMI4 metric and Outage Restoration (all conditions).
- Increase the level of automated restorations (smart grid technology) by adding up to 10,000 reclosers to the system to reduce the size and duration of customer outages. Reclosers placed at the start of circuits will be able to detect and de-energize wire-downs, reducing electrical hazards and improving Wire Down Relief Factor. The ability to sectionalize and restore sections of circuits through automation will improve Outage Restoration metrics.
- Continue to modernize the grid through substation and circuit voltage conversion projects and subtransmission upgrades to improve reliability by replacing end of life equipment; installing the latest automation technology, which will improve safety by eliminating energized wire-downs; and adding capacity for DER and electrification. DTE's four investment pillars help to facilitate these goals (information on each pillar is contained within DTE's 2023 DGP's filing U-20147):
 - Tree Trimming
 - Infrastructure Resilience and Hardening
 - Infrastructure Redesign and Modernization
 - Technology and Automation

The strategic capital plan outlined in the DGP will improve performance in Wire Down Relief, Outage Restoration, and CEMI4. Many of the investments in programs and projects will provide benefits across multiple metrics of wire down events (Wire Down Relief), and outage duration (Outage Restoration) and frequency of events (CEMI4).

Appendix 2 – Description of Catastrophic Conditions

Storm Name	2023003	2023005	2023006	2023007	2023008
Date Storm Began	2/22/2023	6/25/2023	7/20/2023	7/26/2023	8/23/2023
Date Storm Ended	3/7/2023	6/28/2023	7/23/2023	7/30/2023	8/30/2023
Storm Type	Ice	Thunderstorm	Thunderstorm	Thunderstorm	Thunderstorm
Customers Interrupted (#)	866,257	161,244	177,427	364,968	462,108
Storm Duration (hours)	318.0	77.5	79.0	102.0	161.0
Duration of restoration efforts (hours)	323.0	132.0	241.0	166.0	265.0
Date restoration efforts ended	3/7/2023	6/30/2023	7/30/2023	8/2/2023	9/3/2023
spent per event (\$)	\$ 2,766	\$ 3,670	\$ 4,017	\$ 3,930	\$ 5,192
paid in outage credits (\$)	\$ 2,989,455	\$ 441,840	\$ 295,275	\$ 381,455	\$ 496,685
Non-baseload resources requested (Y/N)	Y	Y	Y	Y	Y
Company linemen used (#)	484	485	486	496	508
contractor workers used (#)	551	569	585	513	511
non-baseload workers used (#)	1,564	402	497	1,258	1,218
Company crews used (#)	86	88	66	65	75
Contractor crews used (#)	154	170	160	140	147
Non-baseload crews used (#)	441	125	142	353	336
Wire down personnel used (#)	1,318	316	270	584	296
Downed wires	14,202	1,452	1,386	3,338	4,684
Non-baseload resources cost (\$)	\$145,472,850	\$ 16,932,512	\$ 16,804,571	\$ 42,328,278	\$ 59,030,063

Appendix 3 - Corrective Action Plans to Improve SAIDI/SAIFI Performance

Identifier	Circuit Name and Number	Corrective Action
SAIDI-01	YPSIL0317	Circuit automation - 2024
SAIDI-02	KNGSY0330	Tree Trim - 2023
SAIDI-03	ARGO 0326	4.8kV Conversion - Ongoing
SAIDI-04	SNOVR0302	Customer Excellence – 2023 – spot tree trimming, crossarms and associated pole top hardware replaced at various locations 4.8kV Conversion – 2023 – one section of circuit converted and transferred to neighboring 13.2kV circuit
SAIDI-05	APLGT0311	Single event contributed 75% of customer-minutes resolved at that time
SAIDI-06	LEXTN8770	Single event contributed 78% of customer-minutes resolved at that time
SAIDI-07	NBOST0305	Tree Trim - 2023
SAIDI-08	PULFD2155	Tree Trim - 2023 4.8kV Conversion - Ongoing
SAIDI-09	SNOVR0301	Customer Excellence – 2023 – spot tree trimming, crossarms and associated pole top hardware replaced at various locations
SAIDI-10	DENVR2004	Reliability project – 2023 – added fusing and sectionalizing options, reconductoring at various locations, pole replacements at various locations
SAIFI-01	CROWN9832	Customer Excellence – 2023 – spot tree trimming, crossarms and associated pole top hardware replaced at various locations
SAIFI-02	ARGO 0326	4.8kV Conversion - Ongoing
SAIFI-03	HASKL1625	Circuit automation - 2024
SAIFI-04	NBOST0305	Tree Trim - 2023
SAIFI-05	SNOVR0302	Customer Excellence – 2023 – spot tree trimming, crossarms and associated pole top hardware replaced at various locations 4.8kV Conversion – 2023 – one section of circuit converted and transferred to neighboring 13.2kV circuit
SAIFI-06	SDF012641	Customer Excellence – 2023 - crossarms and associated pole top hardware replaced at various locations
SAIFI-07	ARMAD0302	Customer Excellence – 2023 - spot tree trimming, crossarms and associated pole top hardware replaced at various locations Replaced recloser that led to one of the large outages
SAIFI-08	SNOVR0301	Customer Excellence – 2023 – spot tree trimming, crossarms and associated pole top hardware replaced at various locations
SAIFI-09	SDF339897	Customer Excellence - 2023, 2024 - spot tree trimming, crossarms and associated pole top hardware replaced at various locations
SAIFI-10	CABOT9490	Customer Excellence – 2023 - spot tree trimming, crossarms and associated pole top hardware replaced at various locations

Appendix 4 – Power Quality Resolution Process

Power Quality Inquiry Process

DTE Electric (DTE) has a proven effective process in place that enables its large industrial and commercial customers typically served off the sub-transmission or transmission system to obtain resolution of power quality issues. The customers contact their assigned account representative who in turn starts the process of helping the customer by engaging the appropriate engineer in Distribution Operations. DTE and ITC Transmission (ITCT) have a very successful process concerning the transmission system events.

The response to the customer normally includes the following steps:

- (1) Obtain pertinent information about what is troubling the customer (old or new equipment, one device or many)
- (2) Gather the dates and times from the customer to correlate with EMS Alarm Logger events (cap switching, line trips)
- (3) Correlate the customer's experiences with the power quality meters at the service point or with power quality meters in the area
- (4) Meet with the customer about the correlation of system and customer events.

Based on the correlation of DTE and customer events, the following outcomes or additional steps are possible:

- (1) Special power quality monitoring (DTE or customer) could be installed to determine customer equipment sensitivity and source of problem.
- (2) Customer conducts site survey to determine if his operating voltage is optimal
- (3) Trouble with minor sags from DTE system (sensitive equipment) - customer's responsibility to make compatible.
- (4) Internal system trouble - customer's responsibility to make equipment compatible
- (5) ITCT/DTE will seek resolution of problems caused on the ITCT/DTE systems where the customer equipment wouldn't be expected to have ride-through to significant voltage sags. The rate of occurrence, system exposure and service method determine if remedies are commercially feasible.

Power Quality Monitoring

DTE has an array of power quality meters across its system at key industrial, sub-transmission, and distribution buses that have proven to be very effective. New meters are installed at new or upgraded industrial substations and on sub-transmission buses.

The power quality meters at the industrial locations allow DTE to correlate the recorded voltage sags with system events from the SCADA-EMS system. This system provides DTE with information unique to the customer and a tool to track the performance of the system. The system performance data is used to prioritize capital improvements and system maintenance.

The power quality meters on the sub-transmission and distribution buses provide system performance data. This information will reduce the time and cost to find causes of voltage sags and facilitate repair the system when necessary.

Also, voltage sags on the DTE system can be correlated with faults on the ITCT system. The DTE power quality data is shared with ITCT for the benefit of resolving customer power quality issues.

2023 Power Quality Inquiries Summary

The data below indicates the number of customer inquiry and related power quality events correlated by DTE – Distribution Operations in 2023. Each power quality issue is categorized by service methods, power quality events, source of events.

Inquiries			Power Quality Event ¹		PQ Event Source			Detail ⁶
Month	Total	Loc. Impacted ²	Voltage Sag	Interruption	DTE ³	ITCT ⁴	Customer ⁵	Inquiry Numbers
Jan	0	0	0	0	0	0	0	
Feb	1	1	0	1	1	0	0	10339
Mar	0	0	0	0	0	0	0	
Apr	2	2	2	0	2	0	0	10340, 10341
May	2	2	2	0	1	0	1	10342, 10343
June	0	0	0	0	0	0	0	
July	3	3	2	1	0	1	2	10344, 10345, 10346
Aug	2	2	0	2	1	1	0	10341, 10347
Sept	2	2	1	1	0	1	1	10343, 10345
Oct	2	2	1	1	0	1	1	10340, 10347
Nov	1	1	1	0	0	0	0	10348
Dec	1	1	1	0	0	1	1	10348
Year	16	16	10	6	5	5	6	

- 1 Voltages and durations (IEEE Std 1159 Table 2 – Categories & Typical Characteristics of Power System Phenomena)
- 2 Number of unique customer locations impacted per system event ID
- 3 Equipment owned by DTE (120, 40, 24, 13.2 and 4.8 kV)
- 4 Equipment owned by ITCT (345, 230 and 120 kV)
- 5 Equipment owned by the customer or other power systems not owned by DTE or ITCT
- 6 Inquiry numbers – event detail provided in the table below

The number of locations impacted by customer inquiries was 16 during 2023.

The follow-up investigations indicate that most of the power quality events were due to either voltage sags (62.5%) or interruptions (37.5%) and correlated with trouble occurring on the DTE (31.25%) systems, ITCT (31.25%) systems and possible customer equipment failure (37.5%).

Line clearance, system modifications such as operating practice changes, equipment replacement or maintenance, and adding animal guards/protection are all typical actions taken to reduce the occurrences of the events.

The following table lists information about each inquiry:

Inquiry	Date - Time	System Event	PQ Event	Comments
10339	02/15/2023 10:11	TIE 6931	Interruption	Unknown
10340	04/05/2023 01:27	STERLING TRK 2742	Interruption	Animal Intrusion
10340	10/26/2023 18:00	STERLING TRK 2742	Interruption	Third party interference
10341	04/05/2023 02:58	OLIVER TIE 7520	Unknown	Unknown
10341	08/14/2023 15:56	PIGEON - RANDOLPH 3209	Interruption	Line Equipment
10342	05/09/2023 18:10	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/09/2023 22:23	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/10/2023 02:06	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/10/2023 03:16	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/10/2023 20:10	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/11/2023 01:59	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/11/2023 02:03	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/15/2023 01:55	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/17/2023 01:57	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/17/2023 03:45	Limited Data to identify affected elements	Unknown	Possible Customer
10342	05/17/2023 05:20	Limited Data to identify affected elements	Unknown	Possible Customer
10343	05/22/2023 05:23	STANT DC 8393	Voltage sag	Line Equipment
10343	09/19/2023 19:38	STANT PL 8327	Voltage sag	Line Equipment
10344	07/5/2023 08:43	Limited Data to identify affected elements	Unknown	Possible Customer
10345	07/10/2023	Limited Data to identify affected elements	Unknown	Possible Customer
10345	07/13/2023*	Limited Data to identify affected elements	Unknown	Possible Customer
10345	09/09/2023 16:14*	LALLENDORF-MONROE	Interruption	Line Equipment
10346	07/30/2023 15:26	CUSTER-MONROE	Interruption	Line Equipment
10347	10/04/2023 17:33	ALFRED 120kV	Interruption	Animal Interference
10347	08/24/2023 00:35*	LINCOLN-NORTHEAST-NORTHWEST	Interruption	Storm outage
10348	11/13/2023 21:29	BROWNSTOWN-ENRICO FERMIN	Voltage sag	Unknown
10348	12/11/2023 15:18	Limited Data to identify affected elements	Unknown	Possible Customer

*System shows other customers affected during this time, but no additional complaints were found

Appendix 5

Outage and Cause Listing - Worst performing circuits by SAIDI excluding Major Event Days - Circuit Basis

Ref#	Metric	Rank	Circuit	MED	Storm	Interruption Date/Time	Customers Interrupted	Customer Minutes Interrupted	Cause ¹
SAIDI-01	SAIDI	1	YPSIL0317	-		01/25/23 14:44	1	1,742	Equipment
SAIDI-01	SAIDI	1	YPSIL0317	-		01/26/23 00:25	1	71	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		01/26/23 00:25	1	71	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		02/04/23 16:22	1	5	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 17:44	1	9,923	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 18:35	1	8,372	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 18:38	47	139,914	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 20:25	1	8,301	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 20:28	1	4,235	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 20:56	1	9,483	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 20:58	1	9,707	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 21:08	1	6,913	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 21:21	1	9,572	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 21:21	1	9,572	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 21:46	2	144	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 22:12	1	8,360	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/22/23 23:56	1	16	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/23/23 06:02	2	12,904	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/23/23 11:53	1	8,706	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/23/23 14:32	2	27	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/23/23 15:51	4	50	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/23/23 23:17	1	17	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/23/23 23:25	142	384,548	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/24/23 14:40	1	68	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/24/23 21:34	1	39	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/24/23 23:42	1	23	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/25/23 09:04	1	117	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/25/23 11:43	1	6	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/25/23 16:43	2	26	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	02/25/23 23:09	1,293	3,259,696	Weather
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	02/25/23 23:09	1	2,544	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/27/23 22:48	1	15	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/28/23 05:32	1	8	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	02/28/23 07:26	1	6	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	02/28/23 10:12	12	225	Vegetation

¹ *The "Other" category includes but is not limited to: customer equipment; intentional; and other utility causes.

SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	02/28/23 10:12	1	19	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	02/28/23 10:12	1	19	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	02/28/23 11:16	1	25	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	02/28/23 16:37	1	10	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	02/28/23 21:47	1	9	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	03/01/23 13:22	1	30	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	03/02/23 03:35	1	8	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	03/02/23 05:38	2	72	Vegetation
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	03/02/23 11:22	1	42	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	03/02/23 12:16	1	137	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	03/03/23 20:27	1	2,348	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	03/03/23 21:37	1	1,262	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	03/03/23 21:42	1	1,246	Equipment
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	03/04/23 16:59	17	5,187	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	03/04/23 17:12	46	28,036	Weather
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	03/05/23 11:10	1	345	Weather
SAIDI-01	SAIDI	1	YPSIL0317	-	Cat	03/07/23 08:45	1	162	Weather
SAIDI-01	SAIDI	1	YPSIL0317	-		03/09/23 10:15	1	40	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		03/09/23 14:20	1	223	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		03/10/23 05:12	63	20,175	Equipment
SAIDI-01	SAIDI	1	YPSIL0317	-		03/10/23 05:12	27	10,292	Equipment
SAIDI-01	SAIDI	1	YPSIL0317	-		03/15/23 07:53	8	3,623	Other
SAIDI-01	SAIDI	1	YPSIL0317	-	Small	03/27/23 08:19	1	35	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		05/10/23 08:44	1	366	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		06/02/23 09:06	1	7	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		06/07/23 11:02	1	55	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		06/11/23 17:42	1	1,138	Vegetation
SAIDI-01	SAIDI	1	YPSIL0317	-		06/16/23 19:16	1	8	Equipment
SAIDI-01	SAIDI	1	YPSIL0317	-		06/21/23 15:36	1	160	Equipment
SAIDI-01	SAIDI	1	YPSIL0317	-		06/21/23 15:36	1	160	Vegetation
SAIDI-01	SAIDI	1	YPSIL0317	MED	Small	06/25/23 18:13	2	2,894	Weather
SAIDI-01	SAIDI	1	YPSIL0317	-		07/19/23 10:20	7	303	Planned
SAIDI-01	SAIDI	1	YPSIL0317	-		07/25/23 10:08	12	429	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	07/26/23 15:08	3	13,507	Weather
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	07/27/23 13:39	1,069	328,976	Weather
SAIDI-01	SAIDI	1	YPSIL0317	-		08/15/23 11:49	8	212	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		08/15/23 11:49	1	27	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		08/16/23 17:22	2	829	Equipment
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	08/24/23 03:23	1	2,205	Other
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	08/24/23 03:24	1	2,205	Vegetation
SAIDI-01	SAIDI	1	YPSIL0317	MED	Cat	08/24/23 22:27	2	2,336	Vegetation
SAIDI-01	SAIDI	1	YPSIL0317	-		09/12/23 11:48	2	43	Equipment
SAIDI-01	SAIDI	1	YPSIL0317	-		10/12/23 14:11	2	448	Other

SAIDI-01	SAIDI	1	YPSIL0317	-		12/03/23 18:36	1	18	Wildlife
SAIDI-01	SAIDI	1	YPSIL0317	-		12/09/23 15:42	1	9	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		12/15/23 12:10	1	372	Other
SAIDI-01	SAIDI	1	YPSIL0317	-		12/23/23 14:37	1	11	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		01/01/23 09:10	1	137	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		01/08/23 10:39	1	82	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		01/11/23 10:18	2	33	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		02/02/23 12:01	1	58	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		02/02/23 12:01	269	15,529	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		02/02/23 12:01	1	58	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		02/02/23 12:01	1	58	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		02/13/23 12:58	1	18	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	02/22/23 21:30	497	2,903,057	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	02/22/23 23:59	1	5,347	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	02/23/23 10:12	1	5	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	02/23/23 11:01	1	232	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	02/23/23 12:37	1	5	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	02/23/23 13:12	1	5,919	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	02/24/23 05:07	154	788,813	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	02/24/23 05:08	2	9,958	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	02/24/23 13:11	1	3,148	Other
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	02/26/23 12:38	1	266	Weather
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	02/26/23 17:59	1	1,277	Other
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	02/26/23 18:00	1	1,276	Other
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	02/28/23 12:39	1	33	Other
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	03/01/23 13:54	1	1,774	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	03/03/23 20:06	1	2,771	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	03/03/23 20:50	1	2,501	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	03/04/23 00:44	1	3,853	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	03/04/23 07:55	1	458	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	03/05/23 02:29	1	2,307	Weather
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	03/06/23 15:03	1	112	Weather
SAIDI-02	SAIDI	2	KNGSY0330	-		03/08/23 10:50	1	33	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		03/08/23 10:50	1	34	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		03/12/23 19:47	82	7,392	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		03/12/23 19:47	5	451	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		03/13/23 10:25	273	23,023	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		03/16/23 11:57	3	33	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		03/16/23 11:57	1	11	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		03/16/23 11:57	1	11	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		04/05/23 13:07	1	49	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		04/21/23 18:19	1	42	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		04/22/23 15:37	1	238	Other

SAIDI-02	SAIDI	2	KNGSY0330	-		04/24/23 09:22	1	7	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		05/01/23 11:10	1	105	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		05/01/23 11:47	1	387	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		05/10/23 11:44	1	158	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		05/10/23 23:14	25	1,846	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		05/11/23 15:19	1	32	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		05/16/23 09:05	1	60	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		05/16/23 09:52	1	340	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		05/16/23 12:31	1	88	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		05/17/23 09:11	1	30	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		05/17/23 09:16	1	87	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		06/11/23 08:32	1	81	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		06/22/23 14:11	1	8	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Small	06/25/23 18:18	1	24	Weather
SAIDI-02	SAIDI	2	KNGSY0330	-		07/16/23 10:41	1	11	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED		07/20/23 02:00	1	105	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED		07/20/23 02:00	80	8,394	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Small	07/20/23 15:31	1	461	Other
SAIDI-02	SAIDI	2	KNGSY0330	-	Small	07/23/23 13:00	2	340	Vegetation
SAIDI-02	SAIDI	2	KNGSY0330	-	Small	07/23/23 13:01	3	17	Other
SAIDI-02	SAIDI	2	KNGSY0330	-	Small	07/23/23 14:06	1	109	Other
SAIDI-02	SAIDI	2	KNGSY0330	-	Small	07/23/23 14:10	1	101	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		07/23/23 23:35	2	1,689	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		07/23/23 23:35	1	844	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		07/23/23 23:35	1	844	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		07/24/23 11:00	1	36	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/26/23 17:11	6	212	Vegetation
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/26/23 17:59	60	8,531	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/26/23 19:15	1	31	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/26/23 23:37	3	62	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/26/23 23:47	222	100,145	Vegetation
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/27/23 07:35	1	7	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/27/23 08:36	1	149	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/27/23 12:38	1	86	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/27/23 13:30	10	260	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/27/23 14:49	6	163	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/27/23 15:35	2	14	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/27/23 16:11	1	11	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 02:33	1	17	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 03:19	3	49	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 04:08	1	644	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 04:08	644	304,007	Vegetation
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 04:08	12	5,973	Vegetation

SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 04:08	1	644	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 04:08	1	591	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 04:08	4	2,575	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 04:08	1	591	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	07/28/23 04:08	1	591	Weather
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	07/29/23 04:35	1	2,349	Other
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	07/29/23 04:35	1	2,349	Weather
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	07/29/23 04:36	1	2,349	Weather
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	07/29/23 04:36	4	9,396	Vegetation
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	07/29/23 04:36	596	1,395,078	Vegetation
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	07/29/23 04:36	4	9,396	Vegetation
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	07/29/23 04:36	2	4,698	Vegetation
SAIDI-02	SAIDI	2	KNGSY0330	-	Cat	07/29/23 04:36	1	2,349	Weather
SAIDI-02	SAIDI	2	KNGSY0330	-		08/11/23 12:12	1	34	Planned
SAIDI-02	SAIDI	2	KNGSY0330	-		08/13/23 13:22	2	161	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	08/24/23 02:58	1	736	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	08/24/23 21:54	3	22	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	08/24/23 22:04	1	2,376	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	08/24/23 22:15	3	3,342	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	08/24/23 22:18	54	207,515	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	08/24/23 22:18	25	96,071	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	08/24/23 22:18	4	15,372	Weather
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	08/25/23 06:05	3	18	Other
SAIDI-02	SAIDI	2	KNGSY0330	MED	Cat	08/26/23 02:21	2	2,088	Weather
SAIDI-02	SAIDI	2	KNGSY0330	-		09/11/23 13:26	1	95	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		09/14/23 11:09	1	124	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		09/14/23 16:30	2	178	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		09/24/23 22:37	1	891	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		10/02/23 12:49	1	71	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		10/02/23 12:50	1	69	Planned
SAIDI-02	SAIDI	2	KNGSY0330	-		10/10/23 10:00	2	305	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		10/11/23 16:06	83	8,665	Planned
SAIDI-02	SAIDI	2	KNGSY0330	-		10/14/23 09:32	1	5	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		10/18/23 12:24	1	90	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/01/23 09:02	1	103	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/04/23 10:35	1	58	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/08/23 10:38	1	49	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/08/23 21:44	1	294	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/10/23 09:19	1	91	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/11/23 13:23	1	21	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/14/23 09:23	1	27	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/15/23 08:25	1	96	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/19/23 09:40	2	50	Other

SAIDI-02	SAIDI	2	KNGSY0330	-		11/20/23 09:19	1	19	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/22/23 09:46	1	220	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/22/23 11:43	1	16	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/23/23 10:04	1	90	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/23/23 13:47	1	29	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/28/23 11:06	1	153	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		11/30/23 11:43	1	120	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		12/06/23 12:22	2	403	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		12/08/23 10:12	1	334	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		12/11/23 14:35	1	6	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		12/24/23 06:01	39	5,084	Equipment
SAIDI-02	SAIDI	2	KNGSY0330	-		12/24/23 06:01	6	524	Other
SAIDI-02	SAIDI	2	KNGSY0330	-		12/31/23 13:15	1	285	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		01/01/23 01:54	170	90,380	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		01/01/23 07:57	228	38,490	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	-		01/09/23 10:27	1	54	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		01/09/23 10:28	3	236	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		01/10/23 10:27	13	1,265	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		01/10/23 12:56	3	200	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	-		01/11/23 10:17	7	441	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		01/11/23 12:34	10	720	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		01/12/23 10:42	1	20	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		01/12/23 10:42	5	100	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		01/18/23 10:17	3	468	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		01/24/23 10:21	8	946	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		01/30/23 09:55	13	1,698	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		02/01/23 15:02	1	36	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		02/01/23 15:02	395	14,106	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	-		02/01/23 15:03	1	36	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		02/04/23 08:36	1	36	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		02/06/23 10:02	10	839	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		02/06/23 10:02	2	168	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		02/07/23 10:17	14	1,290	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		02/10/23 13:04	3	279	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		02/14/23 10:03	4	721	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		02/17/23 10:12	1	154	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		02/18/23 10:28	6	672	Planned
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	02/22/23 21:20	1	5,365	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	02/22/23 22:37	1	1,124	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	02/23/23 10:40	1	323	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	02/23/23 12:22	6	27,361	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	02/23/23 20:40	377	114,541	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	02/24/23 02:52	355	1,329,035	Weather

SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	02/24/23 02:52	27	97,019	Weather
SAIDI-03	SAIDI	3	ARGO 0326	-	Cat	02/26/23 16:36	1	2,598	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	Cat	03/01/23 11:21	1	324	Weather
SAIDI-03	SAIDI	3	ARGO 0326	-	Cat	03/01/23 11:40	1	43	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	Cat	03/01/23 18:03	5	258	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	03/03/23 15:30	1	31	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	03/03/23 21:54	1	2,481	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	03/04/23 03:42	1	595	Weather
SAIDI-03	SAIDI	3	ARGO 0326	-		04/15/23 23:43	4	719	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		04/15/23 23:43	9	1,656	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		04/17/23 12:26	7	155	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		04/20/23 09:06	1	11	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		04/21/23 07:50	1	77	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		04/23/23 09:04	1	174	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		04/23/23 09:04	3	522	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		04/28/23 10:29	1	7	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	-		05/04/23 09:27	1	90	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		05/04/23 16:27	1	101	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		05/10/23 18:17	1	19	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		05/17/23 09:57	1	269	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		05/19/23 23:06	42	17,137	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/19/23 23:10	1	338	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/19/23 23:10	1	338	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/19/23 23:10	43	15,657	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/19/23 23:10	26	8,788	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/19/23 23:10	193	81,493	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/19/23 23:10	20	6,829	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/19/23 23:10	67	22,645	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	1	534	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	1	534	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	2	1,066	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	1	534	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	27	18,091	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	324	172,903	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	1	533	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	1	534	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	7	5,168	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		05/30/23 01:49	28	18,351	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		06/01/23 14:44	1	203	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		06/08/23 13:40	2	484	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		06/15/23 17:28	396	97,681	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		06/17/23 16:42	1	6	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:12	2	11,418	Weather

SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:12	18	43,672	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:12	3	6,684	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:12	1	2,699	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:27	2	6,587	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:40	366	424,422	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:40	1	3,890	Lightning
SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:40	1	3,890	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:42	1	1,165	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Small	06/25/23 18:43	1	1,164	Weather
SAIDI-03	SAIDI	3	ARGO 0326	-		07/03/23 16:52	9	393	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		07/07/23 22:20	1	92	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		07/15/23 07:50	1	1,844	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	07/26/23 15:01	1	2,602	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	07/26/23 15:01	65	166,873	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	07/26/23 15:05	14	36,366	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	07/28/23 11:45	3	302	Weather
SAIDI-03	SAIDI	3	ARGO 0326	-	Cat	07/28/23 18:01	9	25,829	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-	Cat	07/28/23 18:01	14	40,180	Vegetation
SAIDI-03	SAIDI	3	ARGO 0326	-		08/01/23 11:41	1	49	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		08/02/23 14:33	1	14	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		08/05/23 17:45	1	7	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		08/11/23 10:39	1	249	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-		08/11/23 10:39	1	249	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/24/23 06:06	4	23	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/24/23 07:21	1	413	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/24/23 07:22	1	413	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/24/23 08:29	2	1,324	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	Cat	08/24/23 08:30	1	662	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	Cat	08/24/23 08:30	1	662	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/24/23 22:07	19	68,929	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/24/23 22:42	75	56,201	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/25/23 08:30	3	148	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/25/23 08:30	1	71	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/25/23 09:23	2	77	Lightning
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/25/23 10:15	2	12	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/25/23 17:37	7	57	Weather
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/25/23 21:22	8	45	Other
SAIDI-03	SAIDI	3	ARGO 0326	MED	Cat	08/26/23 05:53	14	294	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	Cat	08/26/23 09:10	53	32,872	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		09/05/23 03:58	33	2,845	Equipment
SAIDI-03	SAIDI	3	ARGO 0326	-		09/11/23 12:23	60	6,875	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		09/15/23 11:09	1	327	Other
SAIDI-03	SAIDI	3	ARGO 0326	-		09/19/23 10:16	1	202	Other

SAIDI-03	SAIDI	3	ARGO 0326	-	09/21/23 10:54	1	333	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	09/22/23 15:20	1	6	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	09/26/23 09:45	1	285	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	09/26/23 11:06	8	791	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	09/27/23 10:08	10	907	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	09/30/23 09:50	9	1,489	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	09/30/23 09:50	6	991	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	10/06/23 09:09	16	495	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	10/10/23 11:29	6	969	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	10/10/23 11:39	7	754	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	10/13/23 08:49	1	283	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	10/16/23 11:12	13	1,822	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	10/18/23 10:49	1	11	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	10/18/23 10:49	9	103	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	10/21/23 11:44	10	1,024	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	10/23/23 11:49	6	513	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	10/30/23 09:48	1	59	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	10/30/23 10:01	1	81	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	10/31/23 08:34	1	21	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	11/01/23 10:06	38	5,485	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/02/23 12:05	3	482	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/09/23 11:42	9	1,324	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/10/23 10:36	1	435	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	11/11/23 09:43	2	222	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	11/11/23 09:43	2	222	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/11/23 09:43	2	222	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/13/23 09:22	1	203	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	11/20/23 12:02	7	261	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/20/23 12:02	3	126	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/22/23 09:26	1	393	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	11/27/23 11:04	2	195	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/27/23 11:16	2	318	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	11/27/23 11:28	1	221	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/27/23 11:28	1	221	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/28/23 11:25	1	104	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/28/23 11:25	2	208	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	11/28/23 11:25	1	104	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/28/23 11:25	2	208	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	11/29/23 10:39	1	29	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/29/23 10:39	27	789	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/29/23 10:39	2	57	Other
SAIDI-03	SAIDI	3	ARGO 0326	-	11/29/23 10:40	11	309	Planned
SAIDI-03	SAIDI	3	ARGO 0326	-	11/29/23 10:40	14	394	Planned

SAIDI-03	SAIDI	3	ARGO 0326	-	11/29/23 10:40	1	28	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	01/01/23 01:04	696	612,258	Equipment
SAIDI-04	SAIDI	4	SNOVR0302	-	01/01/23 01:04	1	2,206	Equipment
SAIDI-04	SAIDI	4	SNOVR0302	-	01/01/23 19:23	2	2,225	Equipment
SAIDI-04	SAIDI	4	SNOVR0302	-	01/01/23 23:47	1	7	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	01/02/23 13:26	1	24	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	01/02/23 13:42	3	904	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	01/03/23 04:12	811	19,420	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	01/03/23 16:49	1	37	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	01/03/23 16:49	1	37	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	01/03/23 16:49	1	37	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	01/11/23 21:01	1	6	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	02/04/23 11:14	1	157	Equipment
SAIDI-04	SAIDI	4	SNOVR0302	-	03/15/23 18:43	1	9	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	03/30/23 07:29	1	318	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	03/31/23 22:34	1	1,362	Equipment
SAIDI-04	SAIDI	4	SNOVR0302	-	04/01/23 10:31	47	9,998	Weather
SAIDI-04	SAIDI	4	SNOVR0302	-	04/01/23 10:31	20	4,090	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	04/05/23 11:08	1	13	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	04/24/23 11:50	1	28	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	04/24/23 13:31	1	11	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	04/24/23 13:34	1	11	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	04/25/23 09:36	1	145	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	04/26/23 09:35	2	25	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	04/26/23 10:26	1	26	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	04/26/23 11:27	1	51	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/01/23 09:29	1	30	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/01/23 10:31	1	23	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/01/23 11:03	1	29	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/01/23 13:57	1	99	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/04/23 10:25	1	18	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/04/23 11:06	1	16	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/04/23 14:20	1	18	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/04/23 15:13	1	16	Other
SAIDI-04	SAIDI	4	SNOVR0302	-	05/08/23 09:48	1	28	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/08/23 13:45	1	13	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/08/23 14:31	1	30	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/09/23 11:46	1	28	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/09/23 12:40	1	23	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/09/23 15:16	1	16	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/10/23 09:53	1	36	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/10/23 12:09	1	8	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-	05/10/23 12:09	4	36	Other

SAIDI-04	SAIDI	4	SNOVR0302	-		05/10/23 14:10	1	34	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/10/23 15:15	1	7	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		05/11/23 08:38	1	6	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		05/11/23 09:20	1	25	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/19/23 09:21	1	23	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/19/23 10:16	1	51	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		05/19/23 11:15	1	26	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/19/23 12:05	1	95	Equipment
SAIDI-04	SAIDI	4	SNOVR0302	-		05/20/23 08:54	1	135	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/22/23 09:30	1	20	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/22/23 10:32	1	14	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		05/22/23 10:45	1	42	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/22/23 11:13	1	6	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/22/23 11:29	1	26	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		05/22/23 12:26	1	14	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		05/23/23 09:35	1	42	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/23/23 09:53	2	116	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/23/23 11:47	2	48	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		05/23/23 11:47	1	24	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/23/23 12:46	1	18	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/23/23 13:37	1	20	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/23/23 13:37	1	20	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		05/24/23 09:00	1	25	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		05/24/23 10:32	1	55	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		05/24/23 10:33	6	328	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		06/01/23 13:12	1	94	Planned
SAIDI-04	SAIDI	4	SNOVR0302	-		06/06/23 08:11	1	108	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		06/30/23 01:20	5	2,744	Vegetation
SAIDI-04	SAIDI	4	SNOVR0302	-		07/11/23 11:52	1	15	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		07/13/23 01:28	1	937	Weather
SAIDI-04	SAIDI	4	SNOVR0302	-		07/13/23 01:37	4	3,680	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		07/13/23 13:26	1	41	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		07/17/23 11:45	2	71	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		07/17/23 11:45	1	36	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		07/25/23 09:51	1	53	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		08/08/23 14:23	338	83,884	Equipment
SAIDI-04	SAIDI	4	SNOVR0302	MED	Cat	08/24/23 20:06	1	6	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		09/18/23 10:44	1	13	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		09/18/23 12:15	1	34	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		09/19/23 10:47	2	15	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		09/28/23 09:57	5	222	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		10/18/23 15:39	74	9,897	Equipment
SAIDI-04	SAIDI	4	SNOVR0302	-		10/18/23 15:39	1	106	Other

SAIDI-04	SAIDI	4	SNOVR0302	-		10/23/23 12:43	1	41	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		11/09/23 12:59	1	12	Vegetation
SAIDI-04	SAIDI	4	SNOVR0302	-		11/09/23 22:14	1	704	Equipment
SAIDI-04	SAIDI	4	SNOVR0302	-		11/10/23 20:57	5	43	Other
SAIDI-04	SAIDI	4	SNOVR0302	-		11/21/23 07:11	1	294	Equipment
SAIDI-05	SAIDI	5	APLGT0311	-		01/06/23 17:24	1	11	Other
SAIDI-05	SAIDI	5	APLGT0311	-		01/16/23 15:27	1	17	Other
SAIDI-05	SAIDI	5	APLGT0311	-		02/02/23 11:35	2	1,451	Other
SAIDI-05	SAIDI	5	APLGT0311	-		02/12/23 08:00	1	17	Other
SAIDI-05	SAIDI	5	APLGT0311	-		02/12/23 15:54	1	64	Other
SAIDI-05	SAIDI	5	APLGT0311	-	Small	02/16/23 21:50	1	2,286	Weather
SAIDI-05	SAIDI	5	APLGT0311	-		02/18/23 11:03	2	74	Other
SAIDI-05	SAIDI	5	APLGT0311	-		02/18/23 11:03	35	1,295	Planned
SAIDI-05	SAIDI	5	APLGT0311	MED	Cat	02/27/23 15:49	1	1,632	Other
SAIDI-05	SAIDI	5	APLGT0311	MED	Cat	03/04/23 00:02	2	4,296	Weather
SAIDI-05	SAIDI	5	APLGT0311	-		03/16/23 11:27	1	72	Other
SAIDI-05	SAIDI	5	APLGT0311	-	Small	03/27/23 10:59	1	46	Other
SAIDI-05	SAIDI	5	APLGT0311	-	Small	03/27/23 10:59	1	46	Other
SAIDI-05	SAIDI	5	APLGT0311	-		04/10/23 10:21	3	68	Other
SAIDI-05	SAIDI	5	APLGT0311	-		04/10/23 11:17	1	224	Other
SAIDI-05	SAIDI	5	APLGT0311	-		04/30/23 08:37	2	532	Other
SAIDI-05	SAIDI	5	APLGT0311	-		04/30/23 08:37	1	270	Equipment
SAIDI-05	SAIDI	5	APLGT0311	-		06/10/23 07:54	1	745	Other
SAIDI-05	SAIDI	5	APLGT0311	-		06/19/23 10:05	1	12	Other
SAIDI-05	SAIDI	5	APLGT0311	-		06/19/23 15:42	1	119	Equipment
SAIDI-05	SAIDI	5	APLGT0311	-		07/06/23 13:26	1	36	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	1	1,560	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	1	1,560	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	1	1,560	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	1	1,560	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	60	127,013	Weather
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	1	1,560	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	1	1,560	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	1	1,560	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	1	1,560	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 15:58	1	1,560	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/14/23 21:31	8	9,817	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/15/23 11:19	3	1,197	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/17/23 16:48	9	2,428	Other
SAIDI-05	SAIDI	5	APLGT0311	-		07/17/23 16:48	100	23,453	Vegetation
SAIDI-05	SAIDI	5	APLGT0311	-		07/17/23 16:49	2	539	Weather
SAIDI-05	SAIDI	5	APLGT0311	-		07/19/23 11:02	4	569	Other
SAIDI-05	SAIDI	5	APLGT0311	-		08/03/23 09:38	1	65	Other

SAIDI-05	SAIDI	5	APLGT0311	-		08/04/23 14:28	1	181	Other
SAIDI-05	SAIDI	5	APLGT0311	-		08/08/23 15:51	1	1,334	Other
SAIDI-05	SAIDI	5	APLGT0311	-		08/08/23 15:51	446	595,431	Equipment
SAIDI-05	SAIDI	5	APLGT0311	-		11/29/23 13:03	1	190	Other
SAIDI-05	SAIDI	5	APLGT0311	-		11/29/23 14:01	1	27	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/04/23 11:14	12	2,040	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-		01/13/23 08:39	1	151	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-		01/16/23 09:22	1	105	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		01/16/23 09:23	1	105	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/23/23 21:23	3	947	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/23/23 22:42	17	266	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/23/23 22:42	4	62	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/23/23 22:42	10	156	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/23/23 22:42	45	702	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/23/23 22:42	1	16	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/23/23 22:42	2	31	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/23/23 22:42	3	47	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/24/23 10:55	1	14	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/26/23 10:40	1	5	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		01/30/23 01:03	1	9	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		02/04/23 13:20	1	129	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		02/04/23 13:20	1	129	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		02/06/23 18:36	1	45	Wildlife
SAIDI-06	SAIDI	6	LEXTN8770	-		02/09/23 11:14	1	23	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		02/09/23 16:01	2	64	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		02/14/23 08:51	2	167	Wildlife
SAIDI-06	SAIDI	6	LEXTN8770	-	Small	02/15/23 12:13	1	991	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-	Small	02/15/23 12:13	25	24,772	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-		02/18/23 11:03	3	111	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-		02/20/23 13:05	1	68	Other
SAIDI-06	SAIDI	6	LEXTN8770	MED	Cat	02/24/23 03:51	1	513	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-	Cat	02/28/23 08:05	1	257	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	Cat	02/28/23 12:44	1	8	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	Cat	02/28/23 14:12	1	15	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	Cat	03/02/23 10:25	1	34	Other
SAIDI-06	SAIDI	6	LEXTN8770	MED	Cat	03/03/23 21:43	1	2,348	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-	Cat	03/05/23 22:52	2	1,346	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-		03/17/23 15:15	1	70	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		04/03/23 10:11	1	159	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		04/04/23 11:29	1	46	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		04/05/23 21:54	1	1,142	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		04/05/23 22:08	1	803	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		04/07/23 12:25	1	9	Other

SAIDI-06	SAIDI	6	LEXTN8770	-	04/08/23 22:20	5	900	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	04/12/23 13:55	1	86	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	04/16/23 09:16	1	81	Wildlife
SAIDI-06	SAIDI	6	LEXTN8770	-	04/18/23 11:49	1	15	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	04/22/23 14:37	1	1,552	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	04/24/23 10:19	1	20	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	04/24/23 12:13	1	35	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	04/25/23 10:00	1	49	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	04/25/23 11:36	1	32	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	04/25/23 12:37	1	15	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	04/26/23 09:37	1	99	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	04/28/23 08:31	1	28	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	04/28/23 10:48	1	10	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	04/28/23 10:48	1	10	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	04/29/23 11:58	1	201	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	04/29/23 21:48	1	81	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	05/01/23 10:46	4	564	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	05/04/23 08:34	3	453	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	05/04/23 10:14	1	81	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/04/23 12:30	1	214	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/04/23 19:03	1	370	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/05/23 19:47	1	72	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/06/23 09:22	1	18	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/07/23 00:25	3	65	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	05/07/23 03:05	3	34	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/07/23 08:58	1	170	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/08/23 09:58	1	25	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/08/23 11:08	1	109	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/08/23 13:27	1	7	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/08/23 13:51	1	42	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/10/23 09:11	4	288	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	05/11/23 12:22	1	7	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/16/23 08:10	1	155	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/16/23 10:35	2	304	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/17/23 08:49	1	426	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/17/23 10:28	2	213	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	05/17/23 10:54	439	86,700	Vegetation
SAIDI-06	SAIDI	6	LEXTN8770	-	05/17/23 14:46	1	633	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	05/18/23 20:50	1	19	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/22/23 07:29	1	174	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/22/23 08:24	1	132	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/22/23 14:59	1	77	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	05/26/23 12:34	1	65	Planned

SAIDI-06	SAIDI	6	LEXTN8770	-	05/27/23 10:18	1	304	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/01/23 10:42	1	5	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/01/23 11:47	96	9,474	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	06/02/23 12:13	1	11	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/02/23 12:59	1	66	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/05/23 10:16	1	517	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/05/23 19:56	1	13	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/07/23 09:19	1	116	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/09/23 09:28	1	216	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/15/23 18:11	1	138	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/15/23 18:11	1	138	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/21/23 11:28	1	42	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/22/23 08:39	1	217	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/22/23 09:42	1	74	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-	06/23/23 09:25	1	14	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/23/23 19:43	1	1,321	Wildlife
SAIDI-06	SAIDI	6	LEXTN8770	-	06/23/23 19:43	23	30,392	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	06/23/23 19:43	6	7,928	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	06/23/23 19:43	3,030	4,004,995	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	06/23/23 19:43	3	3,964	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	06/23/23 19:43	1	1,321	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	07/01/23 18:09	1	33	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	07/03/23 09:56	1	53	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	07/04/23 10:12	2	99	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	07/07/23 09:03	1	17	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	07/11/23 12:55	14	2,978	Lightning
SAIDI-06	SAIDI	6	LEXTN8770	-	07/11/23 12:55	15	3,190	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	MED	07/11/23 14:41	4	1,010	Other
SAIDI-06	SAIDI	6	LEXTN8770	MED	07/11/23 14:41	1	334	Weather
SAIDI-06	SAIDI	6	LEXTN8770	MED	07/11/23 14:41	1	334	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:34	1	2,879	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:34	292	523,246	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:43	7	17,523	Power Supply
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:43	1	4,336	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:43	2	8,672	Vegetation
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:43	1	4,019	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:44	6	6,732	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:44	2	2,244	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:44	1	1,122	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:49	1	266	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:49	30	25,965	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-	07/14/23 15:50	4	5,345	Other

SAIDI-06	SAIDI	6	LEXTN8770	-		07/14/23 17:29	408	93,367	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-		07/14/23 17:29	3	501	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		07/14/23 20:30	1	1,216	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		07/14/23 21:31	2	2,454	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		07/14/23 21:35	1	165	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		07/16/23 12:37	5	1,047	Power Supply
SAIDI-06	SAIDI	6	LEXTN8770	-		07/16/23 12:37	5	1,047	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		07/16/23 12:37	1	209	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		07/16/23 12:37	13	2,722	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		07/16/23 12:37	1	209	Power Supply
SAIDI-06	SAIDI	6	LEXTN8770	-		07/16/23 12:37	1	209	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		07/16/23 12:37	1	209	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		07/16/23 16:17	1	10	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		07/18/23 12:52	22	10,018	Weather
SAIDI-06	SAIDI	6	LEXTN8770	MED		07/20/23 13:45	1	15	Other
SAIDI-06	SAIDI	6	LEXTN8770	MED	Small	07/20/23 16:04	3	4,364	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-	Small	07/22/23 13:55	1	25	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	Small	07/23/23 11:49	1	5	Other
SAIDI-06	SAIDI	6	LEXTN8770	MED	Cat	07/26/23 14:41	1	2,688	Weather
SAIDI-06	SAIDI	6	LEXTN8770	MED	Cat	07/26/23 17:17	1	5	Other
SAIDI-06	SAIDI	6	LEXTN8770	MED	Cat	07/26/23 17:24	2	5,511	Lightning
SAIDI-06	SAIDI	6	LEXTN8770	MED	Cat	07/27/23 17:30	2	1,933	Wildlife
SAIDI-06	SAIDI	6	LEXTN8770	-	Cat	07/28/23 15:44	1	3,448	Weather
SAIDI-06	SAIDI	6	LEXTN8770	-	Cat	07/29/23 17:09	1	62	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	Cat	07/30/23 04:57	1	6	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		08/03/23 10:34	1	101	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		08/03/23 10:34	1	101	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		08/03/23 10:34	1	101	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		08/03/23 10:34	1	101	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		08/09/23 09:59	9	4,557	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		08/10/23 20:27	1	55	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		08/14/23 10:54	1	152	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		08/16/23 10:18	1	166	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		08/16/23 10:18	259	41,671	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-		08/16/23 10:18	1	166	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		08/16/23 10:18	3	370	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		08/19/23 12:42	1	61	Other
SAIDI-06	SAIDI	6	LEXTN8770	-	Cat	08/30/23 11:37	1	153	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		09/03/23 06:56	1	553	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		09/06/23 10:35	1	51	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		09/11/23 08:33	14	2,296	Vegetation
SAIDI-06	SAIDI	6	LEXTN8770	-		09/12/23 10:09	1	6	Other

SAIDI-06	SAIDI	6	LEXTN8770	-		09/16/23 14:04	1	739	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		09/30/23 10:41	1	95	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		10/05/23 10:20	1	8	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		10/05/23 10:59	2	112	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		10/05/23 13:34	1	9	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		10/08/23 19:35	8	837	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		10/15/23 23:13	663	163,645	Vegetation
SAIDI-06	SAIDI	6	LEXTN8770	-		10/18/23 08:39	1	113	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		10/19/23 13:11	1	251	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		10/21/23 13:02	2	506	Wildlife
SAIDI-06	SAIDI	6	LEXTN8770	-		10/26/23 10:53	1	1,752	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		11/11/23 12:33	1	101	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-		11/11/23 12:33	1	103	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		11/16/23 11:35	1	59	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-		11/16/23 11:35	2	151	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		11/17/23 10:34	1	209	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		11/27/23 07:31	2	736	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		11/27/23 07:31	1	368	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		11/27/23 08:59	1	166	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		11/27/23 09:04	1	64	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-		11/27/23 09:04	1	64	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		11/28/23 10:08	1	23	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		11/28/23 15:00	1	9	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		12/05/23 12:11	1	86	Planned
SAIDI-06	SAIDI	6	LEXTN8770	-		12/05/23 18:08	1	43	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		12/07/23 07:24	1	137	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		12/11/23 12:36	1	60	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		12/22/23 09:29	1	124	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		12/22/23 15:58	1	11	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		12/27/23 10:40	1	1,483	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		12/27/23 12:19	1	165	Other
SAIDI-06	SAIDI	6	LEXTN8770	-		12/28/23 04:06	2	691	Vegetation
SAIDI-06	SAIDI	6	LEXTN8770	-		12/28/23 04:06	1	345	Equipment
SAIDI-06	SAIDI	6	LEXTN8770	-		12/30/23 13:46	1	12	Other
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	02/22/23 22:15	443	809,751	Weather
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	02/22/23 22:15	1	1,467	Weather
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	02/25/23 22:47	401	484,802	Weather
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	02/25/23 22:47	9	34,357	Other
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	02/25/23 22:47	1	3,965	Other
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	02/25/23 22:47	1	4,328	Weather
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	02/28/23 14:25	1	7	Other
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	03/01/23 11:04	1	9	Other
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	03/05/23 09:51	1	122	Weather

SAIDI-07	SAIDI	7	NBOST0305	-	Cat	03/07/23 08:51	1	7	Other
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	03/07/23 16:07	1	26	Weather
SAIDI-07	SAIDI	7	NBOST0305	-		03/12/23 20:09	4	1,905	Other
SAIDI-07	SAIDI	7	NBOST0305	-		03/12/23 20:09	52	8,595	Other
SAIDI-07	SAIDI	7	NBOST0305	-		03/13/23 03:26	7	273	Other
SAIDI-07	SAIDI	7	NBOST0305	-		03/16/23 10:10	2	61	Planned
SAIDI-07	SAIDI	7	NBOST0305	-		03/18/23 18:33	1	25	Other
SAIDI-07	SAIDI	7	NBOST0305	-		03/19/23 08:54	1	192	Other
SAIDI-07	SAIDI	7	NBOST0305	-		04/04/23 15:01	1	25	Equipment
SAIDI-07	SAIDI	7	NBOST0305	-		04/05/23 14:43	2	212	Equipment
SAIDI-07	SAIDI	7	NBOST0305	-		04/10/23 14:19	444	77,333	Other
SAIDI-07	SAIDI	7	NBOST0305	-		04/10/23 14:19	1	174	Other
SAIDI-07	SAIDI	7	NBOST0305	-		04/20/23 12:16	1	88	Other
SAIDI-07	SAIDI	7	NBOST0305	-		04/23/23 22:08	1	272	Wildlife
SAIDI-07	SAIDI	7	NBOST0305	-		04/24/23 10:08	1	897	Other
SAIDI-07	SAIDI	7	NBOST0305	MED		05/31/23 14:42	1	302	Other
SAIDI-07	SAIDI	7	NBOST0305	MED		05/31/23 20:28	1	894	Other
SAIDI-07	SAIDI	7	NBOST0305	-		06/11/23 21:54	1	853	Other
SAIDI-07	SAIDI	7	NBOST0305	MED	Small	06/25/23 18:18	1	1,003	Other
SAIDI-07	SAIDI	7	NBOST0305	MED	Small	06/25/23 18:18	1	1,091	Weather
SAIDI-07	SAIDI	7	NBOST0305	MED	Small	06/25/23 18:18	442	443,584	Weather
SAIDI-07	SAIDI	7	NBOST0305	MED	Small	06/25/23 18:18	1	1,004	Other
SAIDI-07	SAIDI	7	NBOST0305	MED	Small	06/26/23 13:30	1	10	Weather
SAIDI-07	SAIDI	7	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIDI-07	SAIDI	7	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIDI-07	SAIDI	7	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIDI-07	SAIDI	7	NBOST0305	-		07/18/23 14:48	7	36	Equipment
SAIDI-07	SAIDI	7	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIDI-07	SAIDI	7	NBOST0305	-		07/18/23 14:48	410	2,081	Other
SAIDI-07	SAIDI	7	NBOST0305	-		07/18/23 14:48	1	5	Vegetation
SAIDI-07	SAIDI	7	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIDI-07	SAIDI	7	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIDI-07	SAIDI	7	NBOST0305	-		08/03/23 20:11	1	66	Other
SAIDI-07	SAIDI	7	NBOST0305	-		08/04/23 20:38	1	37	Other
SAIDI-07	SAIDI	7	NBOST0305	-		08/10/23 17:20	1	202	Other
SAIDI-07	SAIDI	7	NBOST0305	-		08/10/23 21:59	1	143	Other
SAIDI-07	SAIDI	7	NBOST0305	-		08/11/23 04:28	1	266	Other
SAIDI-07	SAIDI	7	NBOST0305	-		08/12/23 18:32	1	21	Other
SAIDI-07	SAIDI	7	NBOST0305	-		08/14/23 17:31	1	115	Other
SAIDI-07	SAIDI	7	NBOST0305	-		08/16/23 16:56	1	313	Other
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 02:17	6	30,514	Vegetation
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 02:17	9	41,080	Vegetation
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 02:17	13	66,117	Vegetation

SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 02:17	2	10,171	Vegetation
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 02:18	8	39,930	Vegetation
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 02:24	4	1,966	Vegetation
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 02:24	49	24,129	Equipment
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 02:24	388	153,536	Weather
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 02:24	1	492	Other
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/24/23 22:35	2	13	Other
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/25/23 07:01	2	7,203	Equipment
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/25/23 07:01	1	3,601	Other
SAIDI-07	SAIDI	7	NBOST0305	MED	Cat	08/25/23 23:22	2	28	Other
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	08/26/23 08:57	1	33	Equipment
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	08/26/23 18:30	21	893	Vegetation
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	08/26/23 23:50	2	18	Other
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	08/27/23 02:52	1	512	Other
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	08/27/23 20:16	1	14	Other
SAIDI-07	SAIDI	7	NBOST0305	-	Cat	08/30/23 11:01	1	14	Vegetation
SAIDI-07	SAIDI	7	NBOST0305	-		09/01/23 08:02	1	89	Other
SAIDI-07	SAIDI	7	NBOST0305	-		09/01/23 16:07	1	21	Other
SAIDI-07	SAIDI	7	NBOST0305	-		09/03/23 11:17	1	9	Other
SAIDI-07	SAIDI	7	NBOST0305	-		09/15/23 16:28	1	34	Other
SAIDI-07	SAIDI	7	NBOST0305	-		09/16/23 13:57	1	76	Other
SAIDI-07	SAIDI	7	NBOST0305	-		09/17/23 09:18	1	302	Other
SAIDI-07	SAIDI	7	NBOST0305	-		09/17/23 14:59	1	11	Other
SAIDI-07	SAIDI	7	NBOST0305	-		10/02/23 10:42	1	307	Other
SAIDI-07	SAIDI	7	NBOST0305	-		10/03/23 11:43	2	81	Other
SAIDI-07	SAIDI	7	NBOST0305	-		10/04/23 11:22	1	37	Other
SAIDI-07	SAIDI	7	NBOST0305	-		10/04/23 11:22	1	41	Planned
SAIDI-07	SAIDI	7	NBOST0305	-		10/04/23 11:22	2	78	Other
SAIDI-07	SAIDI	7	NBOST0305	-		10/06/23 10:21	890	65,473	Planned
SAIDI-07	SAIDI	7	NBOST0305	-		10/06/23 10:21	2	147	Other
SAIDI-07	SAIDI	7	NBOST0305	-		10/27/23 09:26	1	185	Other
SAIDI-07	SAIDI	7	NBOST0305	-		12/01/23 17:34	1	14	Other
SAIDI-07	SAIDI	7	NBOST0305	-		12/18/23 16:10	1	6	Other
SAIDI-07	SAIDI	7	NBOST0305	-		12/22/23 10:44	1	75	Other
SAIDI-07	SAIDI	7	NBOST0305	-		12/28/23 04:24	1	45	Other
SAIDI-08	SAIDI	8	PULFD2155	-		01/19/23 12:27	2	155	Vegetation
SAIDI-08	SAIDI	8	PULFD2155	-		02/03/23 09:02	1	18	Equipment
SAIDI-08	SAIDI	8	PULFD2155	-		02/09/23 12:17	1	41	Other
SAIDI-08	SAIDI	8	PULFD2155	-		02/09/23 14:04	1	11	Other
SAIDI-08	SAIDI	8	PULFD2155	-		02/09/23 16:27	1	86	Other
SAIDI-08	SAIDI	8	PULFD2155	MED		02/22/23 14:11	1	38	Other
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	02/22/23 20:57	1	1,051	Weather
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	02/27/23 10:39	1	7	Other

SAIDI-08	SAIDI	8	PULFD2155	-	Cat	03/02/23 17:53	1	37	Other
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	03/03/23 17:41	483	1,337,211	Weather
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	03/03/23 17:41	1	2,775	Weather
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	03/03/23 17:41	1	2,775	Other
SAIDI-08	SAIDI	8	PULFD2155	-	Cat	03/06/23 13:05	1	100	Weather
SAIDI-08	SAIDI	8	PULFD2155	-	Cat	03/06/23 16:43	1	453	Other
SAIDI-08	SAIDI	8	PULFD2155	-		03/13/23 13:22	1	195	Other
SAIDI-08	SAIDI	8	PULFD2155	-		03/17/23 11:51	1	7,842	Other
SAIDI-08	SAIDI	8	PULFD2155	-		03/23/23 02:19	1	27	Other
SAIDI-08	SAIDI	8	PULFD2155	-	Small	03/26/23 18:23	1	10	Other
SAIDI-08	SAIDI	8	PULFD2155	-	Small	03/26/23 18:23	1	11	Weather
SAIDI-08	SAIDI	8	PULFD2155	-		03/28/23 00:02	1	20	Equipment
SAIDI-08	SAIDI	8	PULFD2155	-		04/17/23 14:47	1	62	Other
SAIDI-08	SAIDI	8	PULFD2155	-		04/17/23 17:46	1	636	Other
SAIDI-08	SAIDI	8	PULFD2155	-		04/29/23 13:35	1	21	Other
SAIDI-08	SAIDI	8	PULFD2155	-		05/02/23 17:01	1	904	Other
SAIDI-08	SAIDI	8	PULFD2155	-		05/06/23 15:43	1	34	Other
SAIDI-08	SAIDI	8	PULFD2155	-		05/08/23 11:47	1	16	Other
SAIDI-08	SAIDI	8	PULFD2155	-		05/15/23 08:31	1	39	Other
SAIDI-08	SAIDI	8	PULFD2155	-		06/13/23 20:27	12	10,335	Vegetation
SAIDI-08	SAIDI	8	PULFD2155	-		06/13/23 20:27	9	7,737	Other
SAIDI-08	SAIDI	8	PULFD2155	-		06/14/23 19:21	1	14	Other
SAIDI-08	SAIDI	8	PULFD2155	-		06/19/23 09:45	1	137	Other
SAIDI-08	SAIDI	8	PULFD2155	-		06/21/23 19:56	1	457	Other
SAIDI-08	SAIDI	8	PULFD2155	-	Small	06/27/23 10:31	1	35	Other
SAIDI-08	SAIDI	8	PULFD2155	-		06/29/23 10:26	1	20	Other
SAIDI-08	SAIDI	8	PULFD2155	-		06/29/23 11:08	1	20	Other
SAIDI-08	SAIDI	8	PULFD2155	-		07/07/23 11:53	1	53	Other
SAIDI-08	SAIDI	8	PULFD2155	-		07/18/23 11:22	1	90	Other
SAIDI-08	SAIDI	8	PULFD2155	-		07/18/23 11:26	1	77	Planned
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	07/27/23 13:36	1	94	Other
SAIDI-08	SAIDI	8	PULFD2155	-	Cat	07/28/23 19:43	478	659,762	Weather
SAIDI-08	SAIDI	8	PULFD2155	-		08/12/23 21:59	35	14,237	Public
SAIDI-08	SAIDI	8	PULFD2155	-		08/12/23 22:00	43	10,632	Public
SAIDI-08	SAIDI	8	PULFD2155	-		08/12/23 22:01	1	7	Other
SAIDI-08	SAIDI	8	PULFD2155	-		08/12/23 23:37	17	12,469	Public
SAIDI-08	SAIDI	8	PULFD2155	-		08/12/23 23:37	8	8,297	Other
SAIDI-08	SAIDI	8	PULFD2155	-		08/19/23 19:04	1	16	Other
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	08/24/23 09:23	8	163	Vegetation
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	08/24/23 22:26	1	2,611	Weather
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	08/24/23 22:31	1	3,924	Weather
SAIDI-08	SAIDI	8	PULFD2155	MED	Cat	08/24/23 23:02	1	42	Other
SAIDI-08	SAIDI	8	PULFD2155	-	Cat	08/26/23 12:06	1	6	Other

SAIDI-08	SAIDI	8	PULFD2155	-	Cat	08/26/23 16:41	1	6	Other
SAIDI-08	SAIDI	8	PULFD2155	-	Cat	08/30/23 15:24	1	38	Other
SAIDI-08	SAIDI	8	PULFD2155	-	Cat	08/30/23 15:24	1	38	Other
SAIDI-08	SAIDI	8	PULFD2155	-		08/31/23 19:43	1	935	Other
SAIDI-08	SAIDI	8	PULFD2155	-		10/07/23 15:07	1	9	Other
SAIDI-08	SAIDI	8	PULFD2155	-		10/13/23 17:10	4	102	Equipment
SAIDI-08	SAIDI	8	PULFD2155	-		10/14/23 02:13	1	520	Other
SAIDI-08	SAIDI	8	PULFD2155	-		10/30/23 01:45	8	125	Vegetation
SAIDI-08	SAIDI	8	PULFD2155	-		11/12/23 10:33	1	32	Other
SAIDI-08	SAIDI	8	PULFD2155	-		11/17/23 08:13	1	8	Other
SAIDI-08	SAIDI	8	PULFD2155	-		11/22/23 10:13	1	34	Other
SAIDI-08	SAIDI	8	PULFD2155	-		11/22/23 10:13	1	62	Other
SAIDI-08	SAIDI	8	PULFD2155	-		11/22/23 11:08	1	48	Other
SAIDI-08	SAIDI	8	PULFD2155	-		11/26/23 11:09	1	5	Other
SAIDI-08	SAIDI	8	PULFD2155	-		11/30/23 18:04	1	8	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/02/23 09:39	3	92	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/02/23 11:18	3	226	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/04/23 09:25	5	283	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/04/23 12:27	7	471	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/05/23 10:19	12	524	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/05/23 10:19	11	183	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/05/23 10:51	1	22	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/06/23 09:23	8	350	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/06/23 09:23	6	242	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/06/23 10:20	4	131	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/06/23 11:06	3	94	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/06/23 12:06	5	56	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/08/23 13:14	5	427	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/08/23 13:14	12	1,025	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/08/23 13:14	2	171	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/10/23 14:25	1	12	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/10/23 21:00	1	293	Equipment
SAIDI-08	SAIDI	8	PULFD2155	-		12/13/23 10:09	2	101	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/13/23 10:12	1	48	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/13/23 10:23	1	33	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/13/23 13:40	1	9	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/13/23 13:40	1	9	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/14/23 09:11	1	134	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/14/23 09:11	2	267	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/14/23 10:27	2	193	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/14/23 10:27	2	194	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/14/23 11:55	2	66	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/14/23 12:14	6	495	Other

SAIDI-08	SAIDI	8	PULFD2155	-		12/14/23 14:01	4	475	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/15/23 09:35	2	101	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/15/23 13:00	2	111	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/15/23 13:00	1	63	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/16/23 12:26	1	83	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/16/23 12:27	6	495	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/19/23 10:02	4	283	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/19/23 13:42	1	90	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/19/23 13:48	8	433	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/20/23 10:16	1	68	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/20/23 10:16	6	462	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/20/23 13:14	3	69	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/21/23 09:42	1	140	Planned
SAIDI-08	SAIDI	8	PULFD2155	-		12/21/23 09:46	3	400	Other
SAIDI-08	SAIDI	8	PULFD2155	-		12/27/23 10:05	11	1,687	Planned
SAIDI-09	SAIDI	9	SNOVR0301	-		01/01/23 01:04	1	2,327	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		01/01/23 01:04	175	107,423	Equipment
SAIDI-09	SAIDI	9	SNOVR0301	-		01/01/23 11:06	46	27,756	Equipment
SAIDI-09	SAIDI	9	SNOVR0301	-		01/01/23 11:06	2	1,207	Equipment
SAIDI-09	SAIDI	9	SNOVR0301	-		01/01/23 11:06	18	10,860	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		01/01/23 21:08	115	68,839	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		01/01/23 23:47	1	8	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		01/03/23 03:45	127	4,811	Equipment
SAIDI-09	SAIDI	9	SNOVR0301	-		01/03/23 16:49	1	36	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		01/03/23 16:49	233	8,594	Other
SAIDI-09	SAIDI	9	SNOVR0301	MED	Cat	02/24/23 11:55	1	29	Weather
SAIDI-09	SAIDI	9	SNOVR0301	MED	Cat	02/25/23 15:24	1	31	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		03/20/23 22:08	1	221	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		04/04/23 11:14	2	167	Planned
SAIDI-09	SAIDI	9	SNOVR0301	-		04/15/23 13:15	1	36	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		05/11/23 13:30	1	70	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		07/09/23 09:48	2	525	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		07/25/23 13:17	1	10	Planned
SAIDI-09	SAIDI	9	SNOVR0301	MED	Cat	07/26/23 14:43	1	7	Weather
SAIDI-09	SAIDI	9	SNOVR0301	MED	Cat	07/27/23 09:49	1	30	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		07/31/23 11:41	1	40	Planned
SAIDI-09	SAIDI	9	SNOVR0301	-		08/08/23 14:23	2	497	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		08/08/23 14:23	166	41,198	Equipment
SAIDI-09	SAIDI	9	SNOVR0301	-		08/08/23 14:23	1	248	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		08/08/23 14:23	1	248	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		08/12/23 10:41	2	48	Equipment
SAIDI-09	SAIDI	9	SNOVR0301	-		08/16/23 13:19	1	9	Other
SAIDI-09	SAIDI	9	SNOVR0301	-		10/13/23 07:49	1	87	Other

SAIDI-10	SAIDI	10	DENVR2004	-	Cat	03/06/23 09:08	1	143	Weather
SAIDI-10	SAIDI	10	DENVR2004	-		03/18/23 11:22	5	204	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		03/18/23 11:28	4	212	Equipment
SAIDI-10	SAIDI	10	DENVR2004	-		03/20/23 12:32	5	440	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		03/24/23 09:42	4	171	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		03/28/23 12:48	4	188	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		03/30/23 14:47	1	72	Other
SAIDI-10	SAIDI	10	DENVR2004	-		03/30/23 20:35	1	31	Other
SAIDI-10	SAIDI	10	DENVR2004	-		04/03/23 10:11	1	21	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/03/23 13:10	1	48	Other
SAIDI-10	SAIDI	10	DENVR2004	-		04/11/23 10:27	4	96	Other
SAIDI-10	SAIDI	10	DENVR2004	-		04/11/23 10:27	1	28	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/11/23 12:44	1	55	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/13/23 11:11	1	61	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/13/23 11:17	1	48	Other
SAIDI-10	SAIDI	10	DENVR2004	-		04/13/23 12:02	1	40	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/13/23 13:55	2	31	Other
SAIDI-10	SAIDI	10	DENVR2004	-		04/13/23 13:55	1	15	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/14/23 10:33	6	937	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/14/23 11:24	2	199	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/14/23 11:24	2	200	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/14/23 11:24	1	100	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/24/23 10:05	13	3,165	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/24/23 10:05	7	1,701	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/24/23 10:07	2	483	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/24/23 10:07	1	242	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		04/24/23 10:07	1	241	Other
SAIDI-10	SAIDI	10	DENVR2004	-		04/24/23 10:14	1	234	Equipment
SAIDI-10	SAIDI	10	DENVR2004	-		05/03/23 08:43	1	447	Other
SAIDI-10	SAIDI	10	DENVR2004	-		05/18/23 12:28	1	39	Other
SAIDI-10	SAIDI	10	DENVR2004	-		05/19/23 08:44	1	102	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		05/19/23 14:23	1	24	Planned
SAIDI-10	SAIDI	10	DENVR2004	-		05/19/23 14:27	1	18	Other
SAIDI-10	SAIDI	10	DENVR2004	-		06/29/23 08:32	1	7	Other
SAIDI-10	SAIDI	10	DENVR2004	-		07/02/23 20:48	337	113,504	Vegetation
SAIDI-10	SAIDI	10	DENVR2004	-		07/02/23 20:48	1	336	Other
SAIDI-10	SAIDI	10	DENVR2004	-		07/08/23 04:54	1	320	Equipment
SAIDI-10	SAIDI	10	DENVR2004	-		07/08/23 04:54	336	107,368	Equipment
SAIDI-10	SAIDI	10	DENVR2004	-		07/08/23 04:54	1	320	Other
SAIDI-10	SAIDI	10	DENVR2004	-		07/08/23 04:54	1	319	Other
SAIDI-10	SAIDI	10	DENVR2004	-		07/25/23 09:57	16	7,277	Equipment
SAIDI-10	SAIDI	10	DENVR2004	-		07/25/23 09:57	1	370	Other
SAIDI-10	SAIDI	10	DENVR2004	-		07/25/23 09:57	1	370	Other

SAIDI-10	SAIDI	10	DENVR2004	-		07/25/23 09:57	2	753	Other
SAIDI-10	SAIDI	10	DENVR2004	MED	Cat	07/26/23 15:49	2	11,730	Equipment
SAIDI-10	SAIDI	10	DENVR2004	MED	Cat	07/26/23 15:49	302	528,558	Weather
SAIDI-10	SAIDI	10	DENVR2004	MED	Cat	07/26/23 15:49	51	124,667	Vegetation
SAIDI-10	SAIDI	10	DENVR2004	-	Cat	07/28/23 20:54	8	360	Vegetation
SAIDI-10	SAIDI	10	DENVR2004	-		08/07/23 00:08	339	276,548	Vegetation
SAIDI-10	SAIDI	10	DENVR2004	-		08/07/23 00:08	1	815	Other
SAIDI-10	SAIDI	10	DENVR2004	-		09/27/23 12:55	1	23	Other
SAIDI-10	SAIDI	10	DENVR2004	-		10/26/23 14:26	1	94	Other
SAIDI-10	SAIDI	10	DENVR2004	-		11/08/23 20:47	1	507	Equipment

Appendix 6

Outage and Cause Listing - Worst performing circuits by SAIFI excluding Major Event Days - Circuit Basis

Ref#	Metric	Rank	Circuit	MED	Storm	Interruption Date/Time	Customers Interrupted	Customer Minutes Interrupted	Cause
SAIFI-01	SAIFI	1	CROWN9832	-		01/08/23 08:29	4	20	Other
SAIFI-01	SAIFI	1	CROWN9832	-		01/11/23 19:48	265	10,193	Other
SAIFI-01	SAIFI	1	CROWN9832	-		01/11/23 19:48	1	39	Other
SAIFI-01	SAIFI	1	CROWN9832	-		01/11/23 19:48	1	38	Other
SAIFI-01	SAIFI	1	CROWN9832	-	Small	02/15/23 13:20	57	5,223	Weather
SAIFI-01	SAIFI	1	CROWN9832	-	Small	02/15/23 13:20	967	88,585	Weather
SAIFI-01	SAIFI	1	CROWN9832	-	Small	02/15/23 13:20	6	550	Weather
SAIFI-01	SAIFI	1	CROWN9832	-		02/17/23 08:39	1	9	Other
SAIFI-01	SAIFI	1	CROWN9832	MED	Cat	02/22/23 20:22	48	335,689	Weather
SAIFI-01	SAIFI	1	CROWN9832	MED	Cat	02/22/23 20:22	219	1,522,979	Weather
SAIFI-01	SAIFI	1	CROWN9832	MED	Cat	02/23/23 14:19	1	51	Weather
SAIFI-01	SAIFI	1	CROWN9832	MED	Cat	02/23/23 14:19	1	51	Weather
SAIFI-01	SAIFI	1	CROWN9832	MED	Cat	02/24/23 09:34	2	7,214	Other
SAIFI-01	SAIFI	1	CROWN9832	MED	Cat	02/27/23 08:39	15	781	Other
SAIFI-01	SAIFI	1	CROWN9832	-	Cat	03/02/23 13:18	1	64	Other
SAIFI-01	SAIFI	1	CROWN9832	MED	Cat	03/03/23 19:54	1,048	967,898	Weather
SAIFI-01	SAIFI	1	CROWN9832	-	Cat	03/07/23 17:14	1	5	Weather
SAIFI-01	SAIFI	1	CROWN9832	MED	Small	03/25/23 15:22	1,709	174,621	Weather
SAIFI-01	SAIFI	1	CROWN9832	MED	Small	03/25/23 15:22	1	126	Weather
SAIFI-01	SAIFI	1	CROWN9832	MED	Small	03/25/23 16:17	1	72	Other
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	1	378	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	75	28,321	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	1	377	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	1	377	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	1	377	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	1	377	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	1	377	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	1	377	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	1	378	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	84	31,719	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:22	34	12,839	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:23	1	150	Other
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 00:23	3,470	334,006	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		04/04/23 03:17	1	32	Other
SAIFI-01	SAIFI	1	CROWN9832	-		04/09/23 19:11	1	109	Other

SAIFI-01	SAIFI	1	CROWN9832	-		06/02/23 15:25	1	123	Other
SAIFI-01	SAIFI	1	CROWN9832	-		06/02/23 15:25	1,061	102,002	Public
SAIFI-01	SAIFI	1	CROWN9832	-		06/02/23 16:37	1	52	Other
SAIFI-01	SAIFI	1	CROWN9832	-		06/03/23 12:47	2,468	565,201	Public
SAIFI-01	SAIFI	1	CROWN9832	-		06/03/23 12:47	2	615	Other
SAIFI-01	SAIFI	1	CROWN9832	-		06/03/23 12:47	1	286	Other
SAIFI-01	SAIFI	1	CROWN9832	-		06/03/23 12:47	42	9,880	Public
SAIFI-01	SAIFI	1	CROWN9832	-		06/21/23 18:07	1	116	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		06/21/23 18:07	1	116	Other
SAIFI-01	SAIFI	1	CROWN9832	-		06/21/23 18:08	5	581	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		06/21/23 18:08	1	115	Other
SAIFI-01	SAIFI	1	CROWN9832	-		06/23/23 09:22	1,682	146,357	Vegetation
SAIFI-01	SAIFI	1	CROWN9832	-		06/23/23 09:22	1	108	Other
SAIFI-01	SAIFI	1	CROWN9832	-		06/23/23 10:20	1	50	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		06/23/23 10:20	1	50	Other
SAIFI-01	SAIFI	1	CROWN9832	-		06/23/23 10:20	1	50	Other
SAIFI-01	SAIFI	1	CROWN9832	MED		06/25/23 15:56	1,012	134,217	Vegetation
SAIFI-01	SAIFI	1	CROWN9832	MED		06/25/23 15:56	1	133	Other
SAIFI-01	SAIFI	1	CROWN9832	MED		06/25/23 15:56	1	133	Other
SAIFI-01	SAIFI	1	CROWN9832	MED		06/25/23 15:56	1	133	Other
SAIFI-01	SAIFI	1	CROWN9832	MED	Small	06/25/23 16:00	675	86,705	Vegetation
SAIFI-01	SAIFI	1	CROWN9832	MED	Small	06/25/23 16:00	1	129	Other
SAIFI-01	SAIFI	1	CROWN9832	-		07/05/23 07:02	1	10	Other
SAIFI-01	SAIFI	1	CROWN9832	-		07/05/23 08:44	1	120	Other
SAIFI-01	SAIFI	1	CROWN9832	-		07/17/23 09:33	1	56	Other
SAIFI-01	SAIFI	1	CROWN9832	-		07/17/23 09:33	1	56	Planned
SAIFI-01	SAIFI	1	CROWN9832	-		07/19/23 15:03	1,550	120,253	Public
SAIFI-01	SAIFI	1	CROWN9832	-		07/19/23 15:03	3	410	Other
SAIFI-01	SAIFI	1	CROWN9832	MED	Small	07/20/23 16:27	1,048	142,534	Weather
SAIFI-01	SAIFI	1	CROWN9832	MED	Small	07/20/23 16:27	2	271	Other
SAIFI-01	SAIFI	1	CROWN9832	MED	Cat	07/26/23 15:05	266	348,349	Weather
SAIFI-01	SAIFI	1	CROWN9832	MED	Cat	07/26/23 15:05	2	1,315	Other
SAIFI-01	SAIFI	1	CROWN9832	-		08/15/23 16:09	1	13	Other
SAIFI-01	SAIFI	1	CROWN9832	-		08/15/23 16:09	1	13	Other
SAIFI-01	SAIFI	1	CROWN9832	-		08/20/23 11:07	1	113	Other
SAIFI-01	SAIFI	1	CROWN9832	-		09/05/23 10:56	1	1,364	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		09/05/23 10:56	1	1,363	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		09/06/23 14:44	2	29	Other
SAIFI-01	SAIFI	1	CROWN9832	-		09/06/23 15:23	1	1,975	Other
SAIFI-01	SAIFI	1	CROWN9832	-		09/07/23 15:05	1	6	Other
SAIFI-01	SAIFI	1	CROWN9832	-		09/09/23 13:43	1	1,037	Other
SAIFI-01	SAIFI	1	CROWN9832	-		09/21/23 08:51	1	166	Other
SAIFI-01	SAIFI	1	CROWN9832	-		09/21/23 12:34	1	66	Other

SAIFI-01	SAIFI	1	CROWN9832	-		09/27/23 10:23	1	7	Other
SAIFI-01	SAIFI	1	CROWN9832	-		10/09/23 15:37	1	16	Other
SAIFI-01	SAIFI	1	CROWN9832	-		10/16/23 05:38	1	44	Other
SAIFI-01	SAIFI	1	CROWN9832	-		10/16/23 17:09	2	169	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		10/23/23 11:41	1	312	Other
SAIFI-01	SAIFI	1	CROWN9832	-		10/23/23 14:40	2	346	Wildlife
SAIFI-01	SAIFI	1	CROWN9832	-		10/23/23 17:25	1	15	Wildlife
SAIFI-01	SAIFI	1	CROWN9832	-		10/23/23 17:25	1	15	Other
SAIFI-01	SAIFI	1	CROWN9832	-		11/02/23 10:51	1	64	Other
SAIFI-01	SAIFI	1	CROWN9832	-		11/02/23 13:31	1	177	Other
SAIFI-01	SAIFI	1	CROWN9832	-		11/28/23 12:18	80	13,588	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		12/06/23 12:14	35	1,910	Public
SAIFI-01	SAIFI	1	CROWN9832	-		12/06/23 12:14	2	109	Other
SAIFI-01	SAIFI	1	CROWN9832	-		12/06/23 12:14	1	55	Equipment
SAIFI-01	SAIFI	1	CROWN9832	-		12/06/23 12:14	1,007	55,237	Public
SAIFI-02	SAIFI	2	ARGO 0326	-		01/01/23 01:54	170	90,380	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		01/01/23 07:57	228	38,490	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	-		01/09/23 10:27	1	54	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		01/09/23 10:28	3	236	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		01/10/23 10:27	13	1,265	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		01/10/23 12:56	3	200	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	-		01/11/23 10:17	7	441	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		01/11/23 12:34	10	720	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		01/12/23 10:42	1	20	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		01/12/23 10:42	5	100	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		01/18/23 10:17	3	468	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		01/24/23 10:21	8	946	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		01/30/23 09:55	13	1,698	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		02/01/23 15:02	1	36	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		02/01/23 15:02	395	14,106	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	-		02/01/23 15:03	1	36	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		02/04/23 08:36	1	36	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		02/06/23 10:02	10	839	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		02/06/23 10:02	2	168	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		02/07/23 10:17	14	1,290	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		02/10/23 13:04	3	279	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		02/14/23 10:03	4	721	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		02/17/23 10:12	1	154	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		02/18/23 10:28	6	672	Planned
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	02/22/23 21:20	1	5,365	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	02/22/23 22:37	1	1,124	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	02/23/23 10:40	1	323	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	02/23/23 12:22	6	27,361	Weather

SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	02/23/23 20:40	377	114,541	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	02/24/23 02:52	355	1,329,035	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	02/24/23 02:52	27	97,019	Weather
SAIFI-02	SAIFI	2	ARGO 0326	-	Cat	02/26/23 16:36	1	2,598	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	Cat	03/01/23 11:21	1	324	Weather
SAIFI-02	SAIFI	2	ARGO 0326	-	Cat	03/01/23 11:40	1	43	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	Cat	03/01/23 18:03	5	258	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	03/03/23 15:30	1	31	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	03/03/23 21:54	1	2,481	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	03/04/23 03:42	1	595	Weather
SAIFI-02	SAIFI	2	ARGO 0326	-		04/15/23 23:43	4	719	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		04/15/23 23:43	9	1,656	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		04/17/23 12:26	7	155	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		04/20/23 09:06	1	11	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		04/21/23 07:50	1	77	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		04/23/23 09:04	1	174	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		04/23/23 09:04	3	522	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		04/28/23 10:29	1	7	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	-		05/04/23 09:27	1	90	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		05/04/23 16:27	1	101	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		05/10/23 18:17	1	19	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		05/17/23 09:57	1	269	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		05/19/23 23:06	42	17,137	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/19/23 23:10	1	338	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/19/23 23:10	1	338	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/19/23 23:10	43	15,657	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/19/23 23:10	26	8,788	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/19/23 23:10	193	81,493	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/19/23 23:10	20	6,829	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/19/23 23:10	67	22,645	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	1	534	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	1	534	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	2	1,066	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	1	534	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	27	18,091	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	324	172,903	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	1	533	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	1	534	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	7	5,168	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		05/30/23 01:49	28	18,351	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		06/01/23 14:44	1	203	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		06/08/23 13:40	2	484	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		06/15/23 17:28	396	97,681	Vegetation

SAIFI-02	SAIFI	2	ARGO 0326	-		06/17/23 16:42	1	6	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:12	2	11,418	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:12	18	43,672	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:12	3	6,684	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:12	1	2,699	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:27	2	6,587	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:40	366	424,422	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:40	1	3,890	Lightning
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:40	1	3,890	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:42	1	1,165	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Small	06/25/23 18:43	1	1,164	Weather
SAIFI-02	SAIFI	2	ARGO 0326	-		07/03/23 16:52	9	393	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		07/07/23 22:20	1	92	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		07/15/23 07:50	1	1,844	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	07/26/23 15:01	1	2,602	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	07/26/23 15:01	65	166,873	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	07/26/23 15:05	14	36,366	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	07/28/23 11:45	3	302	Weather
SAIFI-02	SAIFI	2	ARGO 0326	-	Cat	07/28/23 18:01	9	25,829	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-	Cat	07/28/23 18:01	14	40,180	Vegetation
SAIFI-02	SAIFI	2	ARGO 0326	-		08/01/23 11:41	1	49	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		08/02/23 14:33	1	14	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		08/05/23 17:45	1	7	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		08/11/23 10:39	1	249	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		08/11/23 10:39	1	249	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/24/23 06:06	4	23	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/24/23 07:21	1	413	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/24/23 07:22	1	413	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/24/23 08:29	2	1,324	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	Cat	08/24/23 08:30	1	662	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	Cat	08/24/23 08:30	1	662	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/24/23 22:07	19	68,929	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/24/23 22:42	75	56,201	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/25/23 08:30	3	148	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/25/23 08:30	1	71	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/25/23 09:23	2	77	Lightning
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/25/23 10:15	2	12	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/25/23 17:37	7	57	Weather
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/25/23 21:22	8	45	Other
SAIFI-02	SAIFI	2	ARGO 0326	MED	Cat	08/26/23 05:53	14	294	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	Cat	08/26/23 09:10	53	32,872	Other
SAIFI-02	SAIFI	2	ARGO 0326	-		09/05/23 03:58	33	2,845	Equipment
SAIFI-02	SAIFI	2	ARGO 0326	-		09/11/23 12:23	60	6,875	Other

SAIFI-02	SAIFI	2	ARGO 0326	-	09/15/23 11:09	1	327	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	09/19/23 10:16	1	202	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	09/21/23 10:54	1	333	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	09/22/23 15:20	1	6	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	09/26/23 09:45	1	285	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	09/26/23 11:06	8	791	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	09/27/23 10:08	10	907	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	09/30/23 09:50	9	1,489	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	09/30/23 09:50	6	991	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	10/06/23 09:09	16	495	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	10/10/23 11:29	6	969	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	10/10/23 11:39	7	754	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	10/13/23 08:49	1	283	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	10/16/23 11:12	13	1,822	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	10/18/23 10:49	1	11	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	10/18/23 10:49	9	103	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	10/21/23 11:44	10	1,024	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	10/23/23 11:49	6	513	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	10/30/23 09:48	1	59	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	10/30/23 10:01	1	81	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	10/31/23 08:34	1	21	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	11/01/23 10:06	38	5,485	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/02/23 12:05	3	482	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/09/23 11:42	9	1,324	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/10/23 10:36	1	435	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	11/11/23 09:43	2	222	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	11/11/23 09:43	2	222	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/11/23 09:43	2	222	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/13/23 09:22	1	203	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	11/20/23 12:02	7	261	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/20/23 12:02	3	126	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/22/23 09:26	1	393	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	11/27/23 11:04	2	195	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/27/23 11:16	2	318	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	11/27/23 11:28	1	221	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/27/23 11:28	1	221	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/28/23 11:25	1	104	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/28/23 11:25	2	208	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	11/28/23 11:25	1	104	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/28/23 11:25	2	208	Other
SAIFI-02	SAIFI	2	ARGO 0326	-	11/29/23 10:39	1	29	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/29/23 10:39	27	789	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-	11/29/23 10:39	2	57	Other

SAIFI-02	SAIFI	2	ARGO 0326	-		11/29/23 10:40	11	309	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		11/29/23 10:40	14	394	Planned
SAIFI-02	SAIFI	2	ARGO 0326	-		11/29/23 10:40	1	28	Planned
SAIFI-03	SAIFI	3	HASKL1625	-		01/09/23 15:20	1	11	Other
SAIFI-03	SAIFI	3	HASKL1625	-		02/10/23 09:20	1	6	Other
SAIFI-03	SAIFI	3	HASKL1625	-	Small	02/15/23 13:01	72	111,202	Weather
SAIFI-03	SAIFI	3	HASKL1625	-	Small	02/15/23 13:01	109	170,641	Weather
SAIFI-03	SAIFI	3	HASKL1625	-	Small	02/15/23 13:01	72	112,662	Weather
SAIFI-03	SAIFI	3	HASKL1625	-	Small	02/15/23 13:01	49	76,673	Weather
SAIFI-03	SAIFI	3	HASKL1625	-	Small	02/15/23 20:28	1	23	Weather
SAIFI-03	SAIFI	3	HASKL1625	-	Small	02/15/23 20:28	1	23	Other
SAIFI-03	SAIFI	3	HASKL1625	-		02/21/23 10:34	1	112	Equipment
SAIFI-03	SAIFI	3	HASKL1625	-		02/21/23 10:34	1	112	Equipment
SAIFI-03	SAIFI	3	HASKL1625	-		02/21/23 10:34	2	225	Planned
SAIFI-03	SAIFI	3	HASKL1625	-		02/21/23 10:34	1	112	Equipment
SAIFI-03	SAIFI	3	HASKL1625	-		02/21/23 12:05	323	18,511	Equipment
SAIFI-03	SAIFI	3	HASKL1625	-		02/21/23 12:05	109	2,314	Equipment
SAIFI-03	SAIFI	3	HASKL1625	-		02/21/23 12:05	1	21	Vegetation
SAIFI-03	SAIFI	3	HASKL1625	MED	Cat	02/24/23 08:23	2	33	Other
SAIFI-03	SAIFI	3	HASKL1625	MED	Cat	02/24/23 09:00	825	2,126,118	Vegetation
SAIFI-03	SAIFI	3	HASKL1625	-		04/14/23 10:14	37	4,472	Planned
SAIFI-03	SAIFI	3	HASKL1625	-		04/20/23 09:26	1	182	Other
SAIFI-03	SAIFI	3	HASKL1625	-		05/05/23 11:09	1	51	Other
SAIFI-03	SAIFI	3	HASKL1625	-		05/05/23 11:30	2	35	Other
SAIFI-03	SAIFI	3	HASKL1625	-		05/08/23 09:53	1	427	Other
SAIFI-03	SAIFI	3	HASKL1625	-		05/15/23 18:19	1	46	Other
SAIFI-03	SAIFI	3	HASKL1625	-		06/09/23 10:27	1	281	Other
SAIFI-03	SAIFI	3	HASKL1625	-		06/21/23 09:34	1	11	Other
SAIFI-03	SAIFI	3	HASKL1625	-		07/13/23 00:10	1	651	Other
SAIFI-03	SAIFI	3	HASKL1625	-		07/13/23 00:11	1	651	Other
SAIFI-03	SAIFI	3	HASKL1625	-		07/18/23 08:45	1	450	Other
SAIFI-03	SAIFI	3	HASKL1625	MED	Cat	07/26/23 15:43	557	1,673,287	Lightning
SAIFI-03	SAIFI	3	HASKL1625	MED	Cat	07/26/23 16:54	1	1,292	Weather
SAIFI-03	SAIFI	3	HASKL1625	MED	Cat	07/26/23 16:54	1	1,292	Other
SAIFI-03	SAIFI	3	HASKL1625	-		09/04/23 19:39	1,713	146,853	Other
SAIFI-03	SAIFI	3	HASKL1625	-		09/05/23 13:55	565	11,164	Equipment
SAIFI-03	SAIFI	3	HASKL1625	-		09/12/23 10:33	1	12	Other
SAIFI-03	SAIFI	3	HASKL1625	-		09/30/23 11:53	1	205	Other
SAIFI-03	SAIFI	3	HASKL1625	-		11/22/23 09:40	1	7	Equipment
SAIFI-03	SAIFI	3	HASKL1625	-		11/22/23 09:40	1	8	Other
SAIFI-03	SAIFI	3	HASKL1625	-		12/21/23 12:09	1	7	Other
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	02/22/23 22:15	443	809,751	Weather
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	02/22/23 22:15	1	1,467	Weather

SAIFI-04	SAIFI	4	NBOST0305	-	Cat	02/25/23 22:47	401	484,802	Weather
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	02/25/23 22:47	9	34,357	Other
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	02/25/23 22:47	1	3,965	Other
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	02/25/23 22:47	1	4,328	Weather
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	02/28/23 14:25	1	7	Other
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	03/01/23 11:04	1	9	Other
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	03/05/23 09:51	1	122	Weather
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	03/07/23 08:51	1	7	Other
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	03/07/23 16:07	1	26	Weather
SAIFI-04	SAIFI	4	NBOST0305	-		03/12/23 20:09	4	1,905	Other
SAIFI-04	SAIFI	4	NBOST0305	-		03/12/23 20:09	52	8,595	Other
SAIFI-04	SAIFI	4	NBOST0305	-		03/13/23 03:26	7	273	Other
SAIFI-04	SAIFI	4	NBOST0305	-		03/16/23 10:10	2	61	Planned
SAIFI-04	SAIFI	4	NBOST0305	-		03/18/23 18:33	1	25	Other
SAIFI-04	SAIFI	4	NBOST0305	-		03/19/23 08:54	1	192	Other
SAIFI-04	SAIFI	4	NBOST0305	-		04/04/23 15:01	1	25	Equipment
SAIFI-04	SAIFI	4	NBOST0305	-		04/05/23 14:43	2	212	Equipment
SAIFI-04	SAIFI	4	NBOST0305	-		04/10/23 14:19	444	77,333	Other
SAIFI-04	SAIFI	4	NBOST0305	-		04/10/23 14:19	1	174	Other
SAIFI-04	SAIFI	4	NBOST0305	-		04/20/23 12:16	1	88	Other
SAIFI-04	SAIFI	4	NBOST0305	-		04/23/23 22:08	1	272	Wildlife
SAIFI-04	SAIFI	4	NBOST0305	-		04/24/23 10:08	1	897	Other
SAIFI-04	SAIFI	4	NBOST0305	MED		05/31/23 14:42	1	302	Other
SAIFI-04	SAIFI	4	NBOST0305	MED		05/31/23 20:28	1	894	Other
SAIFI-04	SAIFI	4	NBOST0305	-		06/11/23 21:54	1	853	Other
SAIFI-04	SAIFI	4	NBOST0305	MED	Small	06/25/23 18:18	1	1,003	Other
SAIFI-04	SAIFI	4	NBOST0305	MED	Small	06/25/23 18:18	1	1,091	Weather
SAIFI-04	SAIFI	4	NBOST0305	MED	Small	06/25/23 18:18	442	443,584	Weather
SAIFI-04	SAIFI	4	NBOST0305	MED	Small	06/25/23 18:18	1	1,004	Other
SAIFI-04	SAIFI	4	NBOST0305	MED	Small	06/26/23 13:30	1	10	Weather
SAIFI-04	SAIFI	4	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIFI-04	SAIFI	4	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIFI-04	SAIFI	4	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIFI-04	SAIFI	4	NBOST0305	-		07/18/23 14:48	7	36	Equipment
SAIFI-04	SAIFI	4	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIFI-04	SAIFI	4	NBOST0305	-		07/18/23 14:48	410	2,081	Other
SAIFI-04	SAIFI	4	NBOST0305	-		07/18/23 14:48	1	5	Vegetation
SAIFI-04	SAIFI	4	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIFI-04	SAIFI	4	NBOST0305	-		07/18/23 14:48	1	5	Other
SAIFI-04	SAIFI	4	NBOST0305	-		08/03/23 20:11	1	66	Other
SAIFI-04	SAIFI	4	NBOST0305	-		08/04/23 20:38	1	37	Other
SAIFI-04	SAIFI	4	NBOST0305	-		08/10/23 17:20	1	202	Other
SAIFI-04	SAIFI	4	NBOST0305	-		08/10/23 21:59	1	143	Other

SAIFI-04	SAIFI	4	NBOST0305	-		08/11/23 04:28	1	266	Other
SAIFI-04	SAIFI	4	NBOST0305	-		08/12/23 18:32	1	21	Other
SAIFI-04	SAIFI	4	NBOST0305	-		08/14/23 17:31	1	115	Other
SAIFI-04	SAIFI	4	NBOST0305	-		08/16/23 16:56	1	313	Other
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 02:17	6	30,514	Vegetation
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 02:17	9	41,080	Vegetation
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 02:17	13	66,117	Vegetation
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 02:17	2	10,171	Vegetation
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 02:18	8	39,930	Vegetation
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 02:24	4	1,966	Vegetation
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 02:24	49	24,129	Equipment
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 02:24	388	153,536	Weather
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 02:24	1	492	Other
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/24/23 22:35	2	13	Other
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/25/23 07:01	2	7,203	Equipment
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/25/23 07:01	1	3,601	Other
SAIFI-04	SAIFI	4	NBOST0305	MED	Cat	08/25/23 23:22	2	28	Other
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	08/26/23 08:57	1	33	Equipment
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	08/26/23 18:30	21	893	Vegetation
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	08/26/23 23:50	2	18	Other
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	08/27/23 02:52	1	512	Other
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	08/27/23 20:16	1	14	Other
SAIFI-04	SAIFI	4	NBOST0305	-	Cat	08/30/23 11:01	1	14	Vegetation
SAIFI-04	SAIFI	4	NBOST0305	-		09/01/23 08:02	1	89	Other
SAIFI-04	SAIFI	4	NBOST0305	-		09/01/23 16:07	1	21	Other
SAIFI-04	SAIFI	4	NBOST0305	-		09/03/23 11:17	1	9	Other
SAIFI-04	SAIFI	4	NBOST0305	-		09/15/23 16:28	1	34	Other
SAIFI-04	SAIFI	4	NBOST0305	-		09/16/23 13:57	1	76	Other
SAIFI-04	SAIFI	4	NBOST0305	-		09/17/23 09:18	1	302	Other
SAIFI-04	SAIFI	4	NBOST0305	-		09/17/23 14:59	1	11	Other
SAIFI-04	SAIFI	4	NBOST0305	-		10/02/23 10:42	1	307	Other
SAIFI-04	SAIFI	4	NBOST0305	-		10/03/23 11:43	2	81	Other
SAIFI-04	SAIFI	4	NBOST0305	-		10/04/23 11:22	1	37	Other
SAIFI-04	SAIFI	4	NBOST0305	-		10/04/23 11:22	1	41	Planned
SAIFI-04	SAIFI	4	NBOST0305	-		10/04/23 11:22	2	78	Other
SAIFI-04	SAIFI	4	NBOST0305	-		10/06/23 10:21	890	65,473	Planned
SAIFI-04	SAIFI	4	NBOST0305	-		10/06/23 10:21	2	147	Other
SAIFI-04	SAIFI	4	NBOST0305	-		10/27/23 09:26	1	185	Other
SAIFI-04	SAIFI	4	NBOST0305	-		12/01/23 17:34	1	14	Other
SAIFI-04	SAIFI	4	NBOST0305	-		12/18/23 16:10	1	6	Other
SAIFI-04	SAIFI	4	NBOST0305	-		12/22/23 10:44	1	75	Other
SAIFI-04	SAIFI	4	NBOST0305	-		12/28/23 04:24	1	45	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		01/01/23 01:04	696	612,258	Equipment

SAIFI-05	SAIFI	5	SNOVR0302	-	01/01/23 01:04	1	2,206	Equipment
SAIFI-05	SAIFI	5	SNOVR0302	-	01/01/23 19:23	2	2,225	Equipment
SAIFI-05	SAIFI	5	SNOVR0302	-	01/01/23 23:47	1	7	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	01/02/23 13:26	1	24	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	01/02/23 13:42	3	904	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	01/03/23 04:12	811	19,420	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	01/03/23 16:49	1	37	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	01/03/23 16:49	1	37	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	01/03/23 16:49	1	37	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	01/11/23 21:01	1	6	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	02/04/23 11:14	1	157	Equipment
SAIFI-05	SAIFI	5	SNOVR0302	-	03/15/23 18:43	1	9	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	03/30/23 07:29	1	318	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	03/31/23 22:34	1	1,362	Equipment
SAIFI-05	SAIFI	5	SNOVR0302	-	04/01/23 10:31	47	9,998	Weather
SAIFI-05	SAIFI	5	SNOVR0302	-	04/01/23 10:31	20	4,090	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	04/05/23 11:08	1	13	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	04/24/23 11:50	1	28	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	04/24/23 13:31	1	11	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	04/24/23 13:34	1	11	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	04/25/23 09:36	1	145	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	04/26/23 09:35	2	25	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	04/26/23 10:26	1	26	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	04/26/23 11:27	1	51	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/01/23 09:29	1	30	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/01/23 10:31	1	23	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/01/23 11:03	1	29	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/01/23 13:57	1	99	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/04/23 10:25	1	18	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/04/23 11:06	1	16	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/04/23 14:20	1	18	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/04/23 15:13	1	16	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	05/08/23 09:48	1	28	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/08/23 13:45	1	13	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/08/23 14:31	1	30	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/09/23 11:46	1	28	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/09/23 12:40	1	23	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/09/23 15:16	1	16	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/10/23 09:53	1	36	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/10/23 12:09	1	8	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/10/23 12:09	4	36	Other
SAIFI-05	SAIFI	5	SNOVR0302	-	05/10/23 14:10	1	34	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-	05/10/23 15:15	1	7	Other

SAIFI-05	SAIFI	5	SNOVR0302	-		05/11/23 08:38	1	6	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		05/11/23 09:20	1	25	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/19/23 09:21	1	23	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/19/23 10:16	1	51	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		05/19/23 11:15	1	26	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/19/23 12:05	1	95	Equipment
SAIFI-05	SAIFI	5	SNOVR0302	-		05/20/23 08:54	1	135	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/22/23 09:30	1	20	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/22/23 10:32	1	14	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		05/22/23 10:45	1	42	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/22/23 11:13	1	6	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/22/23 11:29	1	26	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		05/22/23 12:26	1	14	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		05/23/23 09:35	1	42	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/23/23 09:53	2	116	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/23/23 11:47	2	48	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		05/23/23 11:47	1	24	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/23/23 12:46	1	18	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/23/23 13:37	1	20	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/23/23 13:37	1	20	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		05/24/23 09:00	1	25	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		05/24/23 10:32	1	55	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		05/24/23 10:33	6	328	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		06/01/23 13:12	1	94	Planned
SAIFI-05	SAIFI	5	SNOVR0302	-		06/06/23 08:11	1	108	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		06/30/23 01:20	5	2,744	Vegetation
SAIFI-05	SAIFI	5	SNOVR0302	-		07/11/23 11:52	1	15	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		07/13/23 01:28	1	937	Weather
SAIFI-05	SAIFI	5	SNOVR0302	-		07/13/23 01:37	4	3,680	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		07/13/23 13:26	1	41	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		07/17/23 11:45	2	71	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		07/17/23 11:45	1	36	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		07/25/23 09:51	1	53	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		08/08/23 14:23	338	83,884	Equipment
SAIFI-05	SAIFI	5	SNOVR0302	MED	Cat	08/24/23 20:06	1	6	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		09/18/23 10:44	1	13	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		09/18/23 12:15	1	34	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		09/19/23 10:47	2	15	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		09/28/23 09:57	5	222	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		10/18/23 15:39	74	9,897	Equipment
SAIFI-05	SAIFI	5	SNOVR0302	-		10/18/23 15:39	1	106	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		10/23/23 12:43	1	41	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		11/09/23 12:59	1	12	Vegetation

SAIFI-05	SAIFI	5	SNOVR0302	-		11/09/23 22:14	1	704	Equipment
SAIFI-05	SAIFI	5	SNOVR0302	-		11/10/23 20:57	5	43	Other
SAIFI-05	SAIFI	5	SNOVR0302	-		11/21/23 07:11	1	294	Equipment
SAIFI-06	SAIFI	6	SDF012641	-		03/17/23 03:39	102	17,492	Weather
SAIFI-06	SAIFI	6	SDF012641	-		03/17/23 03:39	1	172	Weather
SAIFI-06	SAIFI	6	SDF012641	-		04/05/23 08:56	1	504	Lightning
SAIFI-06	SAIFI	6	SDF012641	-		04/27/23 09:38	1	308	Other
SAIFI-06	SAIFI	6	SDF012641	-		05/05/23 09:41	1	17	Planned
SAIFI-06	SAIFI	6	SDF012641	-		05/05/23 12:17	1	7	Planned
SAIFI-06	SAIFI	6	SDF012641	-		05/05/23 13:09	1	10	Planned
SAIFI-06	SAIFI	6	SDF012641	-		05/05/23 13:10	1	10	Other
SAIFI-06	SAIFI	6	SDF012641	-		05/05/23 13:59	1	19	Planned
SAIFI-06	SAIFI	6	SDF012641	-		05/08/23 10:52	1	22	Planned
SAIFI-06	SAIFI	6	SDF012641	-		05/08/23 13:27	1	19	Other
SAIFI-06	SAIFI	6	SDF012641	-		05/08/23 13:27	1	19	Planned
SAIFI-06	SAIFI	6	SDF012641	-		05/11/23 08:55	1	87	Other
SAIFI-06	SAIFI	6	SDF012641	-		05/16/23 09:14	1	26	Planned
SAIFI-06	SAIFI	6	SDF012641	-		06/05/23 10:52	1	6	Other
SAIFI-06	SAIFI	6	SDF012641	MED	Small	07/20/23 22:02	1	1,106	Weather
SAIFI-06	SAIFI	6	SDF012641	-		08/01/23 10:09	1	21	Other
SAIFI-06	SAIFI	6	SDF012641	-		08/18/23 10:53	102	43,382	Equipment
SAIFI-06	SAIFI	6	SDF012641	-		09/12/23 08:34	78	17,498	Equipment
SAIFI-06	SAIFI	6	SDF012641	-		09/12/23 08:34	126	28,267	Equipment
SAIFI-06	SAIFI	6	SDF012641	-		09/16/23 09:15	102	38,219	Vegetation
SAIFI-06	SAIFI	6	SDF012641	-		12/21/23 13:00	1	133	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	-		01/05/23 09:17	1	17	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		02/02/23 11:12	2	45	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		02/03/23 11:55	2	89	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		02/05/23 10:57	1	9	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		02/07/23 14:43	2	31	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		02/11/23 14:26	1	42	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		02/13/23 11:05	2	113	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-	Small	02/15/23 10:54	2	444	Weather
SAIFI-07	SAIFI	7	ARMAD0302	-	Small	02/15/23 15:19	336	68,302	Weather
SAIFI-07	SAIFI	7	ARMAD0302	-	Small	02/16/23 07:12	2	463	Weather
SAIFI-07	SAIFI	7	ARMAD0302	-		02/17/23 11:12	1	50	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		02/20/23 10:59	1	37	Planned
SAIFI-07	SAIFI	7	ARMAD0302	MED	Cat	03/03/23 22:30	159	203,260	Weather
SAIFI-07	SAIFI	7	ARMAD0302	-		03/09/23 15:27	1	37	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		03/16/23 11:58	22	1,445	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		03/16/23 11:59	6	740	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		03/19/23 16:23	1	633	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		03/20/23 20:37	3	56	Weather

SAIFI-07	SAIFI	7	ARMAD0302	-		03/21/23 10:54	1	172	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		03/21/23 10:54	1	172	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		03/23/23 17:44	1	118	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	-		03/23/23 17:45	1	118	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	-		03/29/23 12:19	1	107	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		03/30/23 16:30	2	11	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		04/04/23 19:04	2	46	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		04/05/23 13:32	2	476	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	-		04/08/23 10:09	1	1,664	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		04/11/23 12:45	1	111	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		04/23/23 18:58	1	194	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		04/26/23 10:53	2	71	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		05/08/23 10:12	1	111	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		05/08/23 10:44	1	53	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		05/08/23 15:10	1	42	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		05/08/23 15:10	1	42	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		05/13/23 14:10	1	19	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		05/13/23 15:22	1	37	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		05/14/23 10:36	1	52	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		05/14/23 13:08	1	66	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		05/14/23 14:56	1	56	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		05/16/23 14:13	2	80	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		05/18/23 15:30	1	62	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	-		05/21/23 10:42	1	29	Other
SAIFI-07	SAIFI	7	ARMAD0302	MED		05/31/23 13:00	1	25	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		06/13/23 08:55	1	134	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		06/14/23 09:42	1	47	Planned
SAIFI-07	SAIFI	7	ARMAD0302	MED	Small	06/26/23 02:16	1	1,003	Weather
SAIFI-07	SAIFI	7	ARMAD0302	-	Small	06/27/23 14:52	1	167	Weather
SAIFI-07	SAIFI	7	ARMAD0302	-		07/06/23 10:05	1	14	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		07/10/23 19:17	1	33	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		07/14/23 17:58	1	5	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		07/17/23 21:07	318	70,672	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	MED	Small	07/20/23 15:36	319	618,445	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	-		07/23/23 23:12	335	79,420	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	-		08/08/23 18:24	334	37,081	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	-		08/15/23 07:15	1	130	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		08/15/23 07:15	326	42,499	Weather
SAIFI-07	SAIFI	7	ARMAD0302	-	Cat	08/29/23 10:17	1	153	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		10/06/23 12:58	1	25	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		10/11/23 09:39	1	177	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		10/17/23 08:50	1	142	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		10/18/23 10:32	1	81	Planned

SAIFI-07	SAIFI	7	ARMAD0302	-		10/18/23 14:17	1	12	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		10/19/23 08:56	1	18	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		10/19/23 10:54	2	41	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		10/21/23 08:48	1	58	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		10/21/23 10:40	1	21	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		10/21/23 11:36	1	13	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		10/21/23 11:36	1	13	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		10/23/23 10:09	1	104	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		10/23/23 14:00	1	6	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		10/23/23 14:00	1	6	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		10/25/23 09:11	2	25	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		10/25/23 09:45	1	47	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		11/02/23 11:23	1	57	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		11/03/23 12:43	1	48	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		11/12/23 08:55	1	212	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		11/15/23 10:56	1	11	Equipment
SAIFI-07	SAIFI	7	ARMAD0302	-		11/15/23 10:56	1	11	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		11/15/23 13:14	1	6	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		11/17/23 17:16	1	32	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		11/29/23 10:13	1	7	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		12/13/23 08:44	1	125	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		12/20/23 09:30	1	46	Other
SAIFI-07	SAIFI	7	ARMAD0302	-		12/21/23 10:55	1	6	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		12/21/23 12:32	1	14	Planned
SAIFI-07	SAIFI	7	ARMAD0302	-		12/24/23 09:23	1	106	Equipment
SAIFI-08	SAIFI	8	SNOVR0301	-		01/01/23 01:04	1	2,327	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		01/01/23 01:04	175	107,423	Equipment
SAIFI-08	SAIFI	8	SNOVR0301	-		01/01/23 11:06	46	27,756	Equipment
SAIFI-08	SAIFI	8	SNOVR0301	-		01/01/23 11:06	2	1,207	Equipment
SAIFI-08	SAIFI	8	SNOVR0301	-		01/01/23 11:06	18	10,860	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		01/01/23 21:08	115	68,839	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		01/01/23 23:47	1	8	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		01/03/23 03:45	127	4,811	Equipment
SAIFI-08	SAIFI	8	SNOVR0301	-		01/03/23 16:49	1	36	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		01/03/23 16:49	233	8,594	Other
SAIFI-08	SAIFI	8	SNOVR0301	MED	Cat	02/24/23 11:55	1	29	Weather
SAIFI-08	SAIFI	8	SNOVR0301	MED	Cat	02/25/23 15:24	1	31	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		03/20/23 22:08	1	221	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		04/04/23 11:14	2	167	Planned
SAIFI-08	SAIFI	8	SNOVR0301	-		04/15/23 13:15	1	36	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		05/11/23 13:30	1	70	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		07/09/23 09:48	2	525	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		07/25/23 13:17	1	10	Planned

SAIFI-08	SAIFI	8	SNOVR0301	MED	Cat	07/26/23 14:43	1	7	Weather
SAIFI-08	SAIFI	8	SNOVR0301	MED	Cat	07/27/23 09:49	1	30	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		07/31/23 11:41	1	40	Planned
SAIFI-08	SAIFI	8	SNOVR0301	-		08/08/23 14:23	2	497	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		08/08/23 14:23	166	41,198	Equipment
SAIFI-08	SAIFI	8	SNOVR0301	-		08/08/23 14:23	1	248	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		08/08/23 14:23	1	248	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		08/12/23 10:41	2	48	Equipment
SAIFI-08	SAIFI	8	SNOVR0301	-		08/16/23 13:19	1	9	Other
SAIFI-08	SAIFI	8	SNOVR0301	-		10/13/23 07:49	1	87	Other
SAIFI-09	SAIFI	9	SDF339897	-		01/03/23 06:21	1	580	Vegetation
SAIFI-09	SAIFI	9	SDF339897	-		01/09/23 15:27	1	5	Other
SAIFI-09	SAIFI	9	SDF339897	-	Small	02/15/23 10:28	1	1,550	Weather
SAIFI-09	SAIFI	9	SDF339897	-	Small	02/15/23 21:31	1	27	Weather
SAIFI-09	SAIFI	9	SDF339897	-	Small	02/15/23 21:31	1	27	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/22/23 17:03	12	101,820	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/22/23 19:33	5	25,666	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/22/23 19:33	5	42,629	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/22/23 20:16	2	18,122	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/22/23 22:34	2	19,531	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/22/23 23:56	1	216	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/23/23 00:51	148	360,543	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/24/23 00:05	1	124	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/24/23 02:50	2	70	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/24/23 03:35	1	5	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/24/23 07:13	1	6	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/24/23 11:55	84	189,711	Vegetation
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/24/23 15:53	84	55,845	Weather
SAIFI-09	SAIFI	9	SDF339897	-	Cat	02/26/23 12:39	144	4,544	Weather
SAIFI-09	SAIFI	9	SDF339897	-	Cat	02/26/23 14:55	1	27	Other
SAIFI-09	SAIFI	9	SDF339897	-	Cat	02/26/23 19:24	1	9	Other
SAIFI-09	SAIFI	9	SDF339897	-	Cat	02/26/23 20:12	1	22	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/27/23 16:54	2	88	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	02/27/23 16:54	6	265	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	03/03/23 20:19	1	2,629	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	03/03/23 20:26	28	98,272	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	03/03/23 20:26	2	7,500	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	03/03/23 22:56	1	3,587	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	03/04/23 02:27	2	18	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	03/04/23 03:24	2	14	Other
SAIFI-09	SAIFI	9	SDF339897	-	Cat	03/06/23 08:12	3	22	Vegetation
SAIFI-09	SAIFI	9	SDF339897	-	Cat	03/06/23 11:22	1	142	Weather
SAIFI-09	SAIFI	9	SDF339897	-	Cat	03/06/23 15:03	2	324	Weather

SAIFI-09	SAIFI	9	SDF339897	-	Cat	03/07/23 19:06	1	28	Other
SAIFI-09	SAIFI	9	SDF339897	-		03/17/23 12:49	1	22	Other
SAIFI-09	SAIFI	9	SDF339897	-		03/28/23 13:48	341	42,010	Other
SAIFI-09	SAIFI	9	SDF339897	-		05/02/23 19:11	1	78	Planned
SAIFI-09	SAIFI	9	SDF339897	-		05/17/23 13:07	1	27	Other
SAIFI-09	SAIFI	9	SDF339897	-		05/17/23 13:07	5	135	Other
SAIFI-09	SAIFI	9	SDF339897	-		05/19/23 23:05	340	48,696	Vegetation
SAIFI-09	SAIFI	9	SDF339897	-		05/25/23 10:22	340	21,465	Equipment
SAIFI-09	SAIFI	9	SDF339897	-		05/30/23 01:49	341	30,210	Wildlife
SAIFI-09	SAIFI	9	SDF339897	-		06/12/23 11:14	1	58	Planned
SAIFI-09	SAIFI	9	SDF339897	-		06/12/23 11:14	6	345	Other
SAIFI-09	SAIFI	9	SDF339897	-		06/15/23 17:26	1	511	Weather
SAIFI-09	SAIFI	9	SDF339897	-		06/16/23 01:06	7	353	Other
SAIFI-09	SAIFI	9	SDF339897	-		06/24/23 10:37	1	88	Wildlife
SAIFI-09	SAIFI	9	SDF339897	-		06/24/23 10:38	1	88	Other
SAIFI-09	SAIFI	9	SDF339897	-		06/24/23 10:38	1	88	Wildlife
SAIFI-09	SAIFI	9	SDF339897	MED		06/25/23 12:46	341	30,525	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Small	06/25/23 18:12	342	331,400	Weather
SAIFI-09	SAIFI	9	SDF339897	-		07/25/23 09:28	2	82	Planned
SAIFI-09	SAIFI	9	SDF339897	-		07/26/23 09:24	1	55	Other
SAIFI-09	SAIFI	9	SDF339897	-		07/26/23 09:24	1	55	Planned
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:01	1	4,606	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:01	26	117,412	Vegetation
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:01	1	3,098	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:32	1	3,067	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:32	13	54,822	Vegetation
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:32	1	4,434	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:32	288	901,339	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:32	1	4,415	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:32	1	3,067	Weather
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	07/26/23 15:32	21	92,890	Vegetation
SAIFI-09	SAIFI	9	SDF339897	-		08/01/23 09:02	1	34	Planned
SAIFI-09	SAIFI	9	SDF339897	-		08/07/23 10:29	2	72	Other
SAIFI-09	SAIFI	9	SDF339897	-		08/08/23 09:48	5	210	Planned
SAIFI-09	SAIFI	9	SDF339897	-		08/09/23 09:16	1	37	Planned
SAIFI-09	SAIFI	9	SDF339897	-		08/09/23 10:48	5	208	Planned
SAIFI-09	SAIFI	9	SDF339897	-		08/10/23 09:33	2	77	Planned
SAIFI-09	SAIFI	9	SDF339897	-		08/10/23 11:12	7	225	Planned
SAIFI-09	SAIFI	9	SDF339897	-		08/17/23 19:05	1	32	Other
SAIFI-09	SAIFI	9	SDF339897	MED	Cat	08/24/23 22:16	21	81,469	Weather
SAIFI-09	SAIFI	9	SDF339897	-	Cat	08/27/23 12:57	30	4,202	Weather
SAIFI-09	SAIFI	9	SDF339897	-		09/06/23 12:24	1	5	Other
SAIFI-09	SAIFI	9	SDF339897	-		09/06/23 18:28	6	450	Vegetation

SAIFI-09	SAIFI	9	SDF339897	-		09/29/23 20:44	1	8	Other
SAIFI-09	SAIFI	9	SDF339897	-		09/30/23 08:44	1	348	Other
SAIFI-09	SAIFI	9	SDF339897	-		09/30/23 19:03	5	90	Other
SAIFI-09	SAIFI	9	SDF339897	-		10/14/23 09:32	2	10	Other
SAIFI-09	SAIFI	9	SDF339897	-		11/12/23 14:31	2	52	Other
SAIFI-09	SAIFI	9	SDF339897	-		11/17/23 00:18	1	134	Equipment
SAIFI-09	SAIFI	9	SDF339897	-		11/17/23 00:18	6	805	Equipment
SAIFI-09	SAIFI	9	SDF339897	-		12/28/23 09:14	4	50	Planned
SAIFI-09	SAIFI	9	SDF339897	-		12/28/23 11:17	6	76	Planned
SAIFI-09	SAIFI	9	SDF339897	-		12/28/23 11:17	1	13	Other
SAIFI-09	SAIFI	9	SDF339897	-		12/29/23 09:49	2	144	Planned
SAIFI-09	SAIFI	9	SDF339897	-		12/29/23 12:12	4	204	Planned
SAIFI-10	SAIFI	10	CABOT9490	MED	Cat	02/22/23 20:07	300	99,988	Weather
SAIFI-10	SAIFI	10	CABOT9490	MED	Cat	03/03/23 17:47	2	5,300	Weather
SAIFI-10	SAIFI	10	CABOT9490	MED	Cat	03/03/23 17:47	147	144,402	Weather
SAIFI-10	SAIFI	10	CABOT9490	MED	Cat	03/03/23 17:47	5	8,450	Other
SAIFI-10	SAIFI	10	CABOT9490	-		03/09/23 16:02	3	80	Equipment
SAIFI-10	SAIFI	10	CABOT9490	-		03/09/23 16:02	2	53	Equipment
SAIFI-10	SAIFI	10	CABOT9490	-		03/15/23 11:03	3	338	Other
SAIFI-10	SAIFI	10	CABOT9490	-		03/15/23 14:21	3	301	Planned
SAIFI-10	SAIFI	10	CABOT9490	MED	Small	03/25/23 14:23	153	10,677	Weather
SAIFI-10	SAIFI	10	CABOT9490	-		04/02/23 05:04	148	35,100	Equipment
SAIFI-10	SAIFI	10	CABOT9490	-		05/09/23 12:00	146	932	Planned
SAIFI-10	SAIFI	10	CABOT9490	-		05/28/23 14:49	4	21	Equipment
SAIFI-10	SAIFI	10	CABOT9490	-		06/15/23 23:30	30	798	Weather
SAIFI-10	SAIFI	10	CABOT9490	-		06/16/23 05:32	59	1,167	Equipment
SAIFI-10	SAIFI	10	CABOT9490	-		06/16/23 10:22	1	9	Other
SAIFI-10	SAIFI	10	CABOT9490	MED	Cat	07/27/23 13:58	150	40,364	Other
SAIFI-10	SAIFI	10	CABOT9490	-		08/20/23 23:39	1	7	Other
SAIFI-10	SAIFI	10	CABOT9490	-		08/20/23 23:39	149	1,055	Other
SAIFI-10	SAIFI	10	CABOT9490	MED	Cat	08/24/23 22:40	5	19,735	Weather
SAIFI-10	SAIFI	10	CABOT9490	-		09/23/23 12:46	146	11,694	Equipment

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27a

Respondent: M. Hatsios

Page: 1 of 3

- Question:** 27. Refer to the direct testimony of Michael J. Hatsios (Hatsios) p.29-31, particularly on p. MJH-31 where Witness Hatsios states the outage transaction goals for 2023-2024 on improving the timeliness and accuracy of power status updates and restoration estimates.
- a. Please describe the process for how DTE determines and communicates outage restoration estimates. Please also confirm if the company provides estimated times of restoration or simply estimated day of restoration for outage events.

Answer: The referenced Hatsios direct testimony in the question above is on Page MJH-32, Lines 6-8.

Generating an outage restoration estimate

There are two ways outage restoration estimates are generated differentiated by Non-Storm or Storm.

Non-Storm (includes Blue Sky and Gray Sky-High Impact Day)

During non-storm outages, outage restoration estimates are generated automatically through our Outage Management System (OMS) once an outage event is created, based on set rules that have been developed. Gray Sky is a High-Impact Day.

Storm

In storm outage events, DTE has a designated storm role team that is assigned to generating storm outage restoration estimates. During storms, the team provides constant support to generate a multi-day estimate strategy that aligns with our restoration priorities and inputs the estimates into the OMS to be communicated to customers.

Long-term, to reduce the amount of time required to provide customers a manual restoration estimate during storms, we have developed several versions of a restoration estimate machine learning model and are in the process of validating the models against historical storm data. Once fully developed, the machine learning model will improve the timeliness of delivering storm estimates. This summer, we are evaluating the chosen model's ability to generate restoration estimates alongside our existing manual method to gauge the level of improvement and its accuracy. Once

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27a

Respondent: M. Hatsios

Page: 2 of 3

the accuracy of the model is established, we will integrate it with the OMS system. Peers with estimate models have spent several years refining their models. See Witness Hatsios direct testimony on Pages MJH-76 Line 3 through MJH-77 Line 5.

Communicating outage restoration estimates

For both non-storm and storm scenarios, customers can see their restoration estimate as soon as the estimate is generated by clicking their associated outage on the DTE Outage Map, by checking their outage status in the DTE Outage Center, or by receiving a SMS/email notification if subscribed.

In non-storm events, customers are provided both a day and timestamp for their estimate. In storm, customers receive the day they will be restored. See table below.

		NON – STORM Blue Sky & Gray Sky-High Impact Day	STORM
Global Estimate	Definition	Not Applicable. A global estimate is <u>not</u> generated in non-Storm conditions.	General communication applicable for all impacted customers, specifies the percentage of customers expected to be restored by a certain day. <i>Example: 90% of customers restored by end of day Wednesday</i>
	Expected Timelines for Communication		1 hour after weather clears. <i>(*If Weather clears during overnight hours between 12:00am-5:00am, process will begin at 6:00 am)</i>
Outage-Specific Estimates	Definition	Premise-level specific restoration estimate, developed for each Outage Event	Premise-level specific restoration estimate, developed for each Outage Event
	Expected Timelines for Communication	Customer should receive an estimate within 60 minutes of their outage.	4-6 hours after weather clears the service territory. <i>(*If Weather clears during overnight hours between 12:00am-5:00am, 4-6 hours will begin at 6:00 am)</i>

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27a

Respondent: M. Hatsios

Page: 3 of 3

Estimate Visibility	Customers	Both day and time of their estimate <div data-bbox="560 514 799 583" style="border: 1px solid black; padding: 2px;">Estimated Restoration Nov 14, 2023, 12:00 PM</div>	Only see the day of the estimate <div data-bbox="1015 514 1253 583" style="border: 1px solid black; padding: 2px;">Estimated Restoration Friday, August 4</div>
--------------------------------	------------------	--	---

Attachment: None.

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27bi

Respondent: M. Hatsios

Page: 1 of 3

- Question:** 27. Refer to the direct testimony of Michael J. Hatsios (Hatsios) p.29-31, particularly on p. MJH-31 where Witness Hatsios states the outage transaction goals for 2023-2024 on improving the timeliness and accuracy of power status updates and restoration estimates.
- b. Please provide a ten year historical overview of the following, for all-weather, storm- only, and non-storm:
- i. The accuracy of the first restoration estimates provided to customers (i.e., for every customer that received an outage estimate, the percentage of those customers who had their power restored within that estimate)

Answer: Our Company's measurement of estimate accuracy has evolved significantly, with our recent focus on providing our customers with Error Free Communications related to their outage status. Below, we show the methods we used to measure estimate accuracy and the applicable time periods in which historical data is available.

- 2018 – 2022: Blue Sky Estimate Accuracy
- 2022 – 2024 YTD: Storm First Estimate Accuracy
- 2023 – 2024 YTD: Non-Storm (Blue-Sky & Gray Sky) First Estimate Accuracy

Blue Sky Estimate Accuracy

From 2018-2022, our Company measured estimate accuracy for Blue Sky days only. Since then, we have evolved our calculation to include all weather events (Storm & Gray Sky days) and more granularity on the specific reasons why an estimate was not accurate. We are also approaching the calculation from the perspective of the customer's experience. Please note, our Blue Sky estimate accuracy calculation from 2018 - 2022 is significantly different from how we measure estimate accuracy today. See table below for the differences. Below the table is our Blue Sky estimate accuracy by year.

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27bi

Respondent: M. Hatsios

Page: 2 of 3

		2018 - 2022 First Estimate Accuracy	2023 - 2024 First Estimate Accuracy
Weather Included		Blue Sky Limitation: No visibility on Gray Sky Days	Blue Sky & Gray Sky
Data Source		Outage-Management System Focused OMS; AMI-Audited Restoration Limitation: Does not directly correlate to estimate communications to the customer.	Customer-Facing Calculation WISMO; AMI-Audited Restoration Advantage: Quantifies the estimates made visible to our customers on the outage map, check status, and notification platforms.
Accuracy Criteria:	# of Estimates	No failure criteria for multiple estimates Evaluate any estimate generated on the job	Customer must receive a single estimate
	Restoration Timeframe	Customer is restored within 3 hours of the time provided in the estimate	Customer is restored no earlier than 3 hours, no later than 10 minutes of the time provided in the estimate
Granularity		No visibility on reason why the estimate was not accurate (Only Pass or Fail recorded)	Specific failure criteria developed to provide visibility on the reason why an estimate was not accurate (Restored Too Early, Restored Too Late, Multiple Estimates Provided)

2018-2022 Blue Sky Estimate Accuracy

2018: 91%
 2019: 96%
 2020: 97%
 2021: 95%
 2022: 90%
 Yearly Target = 95%

First Estimate Accuracy

The Company measures First Estimate Accuracy as the percent of customers that received a single and accurate estimated restoration time (ETR). During a storm, an estimate is accurate if the customer receives a single estimate communication and is restored the same day as the day provided in the estimate. First Estimate Accuracy is defined more stringently during a non-storm day, as the customer must receive a single estimate and be restored no earlier than 3 hours prior and no later than 10 minutes past the estimated time communicated during Blue Sky and no earlier than 8 hours prior and no later

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27bi

Respondent: M. Hatsios

Page: 3 of 3

than 10 minutes past the estimated time communicated during Gray Sky. See table below. Below the table is our First Estimate Accuracy by year.

	NON – STORM Blue Sky & Gray Sky	STORM
What is an Accurate Estimate?	Both of the following must be true: 1. Customer receives a <u>single estimate</u> . 2. Customer is restored: Blue Sky: - <u>No earlier</u> than 3-hours prior and - <u>No later</u> than 10 minutes past the estimate Gray Sky-High-Impact Day: - <u>No earlier</u> than 8-hours prior and - <u>No later</u> than 10 minutes past the estimate	Both of the following must be true: 1. Customer receives a single estimate. 2. Customer is restored on the day provided in the ETR

2022-2024 June YTD First Estimate Accuracy

Storm – Catastrophic:

2022: 31%
 2023: 46%
 2024 June YTD: 70%
 2024 Target: 65%

Storm – Non-Catastrophic:

2022: 42%
 2023: 60%
 2024 June YTD: 55%
 2024 Target: 65%

Non-Storm (Blue Sky and Gray Sky):

2023: 45%
 2024 June YTD: 57%
 2024 Target: 70%

Attachment: None.

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27bii

Respondent: M. Hatsios

Page: 1 of 3

- Question:** 27. Refer to the direct testimony of Michael J. Hatsios (Hatsios) p.29-31, particularly on p. MJH-31 where Witness Hatsios states the outage transaction goals for 2023-2024 on improving the timeliness and accuracy of power status updates and restoration estimates.
- b. Please provide a ten year historical overview of the following, for all-weather, storm- only, and non-storm:
 - ii. For customers who were not restored within their estimated window, the percentage of customers who were given a revised estimate.

Answer:

As mentioned in MNSCDE-13.27bi, we developed specific failure criteria to provide visibility on the reason why an estimate was not accurate, allowing the team to deep-dive and problem solve areas of opportunity starting in 2023 for both storm and non-storm. Hence, the granularity required to answer this question is only available for 2023-2024 June YTD. The percentage of customers who received one or more revised estimates are provided in blue font below.

Storm – Catastrophic

2023	<p>46% of customers received a single, accurate estimate.</p> <p>29% were restored 1+ day earlier than the day provided on their single estimate. Earlier 2nd estimates are not communicated to customers.</p> <p>5% of customers received a revised estimate, but were restored by the day provided in their first estimate (2nd estimate was unnecessary)</p> <p>20% of customers required a 2nd revised estimate (not restored by day provided in 1st estimate)</p>
2024 (June YTD)	<p>70% of customers received a single, accurate estimate.</p> <p>21% were restored 1+ day earlier than the day provided on their single estimate. Earlier 2nd estimates are not communicated to customers.</p>

<p>(January - June YTD)</p>	<p>8% were restored more than 3 hours earlier than timestamp provided on their single estimate. Earlier 2nd estimates are not communicated to customers.</p> <p>12% of customers received a revised estimate, but were restored by the timestamp provided in their first estimate (2nd estimate unnecessary)</p> <p>23% of customers required a 2nd revised estimate (not restored by timestamp provided in 1st estimate)</p>
-----------------------------	---

Attachment: None.

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27biii

Respondent: M. Hatsios

Page: 1 of 1

- Question:** 27. Refer to the direct testimony of Michael J. Hatsios (Hatsios) p.29-31, particularly on p. MJH-31 where Witness Hatsios states the outage transaction goals for 2023-2024 on improving the timeliness and accuracy of power status updates and restoration estimates.
- b. Please provide a ten year historical overview of the following, for all-weather, storm- only, and non-storm:
- iii. For those customers given a revised estimate in Part ii of this question, the accuracy of that second estimate as described in Part i,

Answer: We do not currently measure second estimate accuracy. Our main focus is in providing our customers a single, accurate estimate. However, we can quantify the number of Estimate Time of Restorations (ETRs) provided to customers before they were restored.

Out of the customers who received multiple (2 or more) estimates, we provide below the percentage of customers who received 2 total ETRs (only 1 revised estimate) before they were restored. As noted in previous responses and for consistency, the data required to answer this question is only available for 2023-2024 June YTD.

Storm – Catastrophic:

2023: 77%

2024 June YTD: 92%

Storm – Non-Catastrophic:

2023: 78%

2024 June YTD: 89%

Non-Storm:

2023: 74%

2024 June YTD: 74%

Attachment: None.

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27biv

Respondent: M. Hatsios

Page: 1 of 1

- Question:** 27. Refer to the direct testimony of Michael J. Hatsios (Hatsios) p.29-31, particularly on p. MJH-31 where Witness Hatsios states the outage transaction goals for 2023-2024 on improving the timeliness and accuracy of power status updates and restoration estimates.
- b. Please provide a ten year historical overview of the following, for all-weather, storm- only, and non-storm:
- iv. The percentage of customers who were not given any estimate

Answer: As described in MNSCDE-13.27a, outage restoration estimates are communicated and visible to customers if they click on their associated outage on the DTE Outage Map or check their outage status in the DTE Outage Center. A customer can also receive an estimate communication if their outage was reported, and they are subscribed to receive SMS/email notifications.

There are a few exceptions below when a customer would not have an outage-specific estimate visible to them.

Storm: (1) If the customer is restored between the time estimates are disabled in anticipation of a storm, and (2) the time before a storm estimate strategy is developed, and (3) the time before the initial damage assessment and restoration priorities are established.

Non-Storm: If the customer is restored within the first 30 minutes after outage creation, before estimates are communicated.

Attachment: None.

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.27v

Respondent: M. Hatsios

Page: 1 of 1

- Question:** 27. Refer to the direct testimony of Michael J. Hatsios (Hatsios) p.29-31, particularly on p. MJH-31 where Witness Hatsios states the outage transaction goals for 2023-2024 on improving the timeliness and accuracy of power status updates and restoration estimates.
- b. Please provide a ten year historical overview of the following, for all-weather, storm- only, and non-storm:
- v. The percentage of customers who only received a system-generated estimate (i.e. where an updated estimate was never provided by a crew)

Answer: As noted in previous responses and for consistency, the data required to answer this question is only available for 2023-2024 June YTD.

As described in MNSCDE-13.27a, in non-storm weather conditions (Blue Sky and Gray Sky), a customer's first estimate will always be automatically generated from the Outage Management System (OMS), based on set rules that have been developed. In storm, a customer's first estimate will be manually provided per the storm estimate strategy.

As non-storm estimates are automatically generated from OMS, the percentages of customers provided below reflect only estimates during non-storm weather conditions.

Non-Storm:

2023: 59%

2024 June YTD: 65%

Attachment: None.

MPSC Case No: U-21534

Requester: MNSC

Question No.: MNSCDE-13.2b

Respondent: M. Fix

Page: 1 of 1

Question: 2. Please refer to Company response to ABATE Discovery ABDE-1.6 and related testimony. The Company indicates multiple temporary O&M reduction measures were taken in 2023.

b. Please provide the number of employees who elected the Voluntary Separation Incentive and the cost reduction associated with those departures by business unit and why this program would not reduce spending below 2022 levels.

Answer: DTE Electric objects for the reason that the information requested consists of confidential, proprietary, research and development of trade secrets, or commercial information, the disclosure of which would cause DTE Electric, its ratepayers, and its customers competitive harm. Subject to these objections, but without waiving them, DTE Electric's response follows

Please see response to AGDE-1.23c. Also see attachment entitled "NDA_U-21534 MNSCDE-13.2b Preliminary Estimated Net VSIP O&M Savings" for the information by business unit. Please note that this is a preliminary estimate that will continue to evolve due to the need to fill many key roles. Moreover, this estimate does not include any offset for the costs of the program.

Even if the Company is able to realize the estimated savings of \$20.2 million in 2025, this is less than the \$42.5 million of projected increases in the Company's O&M expense between 2022 and 2025. See Exhibit A-13, Schedule C5. To the extent actual savings are realized in 2025, they will be embedded in the Company's rates as actual costs in a future rate case.

Attachment: NDA_U-21534 MNSCDE-13.2b Preliminary Estimated Net VSIP O&M Savings

EXHIBIT CUB-15

RESERVED

EXHIBIT CUB-16

RESERVED

Douglas B. Jester

Personal Information

Contact Information:
220 MAC Avenue, Suite 218
East Lansing, MI 48823
517-337-7527
djester@5lakesenergy.com

Professional experience

January 2011 – present
Managing Partner 5 Lakes Energy

Co-owner of a consulting firm working to advance the clean energy economy in Michigan and beyond. Consulting engagements with foundations, startups, and large mature businesses have included work on public policy, business strategy, market development, technology collaboration, project finance, and export development concerning energy efficiency, smart grid, renewable generation, electric vehicle infrastructure, and utility regulation and rate design. Policy director for renewable energy ballot initiative and Michigan energy legislation advocacy. Supported startup of the Energy Innovation Business Council, a trade association of clean energy businesses. Developed integrated resource planning models for use in ten states' compliance with the Clean Power Plan. Expert witness in more than 70 electric utility regulation cases in Michigan and approximately 15 cases in other states.

February 2010 - December 2010
Michigan Department of Energy, Labor and Economic Growth
Senior Energy Policy Advisor

Advisor to the Chief Energy Officer of the State of Michigan with primary focus on institutionalizing energy efficiency and renewable energy strategies and policies and developing clean energy businesses in Michigan. Provided several policy analyses concerning utility regulation, grid-integrated storage, performance contracting, feed-in tariffs, and low-income energy efficiency and assistance. Participated in Pluggable Electric Vehicle Task Force, Smart Grid Collaborative, Michigan Prosperity Initiative, and Green Partnership Team. Managed development of social-media-based community for energy practitioners. Organized conference on Biomass Waste to Energy.

August 2008 - February 2010
Rose International
Business Development Consultant - Smart Grid

- Employed by Verizon Business' exclusive external staffing agency for the purpose of providing business and solution development consultation services to Verizon Business in the areas of Smart Grid services and transportation management services.

December 2007 - March 2010 Efficient Printers Inc

President/Co-Owner

- Co-founder and co-owner with Keith Carlson of a corporation formed for the purpose of acquiring J A Thomas Company, a sole proprietorship owned by Keith Carlson. Recognized as Sacramento County (California) 2008 Supplier of the Year and Washoe County (Nevada) Association for Retarded Citizens 2008 Employer of the Year. Business operations discontinued by asset sale to focus on associated printing software services of IT Services Corporation.

August 2007 - 2015 IT Services Corporation

President/Owner

- Founder, co-owner, and President of a startup business intended to provide advanced IT consulting services and to acquire or develop managed services in selected niches, currently focused on developing e-commerce solutions for commercial printing with software-as-a-service.

2004 – August 2007 Automated License Systems

Chief Technology Officer

- Member of four-person executive team and member of board of directors of a privately-held corporation specializing in automated systems for the sale of hunting and fishing licenses, park campground reservations, and in automated background check systems. Executive responsible for project management, network and data center operations, software and product development. Brought company through mezzanine financing and sold it to Active Networks.

2000 - 2004 WorldCom/MCI

Director, Government Application Solutions

- Executive responsible in various combinations for line of business sales, state and local government product marketing, project management, network and data center operations, software and product development, and contact center operations for specialized government process outsourcing business. Principal lines of business were vehicle emissions testing, firearm background checks, automated hunting and fishing license systems, automated appointment scheduling, and managed application hosting services. Also responsible for managing order entry, tracking, and service support systems for numerous large federal telecommunications contracts such as the US Post Office, Federal Aviation Administration, and Navy-Marine Corps Intranet.
- Increased annual line-of-business revenue from \$64 million to \$93 million, improved EBITDA from approximately 2% to 27%, and retained all customers, in context of corporate scandal and bankruptcy.
- Repeatedly evaluated in top 10% of company executive management on annual performance evaluations.

1999-2000 Compuware Corporation

Senior Project Manager

- Senior project manager, on customer site with five project managers and team of approximately 80, to migrate a major dental insurer from a mainframe environment to internet-enabled client-server environment.

1995 - 1999 City of East Lansing, Michigan

Mayor and Councilmember

- Elected chief executive of the City of East Lansing, a sophisticated city of 52,000 residents with a council-manager government employing about 350 staff and with an annual budget of about \$47 million. Major accomplishments included incorporation of public asset depreciation into budgets with consequent improvements in public facilities and services, complete rewrite and modernization of city charter, greatly intensified cooperation between the City of East Lansing and the East Lansing Public Schools, significant increases in recreational facilities and services, major revisions to housing code, initiation of revision of the City Master Plan, facilitation of the merger of the Capital Area Transportation Authority and Michigan State University bus systems, initiation of a major downtown redevelopment project, City government efficiency improvements, and numerous other policy initiatives. Member of Michigan Municipal League policy committee on Transportation and Environment and principal writer of league policy on these subjects (still substantially unchanged as of 2022).

1995-1999 Michigan Department of Natural Resources

Chief Information Officer

- Executive responsibility for end-user computing, data center operations, wide area network, local area network, telephony, public safety radio, videoconferencing, application development and support, Y2K readiness for Departments of Natural Resources and Environmental Quality. Directed staff of about 110. Member of MERIT Affiliates Board and of the Great Lakes Commission's Great Lakes Information Network (GLIN) Board.

1990-1995 Michigan Department of Natural Resources

Senior Fisheries Manager

- Responsible for coordinating management of Michigan's Great Lakes fisheries worth about \$4 billion per year including fish stocking and sport and commercial fishing regulation decisions, fishery monitoring and research programs, information systems development, market and economic analyses, litigation, legislative analysis and negotiation. University relations. Extensive involvement in regulation of steam electric and hydroelectric power plants.
- Served as agency expert on natural resource damage assessment, for all resources and causes.
- Considerable involvement with Great Lakes Fishery Commission, including:

- Co-chair of Strategic Great Lakes Fishery Management Plan working group
- Member of Lake Erie and Lake St. Clair Committees
- Chair, Council of Lake Committees
- Member, Sea Lamprey Control Advisory Committee
- St Clair and Detroit River Areas of Concern Planning Committees

1989-1990 American Fisheries Society

Editor, North American Journal of Fisheries Management

- Full responsibility for publication of one of the premier academic journals in natural resource management.

1984 - 1989 Michigan Department of Natural Resources

Fisheries Administrator

- Assistant to Chief of Fisheries, responsible for strategic planning, budgets, personnel management, public relations, market and economic analysis, and information systems. Department of Natural Resources representative to Governor's Cabinet Council on Economic Development. Extensive involvement in regulation of steam electric and hydroelectric power plants.

1983-present Michigan State University

Adjunct Instructor

- Irregular lecturer in various undergraduate and graduate fisheries and wildlife courses and informal graduate student research advisor in fisheries and wildlife and in parks and recreation marketing.

1977 – 1984 Michigan Department of Natural Resources

Fisheries Research Biologist

- Simulation modeling & policy analysis of Great Lakes ecosystems. Development of problem-oriented management records system and "epidemiological" approaches to managing inland fisheries.
- Modeling and valuation of impacts of power plants on natural resources and recreation.

Education

1991-1995 Michigan State University

PhD Candidate, Environmental Economics

Coursework completed, dissertation not pursued due to decision to pursue different career direction.

1980-1981 University of British Columbia

Non-degree Program, Institute of Animal Resource Ecology

1974-1977 Virginia Polytechnic Institute & State University

MS Fisheries and Wildlife Sciences

MS Statistics and Operations Research

1971-1974 New Mexico State University

BIS Mathematics, Computer Science, Biology, and Fine Arts

**Citizenship and
Community
Involvement**

Youth Soccer Coach, East Lansing Soccer League, 1987-89

Co-organizer, East Lansing Community Unity, 1992-1993

Bailey Community Association Board, 1993-1995

East Lansing Commission on the Environment, 1993-1995

East Lansing Street Lighting Advisory Committee, 1994

Councilmember, City of East Lansing, 1995-1999

Mayor, City of East Lansing, 1995-1997

East Lansing Downtown Development Authority Board Member, 1995-1999

East Lansing Transportation Commission, 1999-2004

East Lansing Non-Profit Housing and Neighborhood Services Corporation Board Member, 2001-2004

Lansing – East Lansing Smart Zone Board of Directors, 2007-2017

Council on Labor and Economic Growth, State of Michigan, by appointment of the Governor, May 2009 – May 2012

East Lansing Downtown Development Authority Board Member and Vice-Chair, 2010 – 2018.

East Lansing Brownfield Authority Board Member and Vice-Chair, 2010 – 2018.

East Lansing Downtown Management Board and Chair, 2010 – 2016

East Lansing City Center Condominium Association Board Member, 2015 – present.

City of East Lansing Advisory Commissioner to the Lansing Board of Water and Light, 2017 – present.

State of Michigan UP Energy Task Force, 2019-present, appointed by Governor Whitmer.

State of Michigan Dam Safety Committee, 2020-2021

State of Michigan Council on Climate Solutions, Energy Production, Transmission, Distribution, and Storage Workgroup Co-Chair, 2021-present.

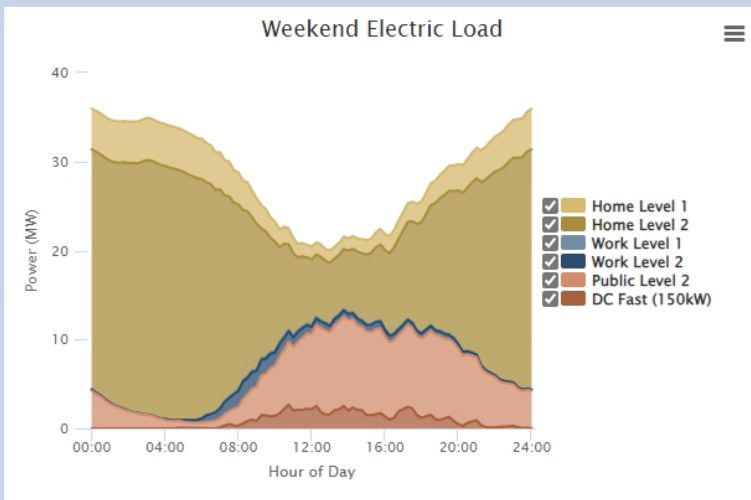
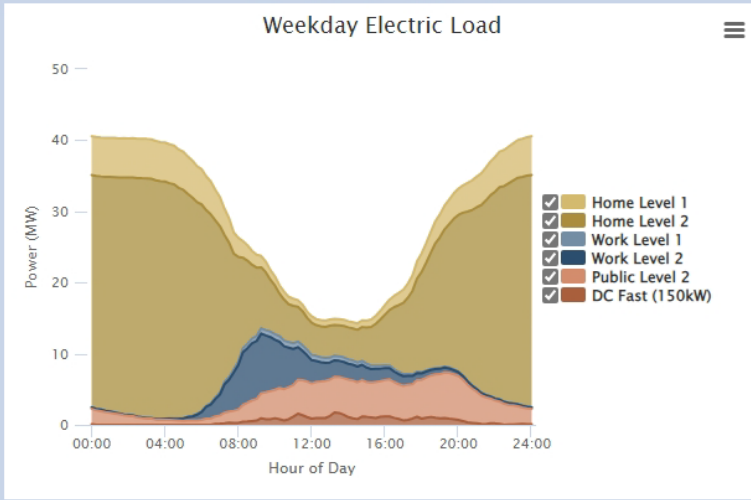
Board and Executive Committee Member, For Love of Water (FLOW), 2019 - present

EXHIBIT CUB-18

RESERVED

Results for Detroit, Michigan

In the Detroit area, supporting a fleet of 40,000 plug-in electric vehicles would result in the following electric load profile:



[Download load profile data](#)

Change Assumptions

These assumptions are based on the location you chose: **Detroit**.

Plug-in Electric Vehicles in the Fleet ?

1,000 10,000 30,000 More

40000

For reference, there were approximately 9,030 plug-in electric vehicles on the road in the Detroit area as of the end of 2018.

Average Daily Miles Traveled per vehicle ?

25 miles 35 miles 45 miles

Average Ambient Temperature ?

-4°F (-20°C) 68°F (20°C)
 14°F (-10°C) 86°F (30°C)
 32°F (0°C) 104°F (40°C)
 50°F (10°C)

Plug-in Vehicles that are All-Electric ?

25% 50% 75%

Plug-in Vehicles that are Sedans ?

20% 50% 80%

Mix of Workplace Charging

20% Level 1 and 80% Level 2
 50% Level 1 and 50% Level 2
 80% Level 1 and 20% Level 2

Access to Home Charging ?

50% 75% 100%

with the following mix:

20% Level 1 and 80% Level 2
 50% Level 1 and 50% Level 2
 80% Level 1 and 20% Level 2

Preference for Home Charging ?

60% 80% 100%

Home Charging Strategy ?

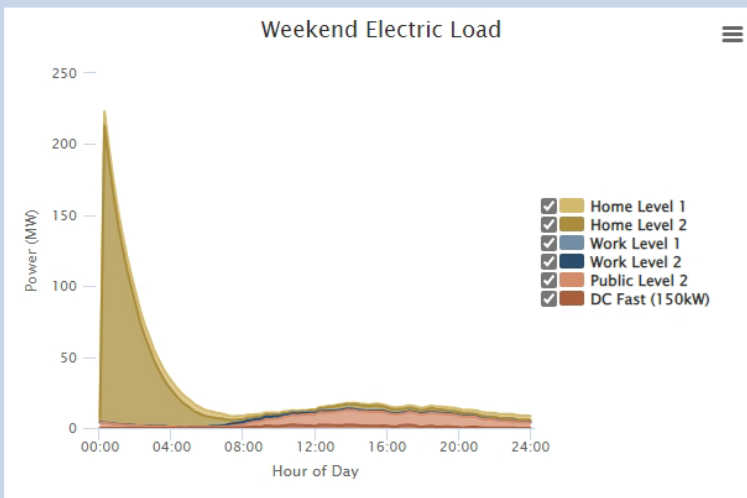
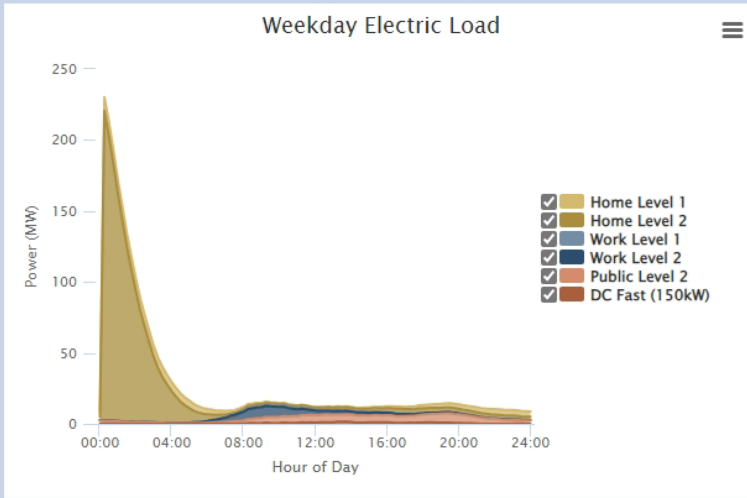
Immediate – as fast as possible
 Immediate – as slow as possible (even spread)
 Delayed – finish by departure
 Delayed – start at midnight

Workplace Charging Strategy ?

Immediate – as fast as possible
 Immediate – as slow as possible (even spread)
 Delayed – finish by departure

Results for Detroit, Michigan

In the Detroit area, supporting a fleet of 40,000 plug-in electric vehicles would result in the following electric load profile:



[Download load profile data](#)

Change Assumptions

These assumptions are based on the location you chose: **Detroit**.

Plug-in Electric Vehicles in the Fleet

1,000 10,000 30,000 More

40000

For reference, there were approximately 9,030 plug-in electric vehicles on the road in the Detroit area as of the end of 2018.

Average Daily Miles Traveled per vehicle

25 miles 35 miles 45 miles

Average Ambient Temperature

-4°F (-20°C) 68°F (20°C)
 14°F (-10°C) 86°F (30°C)
 32°F (0°C) 104°F (40°C)
 50°F (10°C)

Plug-in Vehicles that are All-Electric

25% 50% 75%

Plug-in Vehicles that are Sedans

20% 50% 80%

Mix of Workplace Charging

20% Level 1 and 80% Level 2
 50% Level 1 and 50% Level 2
 80% Level 1 and 20% Level 2

Access to Home Charging

50% 75% 100%

with the following mix:

20% Level 1 and 80% Level 2
 50% Level 1 and 50% Level 2
 80% Level 1 and 20% Level 2

Preference for Home Charging

60% 80% 100%

Home Charging Strategy

Immediate – as fast as possible
 Immediate – as slow as possible (even spread)
 Delayed – finish by departure
 Delayed – start at midnight

Workplace Charging Strategy

Immediate – as fast as possible
 Immediate – as slow as possible (even spread)
 Delayed – finish by departure



David Gard

Senior Consultant
dgard@5lakesenergy.com

Expertise

Building energy use & decarbonization; electricity system modeling; life cycle assessment; energy project financing options.

Selected Projects

- **Low Carbon Energy Infrastructure Development.** Led a multi-partner team that developed an analytical toolkit to help communities evaluate the costs and benefits of potential local building electrification projects, across a comprehensive range of cost, environmental, climate, economic, and other considerations. Funded through a contract with the Michigan Public Service Commission, this 5LE-directed initiative also involved engaging residents and other stakeholders in seven Michigan cities in identifying, evaluating, financing, and implementing electrification plans that emerge from project-led community conversations.
- **Grand Haven community climate and energy plan.** Served as 5LE's lead team member in a collaboration with Michigan Energy Options (MEO) and local stakeholders to develop a clean energy plan for the service territory of Grand Haven Board of Light and Power in west Michigan. Responsibilities for the project included using EPA's local GHG inventory tool to establish a baseline multi-sector emissions profile—including electricity use, onsite fuel combustion, waste management, land use, and transportation—and make future projections.
- **Traverse City Light and Power (TCLP) decarbonization planning.** Supported 5LE's work to advise TCLP—a municipal utility in the northwest Lower Peninsula of Michigan—on the best strategies and action plans for decarbonizing the power it provides its customers. Among others, contributions to the project included deploying hourly energy modeling and forecasting to assess options for electrifying the utility's natural gas/heating load and how those options would guide/impact its renewable energy generation and purchases, internal costs and customer pricing, and other aspects of its operations.
- **Heat-pump rate design modeling.** Applied National Renewable Energy Lab (NREL) end-use load profile data in hourly energy modeling to support a partnership with Rocky Mountain Institute (RMI) and Natural Resources Defense Council (NRDC) that focused on determining how ratepayer tariffs can be designed—and other such strategies can be adopted—to accelerate the uptake of air source heat pumps in cold weather climates.
- **Michigan Energy Efficiency Contractors Association (MEECA).** As a member of the 5LE team, serves as MEECA's part-time Executive Director, providing organizational leadership and development support and helping the industry expand its capacity, develop its future workforce, and speak with an effective voice in public policy arenas and debates.

Past Employment

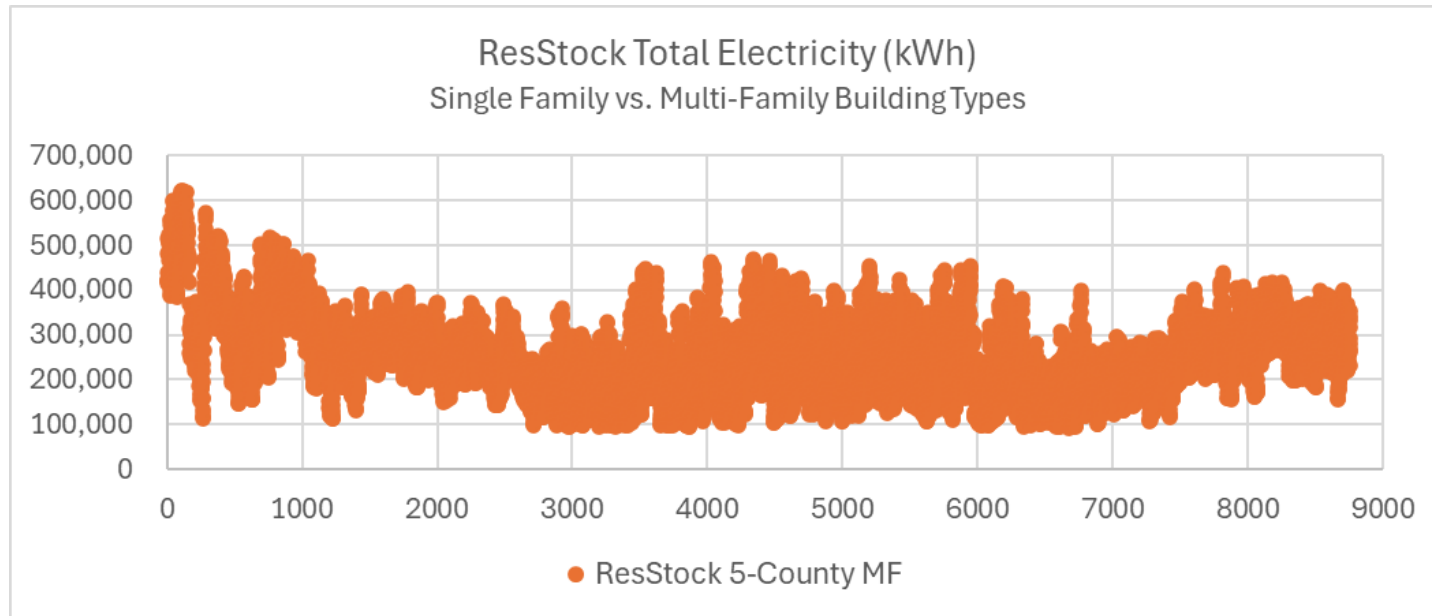
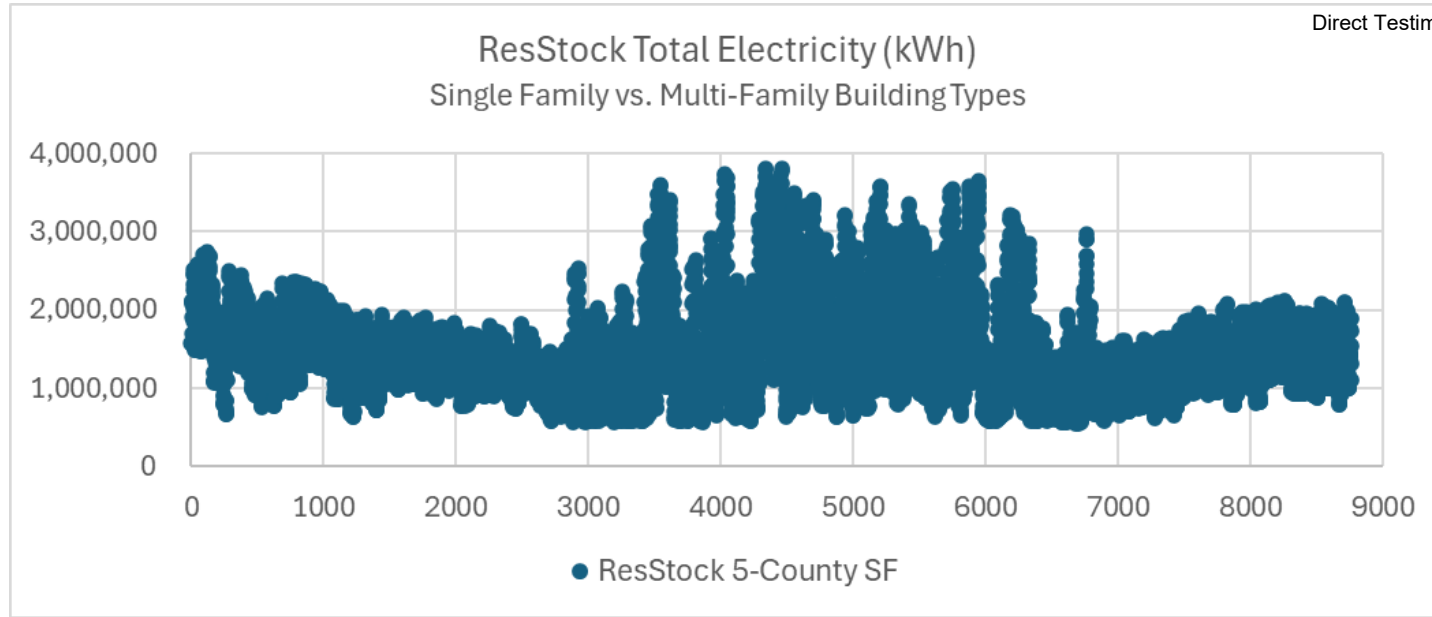
- Executive Director |The Oberlin Project | 2013-2014
- Energy Program Director | Michigan Environmental Council | 2002-2013
- Senior Design Engineer | Dematic | 1995-1998
- Division Officer| U.S. Navy, USS Mount Whitney | |1991-1995

Education

- MBA and MS, Environment and Sustainability (dual degree program) | University of Michigan | 2001
- BS, Mechanical Engineering | Northwestern University | 1991

Service, Affiliations, and Awards

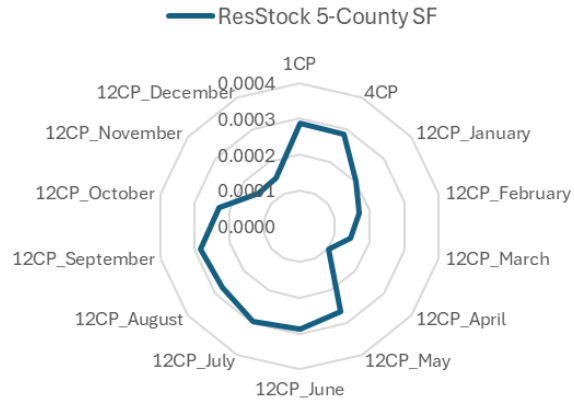
- External Advisory Board | University of Michigan, Center for Sustainable Systems | 2005-Present
- Board of Directors | Michigan Energy Options | 2012-2021
- Fellow | University of Michigan, Tauber Institute for Global Operations | 1998-2001
- 3M Prize for Outstanding Achievement in Industrial Ecology | 2001



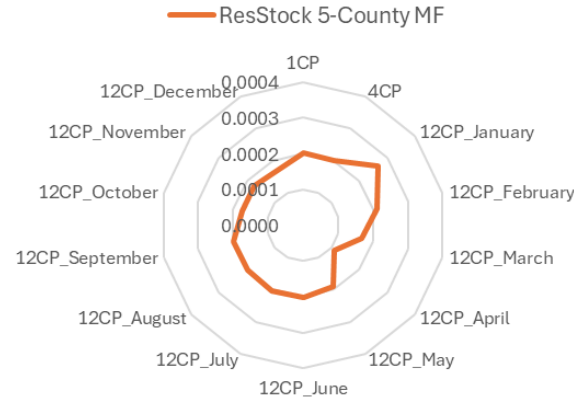
COS Metric	COS Metric/Annual Energy		
	ResStock 5-County SF	ResStock 5-County MF	DTE 2018 Residential
1CP	0.00029	0.00020	0.00029
4CP	0.00029	0.00020	0.00029
12CP_January	0.00020	0.00027	0.00017
12CP_February	0.00017	0.00021	0.00015
12CP_March	0.00015	0.00017	0.00013
12CP_April	0.00011	0.00011	0.00009
12CP_May	0.00026	0.00019	0.00025
12CP_June	0.00029	0.00020	0.00029
12CP_July	0.00030	0.00020	0.00031
12CP_August	0.00027	0.00020	0.00028
12CP_September	0.00028	0.00020	0.00028
12CP_October	0.00023	0.00018	0.00016
12CP_November	0.00015	0.00017	0.00014
12CP_December	0.00015	0.00017	0.00015

COS Metric	COS Metric/Annual Energy		
	ResStock 5-County SF	ResStock 5-County MF	DTE 2018 Residential
1NCP	0.00029	0.00021	0.00032
4CNP	0.00028	0.00021	0.00031
12NCP_January	0.00019	0.00025	0.00018
12NCP_February	0.00017	0.00022	0.00016
12NCP_March	0.00015	0.00017	0.00014
12NCP_April	0.00014	0.00016	0.00013
12NCP_May	0.00027	0.00020	0.00029
12NCP_June	0.00029	0.00021	0.00032
12NCP_July	0.00029	0.00021	0.00032
12NCP_August	0.00028	0.00020	0.00030
12NCP_September	0.00028	0.00020	0.00029
12NCP_October	0.00020	0.00017	0.00017
12NCP_November	0.00013	0.00016	0.00016
12NCP_December	0.00016	0.00017	0.00016

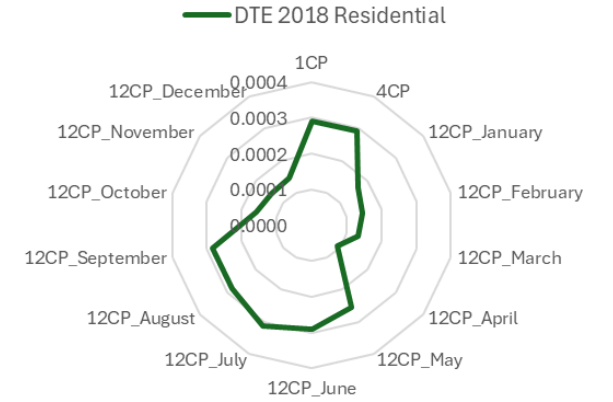
DTE CP Metrics / Annual Energy



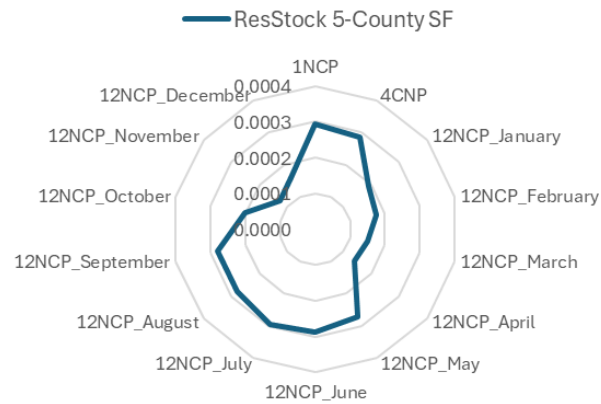
DTE CP Metrics / Annual Energy



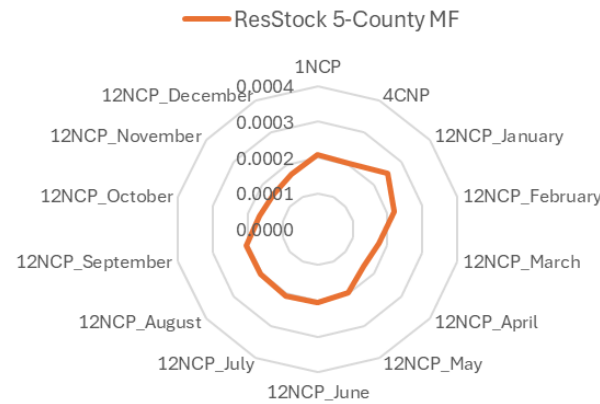
DTE CP Metrics / Annual Energy



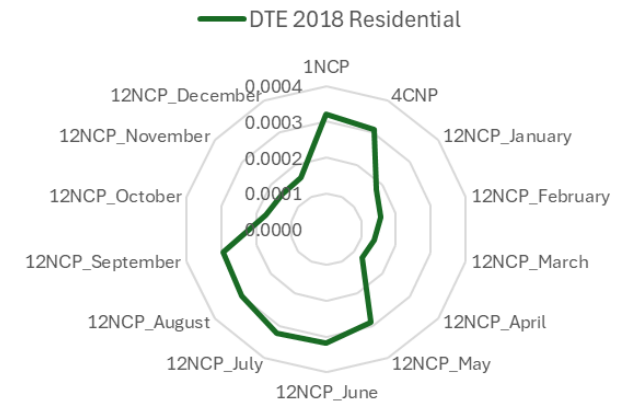
DTE NCP Metrics / Annual Energy



DTE NCP Metrics / Annual Energy



DTE NCP Metrics / Annual Energy



DESCRIPTION OF MODELING ANALYSIS TO INVESTIGATE IMPACTS OF INCREASED BUILDING ELECTRIFICATION AND OTHER MEASURES ON RESIDENTIAL HOURLY LOAD

Model Summary

An Excel spreadsheet model was created to simulate the effects of building electrification and other measures on hourly load. This model was used to evaluate several scenarios compared to a baseline representation of customer load in Southeast Michigan. The results are indicative of changes in load shape in response to greater adoption of these building measures.

ResStock Data Source

The model relies heavily on end-use load profiles developed by the National Renewable Energy Laboratory (NREL). These profiles, available in the ResStock and ComStock datasets, can be downloaded in 15-minute interval times series at various levels of aggregation including national, state, county, and sub-county geographies.

While the Company reports total electricity load profiles for each customer class, these lack sufficient granularity for this analysis. By comparison, the NREL load profiles reflect specific end uses and fuel types, not just total electricity load. For example, NREL data allows the user to isolate hourly natural gas consumed for water heating apart from other natural gas uses and other water heating fuels.

This an appropriate application of the NREL load profiles. Published guidance from NREL explicitly mentions Electrification Planning as one of seven use cases for its end-use load profiles. The other six use cases discussed are Integrated Resource Planning, Long-term load forecasting, Transmission planning, Distribution system planning, Demand-side management planning, and Bill impacts and rate design.¹

This analysis only considered the residential sector. NREL hourly profiles are available for residential and commercial customer types, but the amount of time needed to gather and organize the data is nontrivial. Knowing that preparing ResStock data would involve significantly less effort than ComStock data, and that the pattern of results for the residential and commercial sectors would be similar, it was decided to focus exclusively on residential load for this analysis.

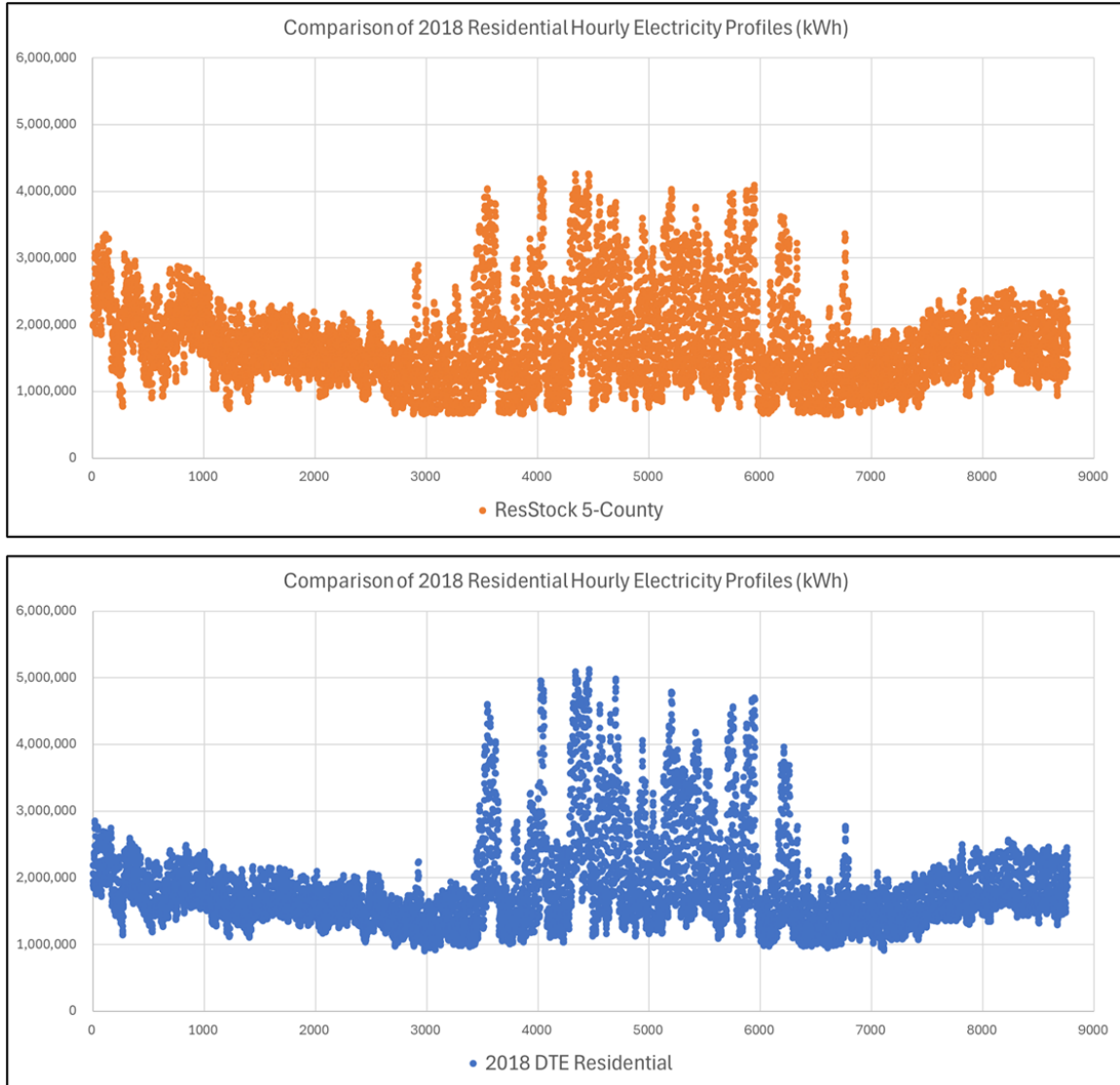
NREL followed a rigorous methodology to develop its nationwide ResStock and ComStock datasets. The process involved extensive sampling of building types reflecting multiple characteristics, physics-based energy modeling of representative buildings, and calibration using U.S. census and utility operations data. NREL load profiles down to the county level are meant to provide a reasonable representation of actual load in U.S. buildings as it occurred in weather year 2018.

To select the ResStock aggregation level for this analysis, a straightforward visual comparison was made of total electricity load shapes at various ResStock scales to the actual 2018 residential load shape which were retrieved from the Company's previously filed workpaper "U-20516_Part III

¹ NREL, "End-Use Load Profiles for the U.S. Building Stock: Practical Guidance on Accessing and Using the Data," p. 20, December 2022.

Attachment 5 (28) Final.” From this process it was determined that aggregating ResStock data across the five Southeast Michigan counties of Lapeer, Macomb, Oakland, St. Clair, Wayne achieved a reasonable visual match. This visual comparison is shown in Figure 1.

Figure 1. Visual Comparison of ResStock Aggregated Profile and DTE 2018 Residential Load



Although the priority was to achieve a similar load shape and not necessarily a precise match of load size, the 5-county dataset does get fairly close to the Company’s 2018 residential load in this regard.

ResStock data are reported separately for five building types: Single-family detached, single-family attached (duplex), mobile home, multi-family (2-4 units), and multi-family (5 or more units). It was decided to limit the analysis to the single-family detached building type. This kept the modeling workload manageable while still accounting for 78.1 percent of ResStock load at the 5-county aggregation level. In addition, the single-family detached building type can be considered a “worst case” given that its load tends to be more weather-sensitive than multi-family building types.

Model Structure and Operation

The model simulates changes in hourly load due to building electrification by converting various building end use load profiles from on-site fuel combustion to electric equipment in response to user inputs. Notable details of the model's basic structure and operation include the following:

- The model is populated with two sets of load profiles from the 5-county aggregation of ResStock data for the single-family detached building type. One set represents pre-conversion baseline conditions; the other set represents the application of enhanced building envelope upgrades which the model applies at the same rate as building electrification (following the assumption that envelope upgrades co-occur with installation of air source heat pumps).
- The user selects an adoption rate from 0.0% to 100.0% for building electrification. The model converts all non-electric end uses including space heating, water heating, cooking, clothes drying, and several others at this rate.
- To convert each non-electric end use, the load profile is adjusted, in proportion to the adoption rate, to actual heating demand using an assumed equipment efficiency. The amount of heating demand to be electrified is then converted to electricity using an algorithm specific to each end use. The space heating algorithm computes air source heat pump coefficient of performance hourly as a function of ambient air temperature. It also simulates backup heating and operation of the defrost mode, as needed. By comparison, the algorithms for water heating and other end uses apply constant efficiencies for conversion to electric.
- Given the prevalence of air conditioning, energy for space cooling is assumed to remain constant with building electrification and is therefore neglected in the model.
- The model sums the separately derived post-conversion end use electricity load profiles to a total electricity hourly profile. The resulting post-conversion total electricity load profile is reported both in aggregate and normalized to the number of households to yield the unit load profile of a representative customer.

EV Charging and On-Site PV Generation Modules

Because building electrification is likely to occur alongside other measures which impact customer load shape, users of the model can also simulate the adoption of EV charging and on-site PV generation, both of which are becoming increasingly popular with utility customers.

To represent EV charging in the model, a representative EV charging profile was constructed using U.S. DOE's EVI-Pro Lite modeling tool. This profile reflects weekday and weekend results for 32, 50 and 68 degrees (Fahrenheit) which were spliced throughout the year based on day of week and average monthly ambient air temperature. The selected EVI-Pro Lite home charging strategy included home charging levels 1 and 2 set at "immediate, as slow as possible (even spread)." The EVI-Pro Lite charging profile was imported into the model where it is multiplied by the number of EVs per household selected by the user. The resulting hourly charging profile is added directly to the post-conversion building electrification profile.

To represent on-site PV generation, an hourly solar generation shape for Detroit was created with NREL's System Advisor Model (SAM) and imported this unit profile shape into the model. The user

can set the amount of annual PV production equal to some portion of total annual load from 0.0% to 100.0%. The SAM profile shape is multiplied by this percentage and by the total hourly load profile. The resulting PV generation profile is then subtracted from the total hourly profile to yield a net post-conversion total hourly load profile. This is the model's primary output.

Modeling Distribution Transformer Aging Capacity

Transformer aging capacity is treated in the model by estimating the maximum allowable customer load in each hour while staying within the existing distribution transformer network's design capacity. To compute this, Witness Graham Woolley calibrated the tool described in his testimony using the ResStock 5-county, single-family detached load profile, normalized to a unit household. He then produced an hourly profile equal to load as a fraction of effective transformer rating. The building electrification model divides this result into the baseline profile to yield the maximum allowable customer load profile mentioned above. Exceeding the maximum allowable customer load profile in any hour has the effect of aging the transformer equipment prematurely.

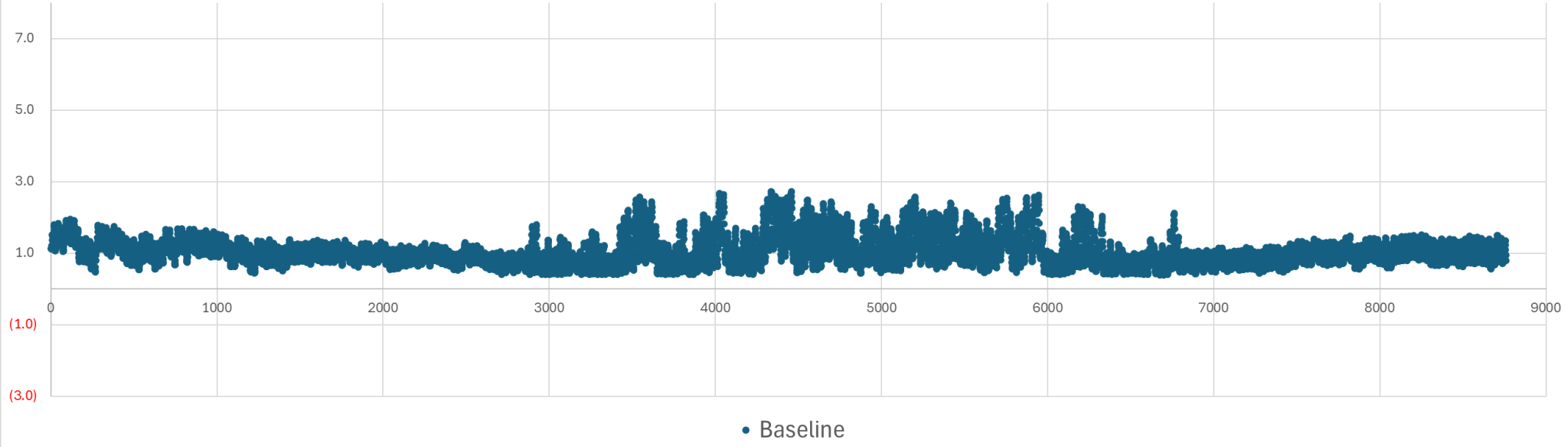
Adoption Level of Building Electrification Within Existing System Capacity

The feature of the model described in the previous section can be used to find the adoption rate of maximum building electrification—expressed as maximum allowable customer load in each hour—within the existing transformer network's design capacity which is sized to a summer peak. As the model user increases building electrification, a level is reached at which the total peak load in winter matches the size of the baseline summer peak. This point is reached at 44.28 percent adoption of building electrification.

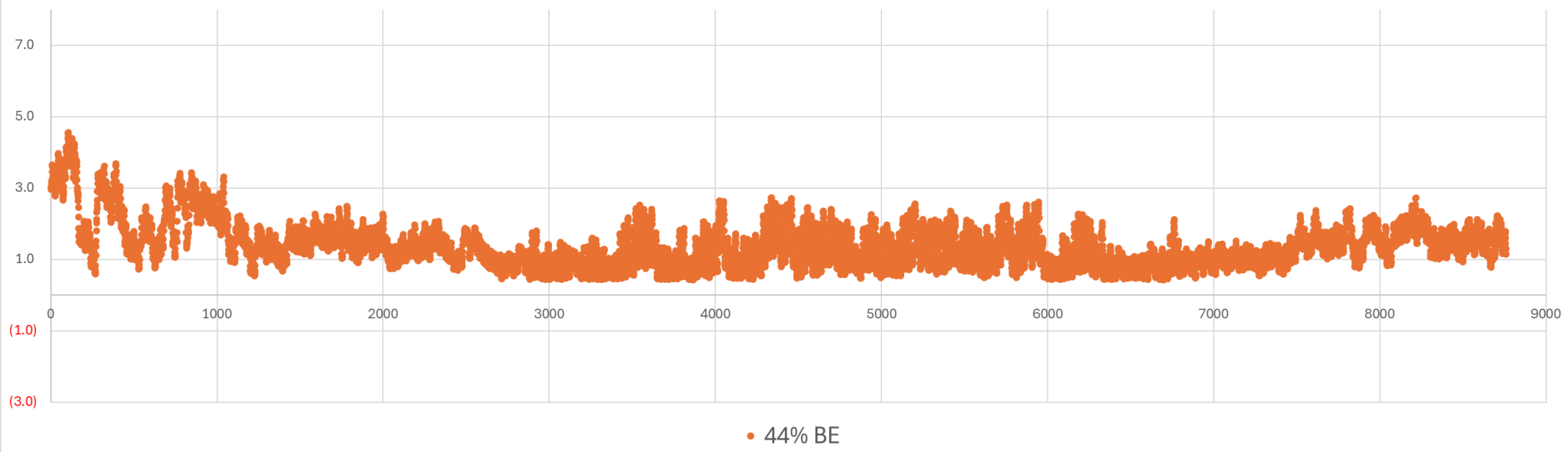
The model's ability to accommodate such a high level of building electrification within existing transformer capacity has two drivers. One is the existing gap between summer and winter peaks, providing headroom for the winter value to increase up to the summer value. The second relates to the variable degradation of transformer equipment across a range of ambient temperatures. Lower temperatures seen during winter months permit greater current through a transformer without increasing the aging effect. Both of these factors contribute to the significant amount of building electrification possible within the existing transformer network's capacity.

The two decimal places in the 44.28 percent figure should not be misconstrued. This level of precision simply reflects the exact number at which a single parameter (building electrification adoption rate) delivers a winter peak equal to summer peak in the model. There are multiple sources of uncertainty behind this result which must be acknowledged. These include the use of ResStock to represent the Company's residential load, various simplifying assumptions inherent in any modeling exercise of this kind, and the artificial case of adjusting the level of building electrification while holding all else constant. In the real world, 44.28 percent might or might not be fairly accurate. The key conclusion to be drawn is that this figure is significantly above the existing level of electric heating in the Company's service territory so as to warrant further analysis. This calls for the Company to rigorously investigate the ability of its distribution system to handle higher levels of electric heating before significant capacity upgrades might be needed.

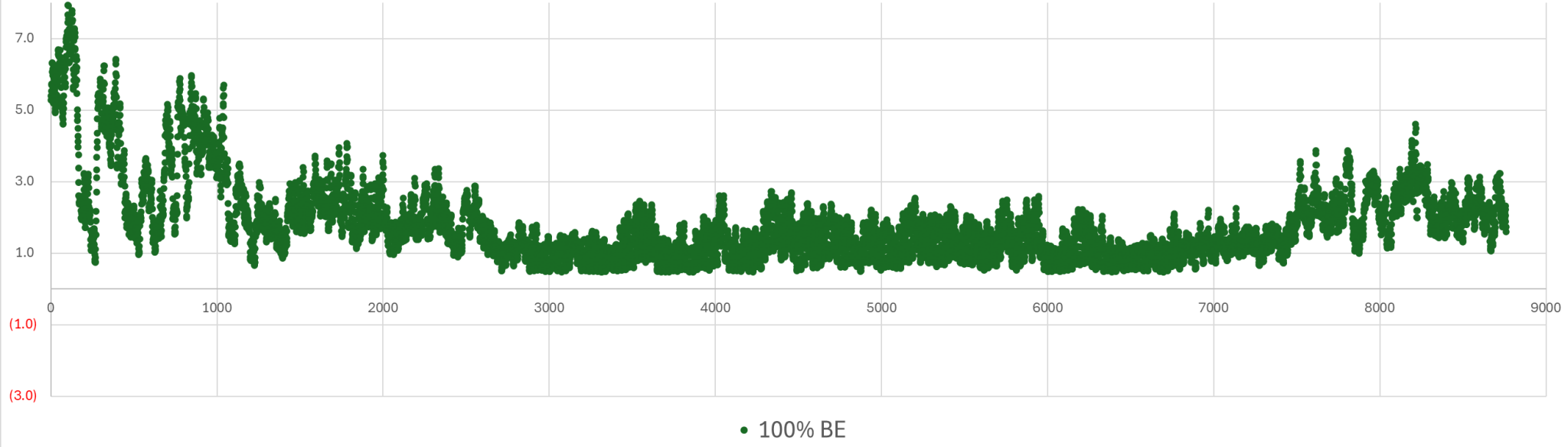
Hourly Total Electricity by Scenario (kWh)
Modeled Using ResStock 5-County Single Family Detached



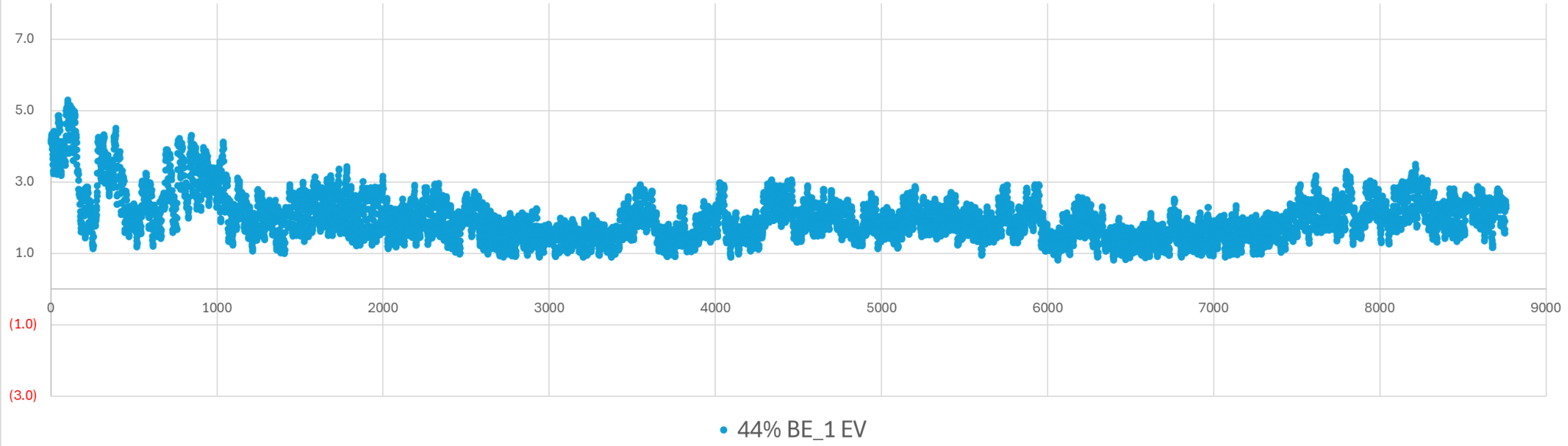
Hourly Total Electricity by Scenario (kWh)
Modeled Using ResStock 5-County Single Family Detached



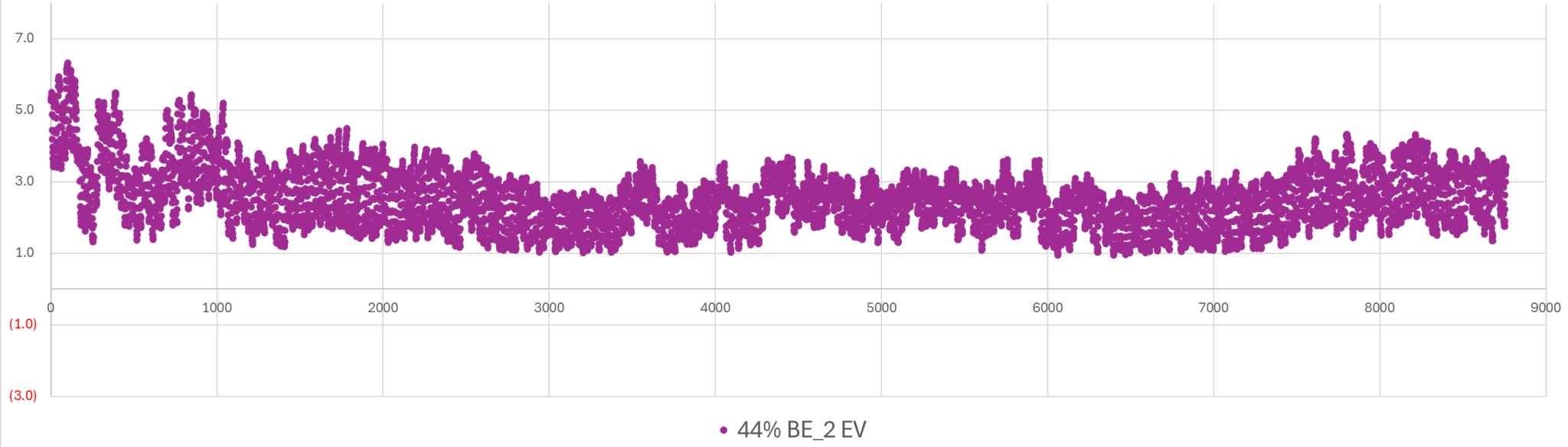
Hourly Total Electricity by Scenario (kWh)
Modeled Using ResStock 5-County Single Family Detached



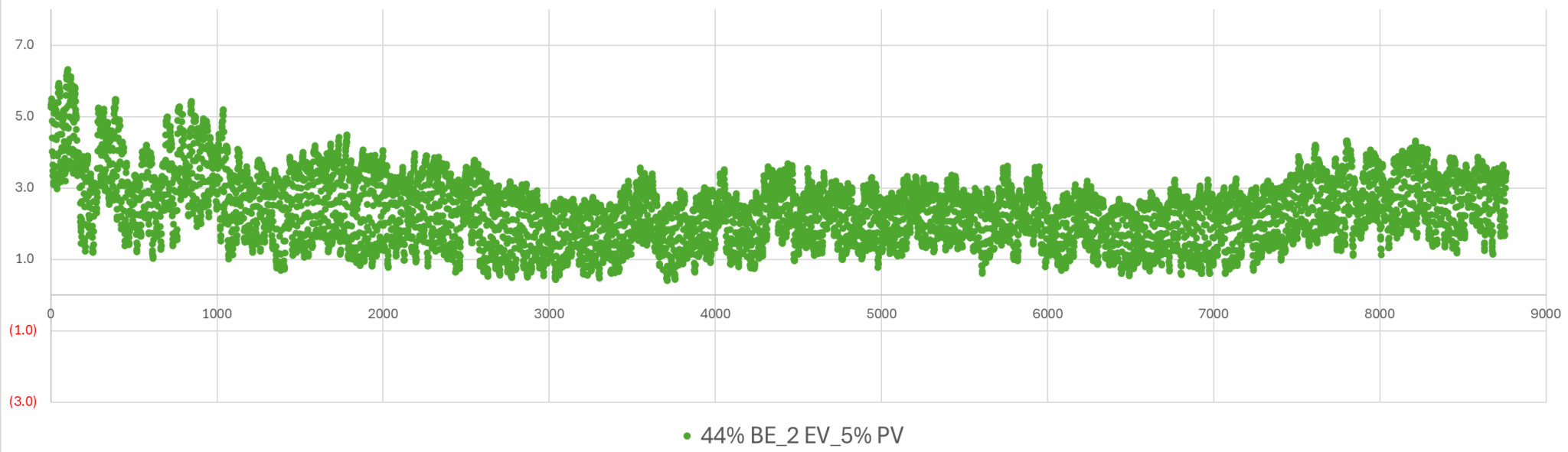
Hourly Total Electricity by Scenario (kWh)
Modeled Using ResStock 5-County Single Family Detached



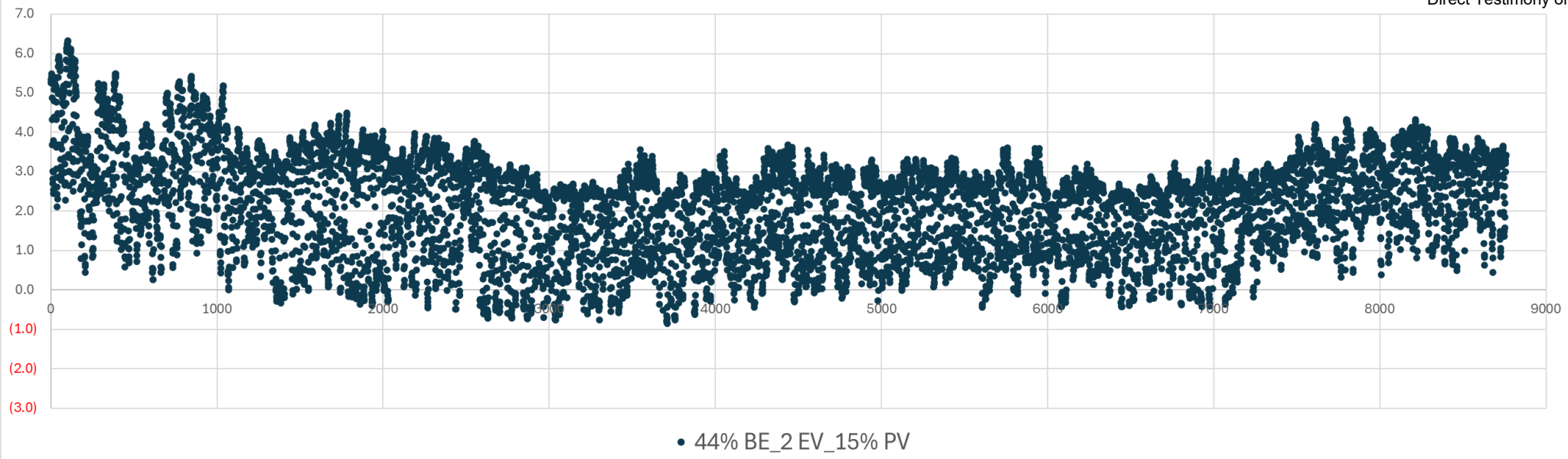
Hourly Total Electricity by Scenario (kWh)
Modeled Using ResStock 5-County Single Family Detached



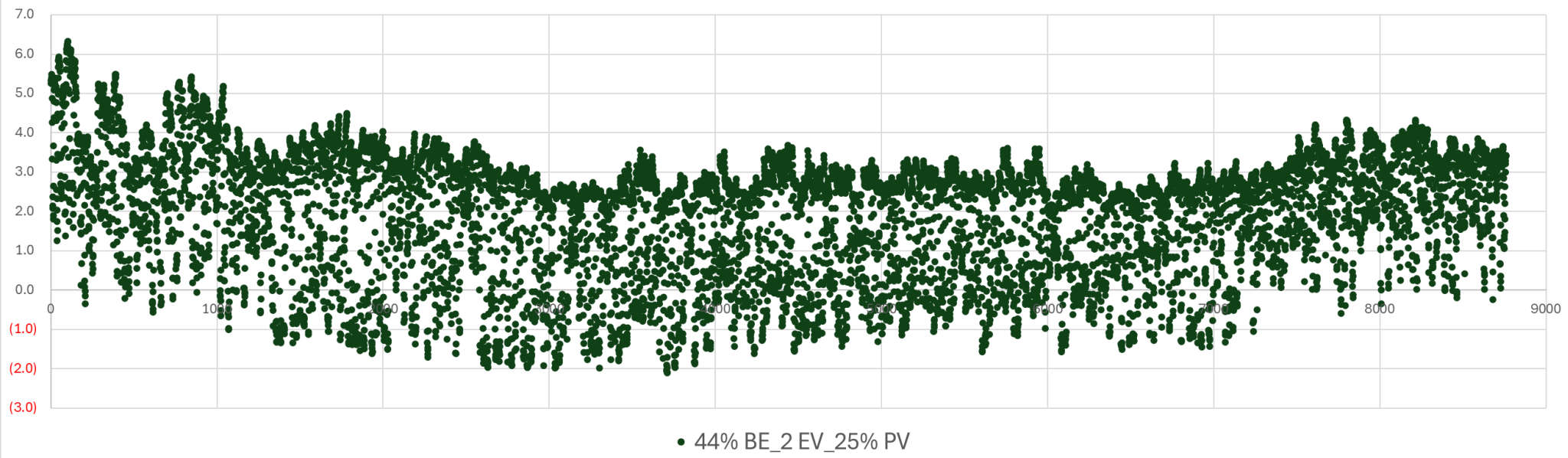
Hourly Total Electricity by Scenario (kWh)
Modeled Using ResStock 5-County Single Family Detached



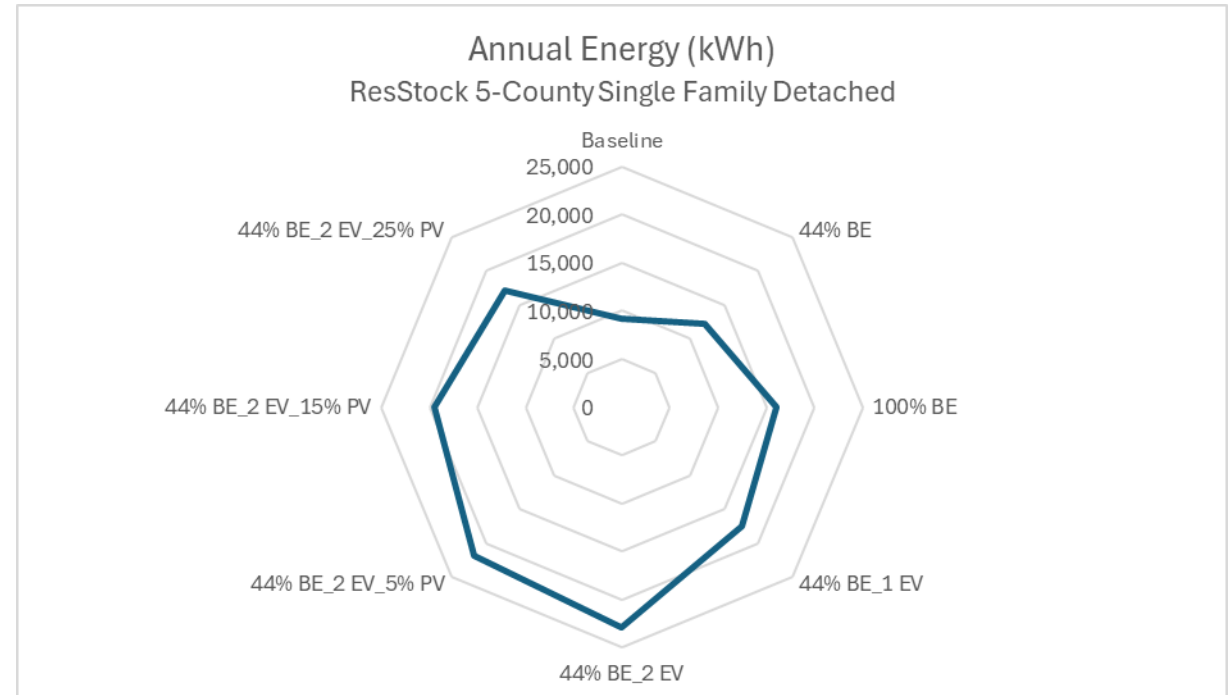
Hourly Total Electricity by Scenario (kWh)
Modeled Using ResStock 5-County Single Family Detached



Hourly Total Electricity by Scenario (kWh)
Modeled Using ResStock 5-County Single Family Detached



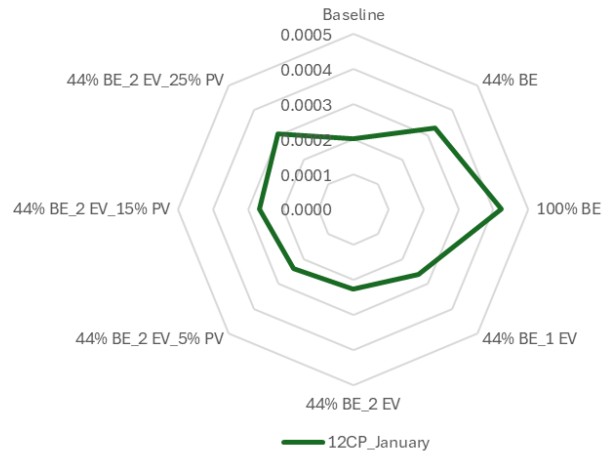
Scenario	Annual Energy (kWh)
Baseline	9,140
44% BE	12,196
100% BE	16,040
44% BE_1 EV	17,581
44% BE_2 EV	22,965
44% BE_2 EV_5% PV	21,817
44% BE_2 EV_15% PV	19,521
44% BE_2 EV_25% PV	17,224



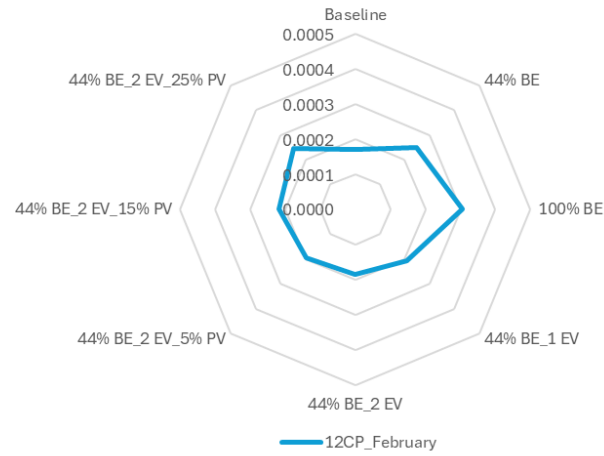
COS Parameter	COS Parameter / Annual Energy							
	Baseline	44% BE	100% BE	44% BE_1 EV	44% BE_2 EV	44% BE_2 EV_5% PV	44% BE_2 EV_15% PV	44% BE_2 EV_25% PV
1CP	0.00029	0.00021	0.00016	0.00016	0.00014	0.00013	0.00010	0.00008
4CP	0.00029	0.00021	0.00016	0.00016	0.00014	0.00013	0.00010	0.00007
12CP_January	0.00020	0.00033	0.00042	0.00026	0.00023	0.00024	0.00027	0.00030
12CP_February	0.00017	0.00025	0.00030	0.00021	0.00019	0.00020	0.00022	0.00025
12CP_March	0.00015	0.00016	0.00018	0.00016	0.00015	0.00016	0.00018	0.00020
12CP_April	0.00011	0.00012	0.00012	0.00009	0.00008	0.00008	0.00007	0.00006
12CP_May	0.00026	0.00019	0.00014	0.00015	0.00013	0.00011	0.00007	0.00001
12CP_June	0.00029	0.00021	0.00016	0.00016	0.00014	0.00013	0.00010	0.00008
12CP_July	0.00030	0.00022	0.00017	0.00017	0.00014	0.00013	0.00010	0.00007
12CP_August	0.00028	0.00020	0.00015	0.00016	0.00014	0.00013	0.00011	0.00007
12CP_September	0.00029	0.00021	0.00016	0.00016	0.00014	0.00013	0.00010	0.00006
12CP_October	0.00023	0.00017	0.00013	0.00014	0.00012	0.00011	0.00008	0.00005
12CP_November	0.00015	0.00018	0.00021	0.00015	0.00014	0.00014	0.00016	0.00018
12CP_December	0.00015	0.00018	0.00019	0.00015	0.00013	0.00014	0.00016	0.00018

COS Parameter	COS Parameter / Annual Energy							
	Baseline	44% BE	100% BE	44% BE_1 EV	44% BE_2 EV	44% BE_2 EV_5% PV	44% BE_2 EV_15% PV	44% BE_2 EV_25% PV
1NCP	0.00030	0.00022	0.00017	0.00017	0.00015	0.00015	0.00014	0.00013
4NCP	0.00029	0.00021	0.00016	0.00017	0.00015	0.00014	0.00012	0.00010
12NCP_January	0.00019	0.00029	0.00037	0.00024	0.00021	0.00022	0.00025	0.00028
12NCP_February	0.00017	0.00024	0.00029	0.00019	0.00017	0.00018	0.00020	0.00023
12NCP_March	0.00015	0.00016	0.00017	0.00015	0.00015	0.00016	0.00018	0.00020
12NCP_April	0.00014	0.00015	0.00016	0.00014	0.00014	0.00015	0.00016	0.00018
12NCP_May	0.00027	0.00020	0.00015	0.00017	0.00015	0.00015	0.00014	0.00013
12NCP_June	0.00029	0.00022	0.00016	0.00017	0.00015	0.00014	0.00012	0.00010
12NCP_July	0.00030	0.00022	0.00017	0.00017	0.00015	0.00015	0.00014	0.00013
12NCP_August	0.00028	0.00021	0.00016	0.00016	0.00014	0.00013	0.00011	0.00008
12NCP_September	0.00028	0.00021	0.00016	0.00017	0.00014	0.00013	0.00011	0.00008
12NCP_October	0.00020	0.00015	0.00012	0.00014	0.00014	0.00014	0.00016	0.00018
12NCP_November	0.00013	0.00018	0.00021	0.00013	0.00011	0.00011	0.00012	0.00013
12NCP_December	0.00016	0.00017	0.00018	0.00015	0.00014	0.00015	0.00017	0.00019

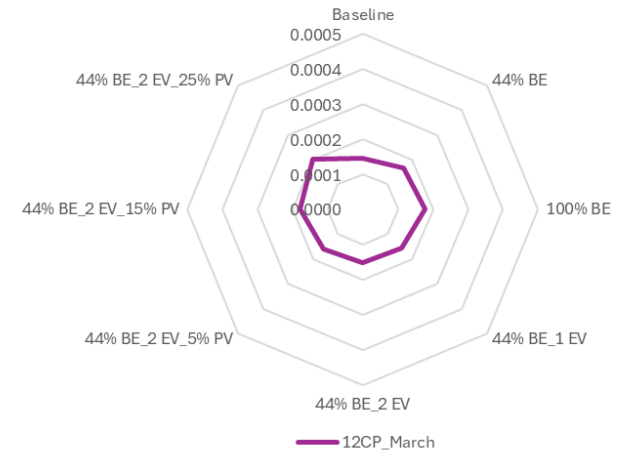
DTE CP Metrics / Annual Energy (by Scenario)



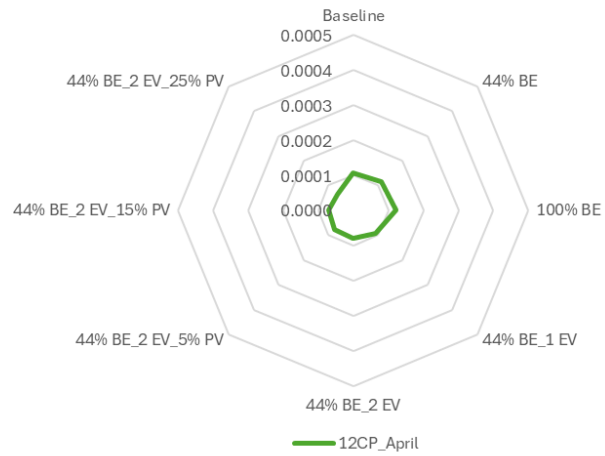
DTE CP Metrics / Annual Energy (by Scenario)



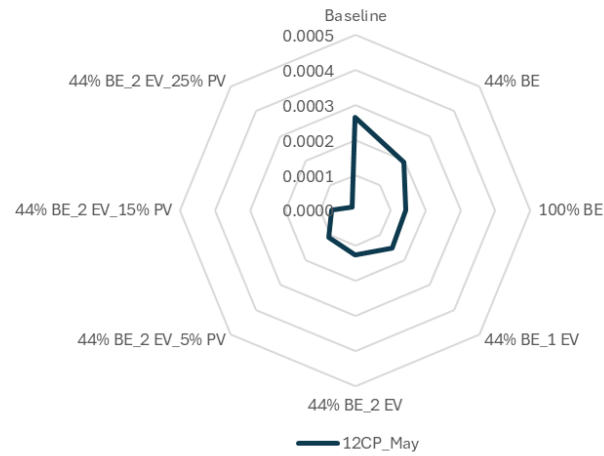
DTE CP Metrics / Annual Energy (by Scenario)



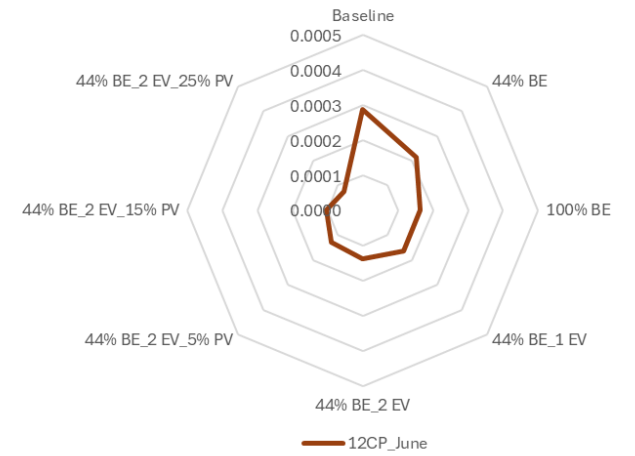
DTE CP Metrics / Annual Energy (by Scenario)



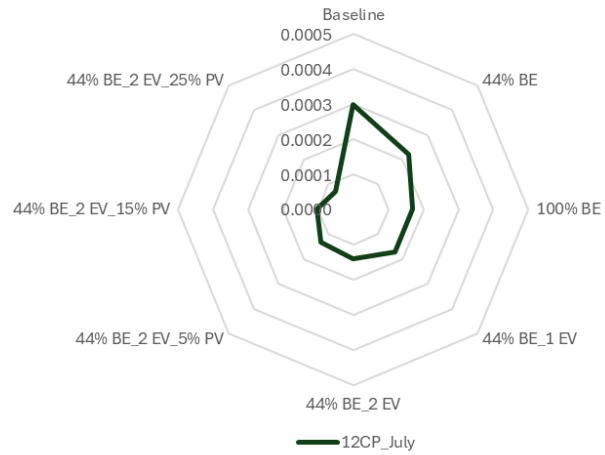
DTE CP Metrics / Annual Energy (by Scenario)



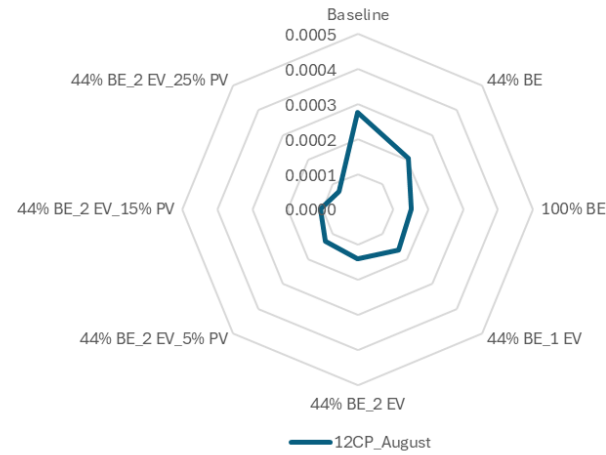
DTE CP Metrics / Annual Energy (by Scenario)



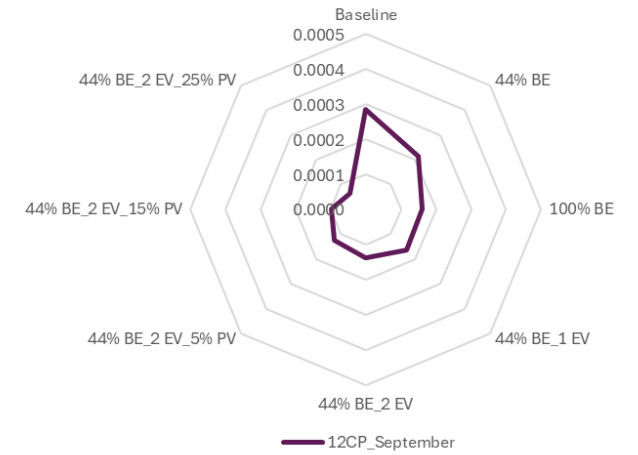
DTE CP Metrics / Annual Energy (by Scenario)



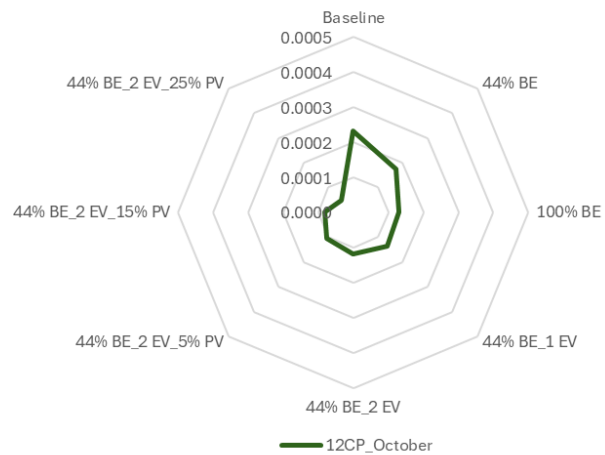
DTE CP Metrics / Annual Energy (by Scenario)



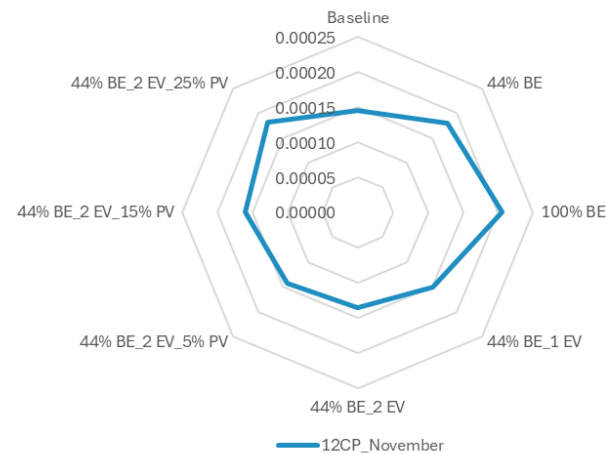
DTE CP Metrics / Annual Energy (by Scenario)



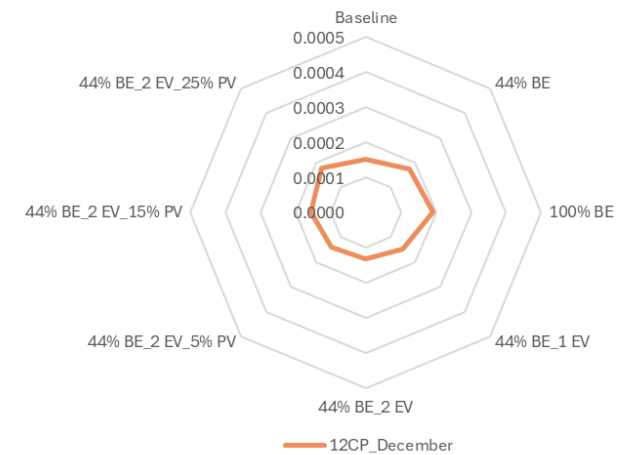
DTE CP Metrics / Annual Energy (by Scenario)



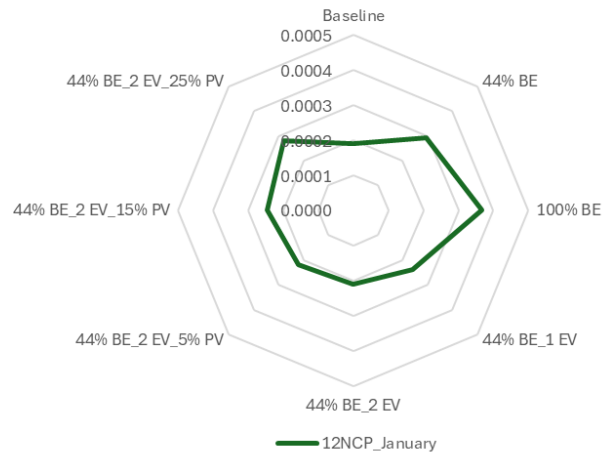
DTE CP Metrics / Annual Energy (by Scenario)



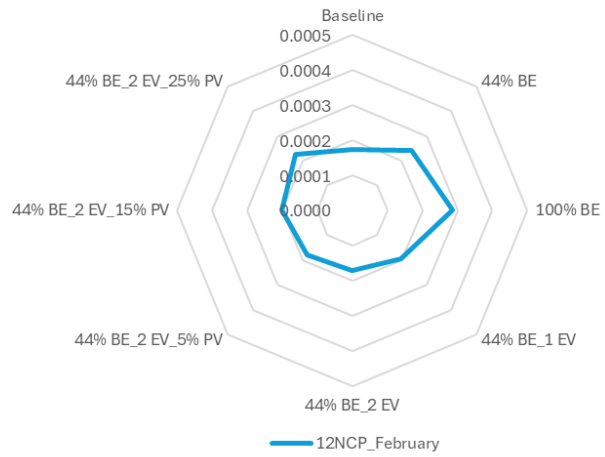
DTE CP Metrics / Annual Energy (by Scenario)



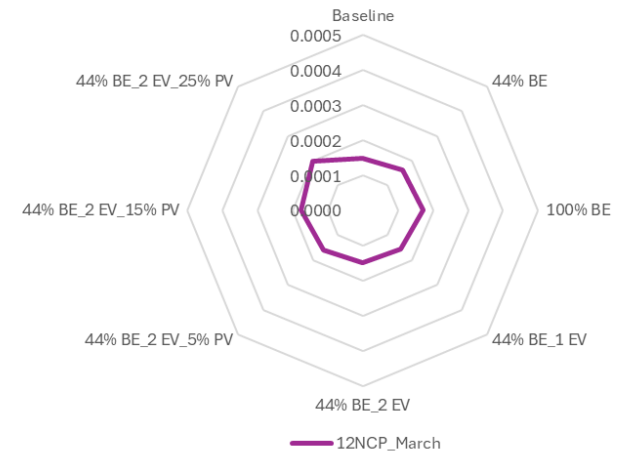
DTE NCP Metrics / Annual Energy (by Scenario)



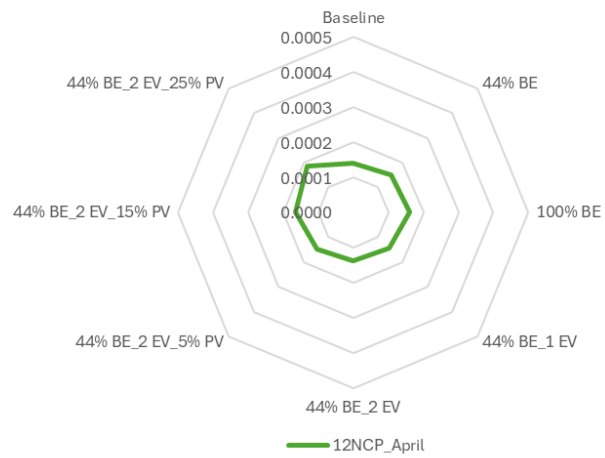
DTE NCP Metrics / Annual Energy (by Scenario)



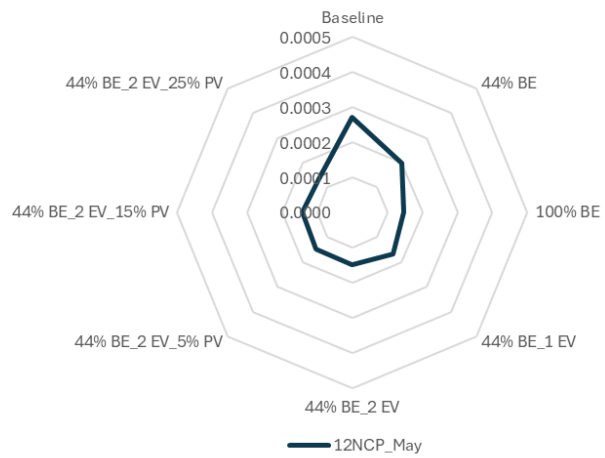
DTE NCP Metrics / Annual Energy (by Scenario)



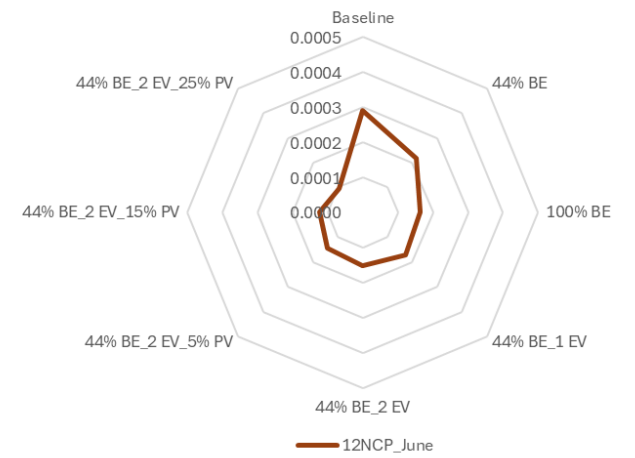
DTE NCP Metrics / Annual Energy (by Scenario)



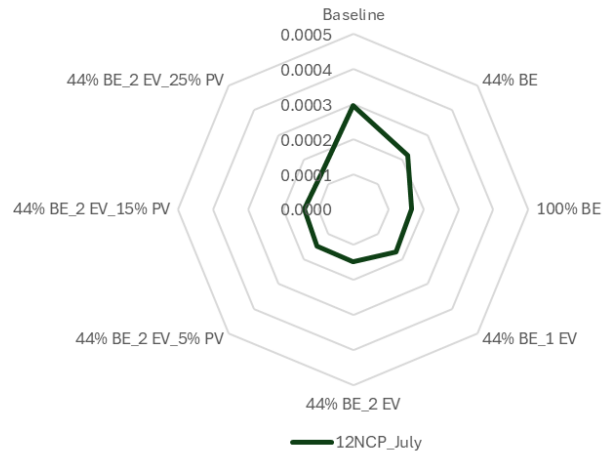
DTE NCP Metrics / Annual Energy (by Scenario)



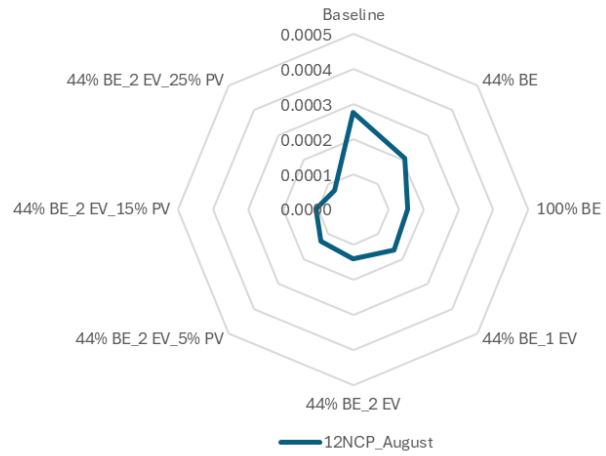
DTE NCP Metrics / Annual Energy (by Scenario)



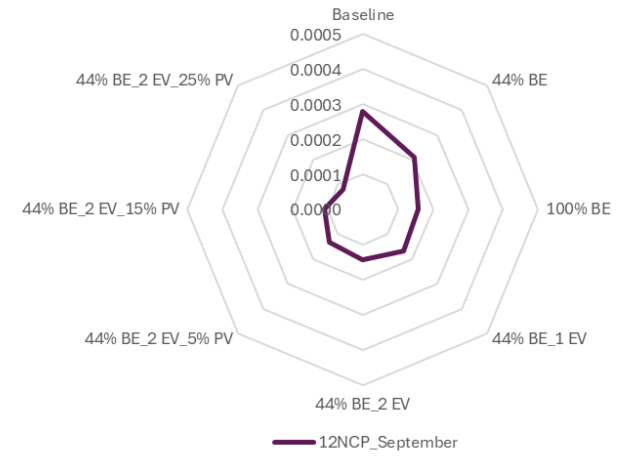
DTE NCP Metrics / Annual Energy (by Scenario)



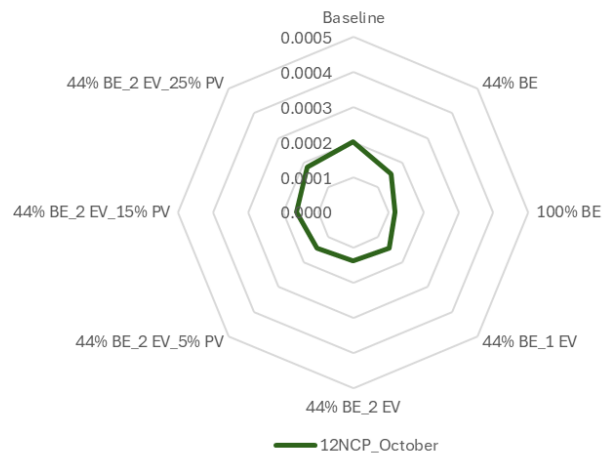
DTE NCP Metrics / Annual Energy (by Scenario)



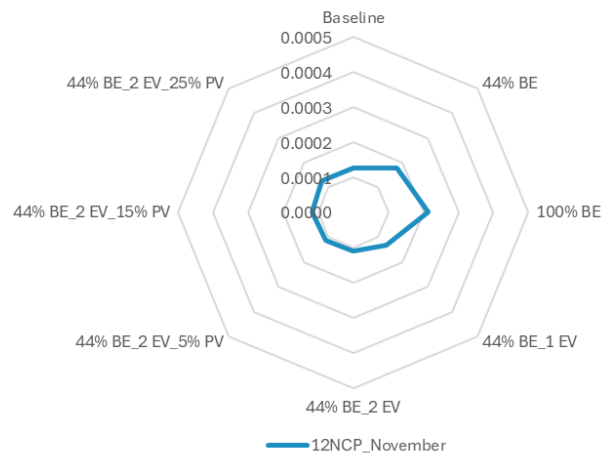
DTE NCP Metrics / Annual Energy (by Scenario)



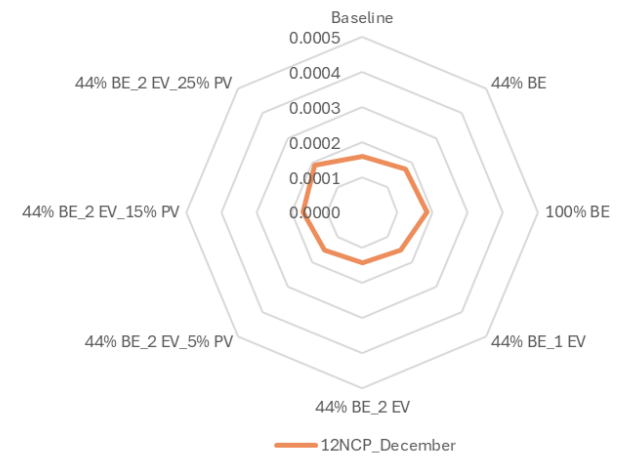
DTE NCP Metrics / Annual Energy (by Scenario)



DTE NCP Metrics / Annual Energy (by Scenario)



DTE NCP Metrics / Annual Energy (by Scenario)





Graham Woolley

Consultant

gwoolley@5lakesenergy.com

Expertise

Physical and economic modeling, programming, data analytics, data science, statistics, physics, utility performance data reporting, climate technology expert, quantitative analysis of energy use in buildings, and analysis of transformer aging cost implications.

Selected Projects

- **Low Carbon Infrastructure Project Analysis.** Designed and built a cost/benefit analysis toolkit to assess the impacts of building electrification and energy efficiency projects for the state of Michigan.
- **Citizens Utility Board of Michigan *Utility Performance Report*.** Built a data pipeline and Tableau workbook for the latest edition of the MICUB's annual *Utility Performance Report*, which scores the performance of Michigan's electric utilities on reliability, affordability, and environmental responsibility with in-state and nationwide comparisons.
- **Physical modeling of transformer aging in real world conditions.** Created a physics-based weather-dependent transformer aging model for use in analysis of distribution system costs.
- **Climate legislation modeling.** Modeled the physical and economic effects of proposed climate legislation in Michigan that became law in 2023.

Past Employment

- **STEM Teacher | ARISE High School | California | 2020-2022**
- **Founding Fellow | Climatebase | California | 2022**
- **Data Analytics Intern | New Sun Road PBC | California | 2020**

Awards, Affiliations, and Service

Olsen Memorial Award, University of California, Berkeley, Department of Physics | 2018

The loss of life as a function of temperature can be quantified by an Aging Acceleration Factor, denoted as F_{AA} , which is given by the following equation:

$$F_{AA}(T) = \exp\left(\frac{15,000}{383} - \frac{15000}{T + 273}\right)$$

Here T is the hottest-spot temperature of the transformer, expressed in degrees Celsius. We've assumed a rated hottest-spot temperature of 110 °C. This expression illustrates the exponential relationship between temperature and aging, and it's an example of an Arrhenius relationship, in which linear changes to temperature result in exponential changes in the rates of many chemical reactions. The aging of a transformer's insulation system is an example of such a reaction.

This expression was adapted from equation 17.83 in section 17.11 on Thermal Design of the textbook *Transformer Design Principles*, Third Edition, by Robert M. Del Vecchio, Bertrand Poulin, Pierre T. Feghali, Dilipkumar M. Shah, and Rajendra Ahuja

Let Q_{in} denote the total power losses in the transformer; this is the heat generated within it.

Let E_{core} denote the core losses.

Let E_{copper} denote the copper losses.

The losses in a transformer can be summarized as follows:

$$Q_{in} = E_{core} + E_{copper} \quad (1)$$

Core and copper losses are not usually specified in manufacturer testing. Rather, a measure of “loss at no load” and “loss at full load” is often included. These are measured empirically. Loss at no load is what remains constant regardless of the load. This corresponds directly to the core losses. Loss at full load is the total loss that occurs when the transformer is running at its rated capacity. Since the core loss remains constant, the loss at full load includes both copper losses and core losses.

Let L_0 denote the loss at no load.

Let L_1 denote the loss at full load.

Let R_{nom} denote the rated kVA capacity of the transformer.

Knowing these three values from the manufacturer allows us to write down an expression for the loss occurring at any load. The argument is as follows:

The core loss is simply given by:

$$E_{core} = L_0 \quad (2)$$

The copper loss, also known as the resistive loss, is given by Ohm's law, a very well-known result in elementary circuit analysis. We then have:

$$P = VI \text{ (definition of electric power)} \quad (3)$$

$$V = IR \text{ (Ohm's law)} \quad (4)$$

Combining equations (3) and (4):

$$P = I^2R \quad (5)$$

Equation (5) expresses the relationship between the current flowing through a resistor and the power dissipated from it. Here the resistor is the copper windings of the transformer. We don't need to know the resistance of these windings to determine the copper losses, however. Consider the following proportionality relationships:

$$E_{copper} = I^2R \propto I^2 \propto P^2 \quad (6)$$

Here the symbol \propto means "proportional to". The first step is a restatement of equation (5), and the last step is a restatement of equation (3), since electric power is proportional to the current. Since the copper loss is proportional to the square of the power flow (load), it suffices to know the value of the copper loss at any single value of the load. The following equation expresses the copper loss when the transformer runs at its nominal load:

$$E_{copper}(R_{nom}) = L_1 - E_{core} = L_1 - L_0 \quad (7)$$

In the first step, we used equation (1), and in the last step we applied equation (2). But equation (6) allows us to write down the following, using k as an unknown constant:

$$E_{copper}(P) = kP^2 \quad (8)$$

This is the definition of proportionality. Combining equations (7) and (8), we get:

$$E_{copper}(R_{nom}) = kR_{nom}^2 = L_1 - L_0 \quad (9)$$

Solving this equation for our unknown constant k , we get:

$$k = \frac{L_1 - L_0}{R_{nom}^2} \quad (10)$$

Combining (8) and (10), we obtain:

$$E_{copper}(P) = \frac{L_1 - L_0}{R_{nom}^2} P^2 \quad (11)$$

Finally, combining (1), (2), and (11), we get an expression for the loss at any load, assuming L_0 , L_1 , and R_{nom} are known:

$$Q_{in}(P) = L_0 + (L_1 - L_0) * \left(\frac{P}{R_{nom}}\right)^2$$

This expression for Q_{in} is what we use in the model.

The following discussion is adapted from section 17.11 on Thermal Design, particularly after equation 17.85, of the textbook *Transformer Design Principles*, Third Edition, by Robert M. Del Vecchio, Bertrand Poulin, Pierre T. Feghali, Dilipkumar M. Shah, and Rajendra Ahuja.

Given an aging acceleration factor, F_{AA} for each hour of the year, we can express the fraction of the transformer's life lost in that hour. The desired expression is as follows:

$$LoL(F_{AA}) = \frac{(F_{AA} * \Delta t) / 8760}{L_{nom}}$$

Here LoL is the loss of life of the transformer in each hour, L_{nom} is the nominal expected life (in years) of the transformer, which is given in the model as an assumption, and Δt is the time interval over which the aging acceleration factor applies. Since the model uses hourly intervals, $\Delta t = 1\text{hr}$, and so we might re-express the equation as:

$$LoL(F_{AA}) = F_{AA} \frac{\Delta t / 8760}{L_{nom}}$$

We've separated the aging acceleration factor from the rest of the expression to illustrate the following: the numerator, $\Delta t / 8760$, is one hour expressed as a fraction of a year, and the denominator is the expected lifetime in years. In other words, the fraction of the transformer's nominal lifetime that passes in one hour is multiplied by F_{AA} to yield the *effective* fraction of its life lost in that hour.

Since F_{AA} changes from hour to hour, it makes more sense to consider an annual loss of life, which is simply the sum of the hourly LoL values throughout the year. Once we have an annual LoL , we simply take its inverse to yield the computed expected lifetime. For example, if $F_{AA} = 1$ for every hour of the year, then the annual loss of life is $1 / L_{nom}$, as expected.. If $L_{nom} = 30$ years,

this corresponds to roughly a 3.3% loss of life per year. If $F_{AA} < 1$, there will be a smaller annual loss of life, also as expected.

The hourly *LoL*, the annual *LoL*, and the computed expected lifetime are all stated prominently in the Calculations tab of the model.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of **DTE ELECTRIC COMPANY** for authority to increase its rates, amend its rate schedules and rules governing the distribution and supply of electric energy, and for miscellaneous accounting authority.

Case No. U-21534

Proof of Service

On the date below, an electronic copy of **Official Exhibits and Exhibit List of Citizens Utility Board of Michigan** was served on the following:

Name/Party	E-mail Address
Administrative Law Judge Hon. Sally Wallace	wallaces2@michigan.gov
DTE Electric Company Paula Johnson-Bacon Jon P. Christinidis John A. Janiszewski Breanne K. Reitzel Andrea E. Hayden	mpsc filings@dteenergy.com paula.bacon@dteenergy.com jon.christinidis@dteenergy.com john.janiszewski@dteenergy.com Breanne.reitzel@dteenergy.com Andrea.hayden@dteenergy.com
Michigan Attorney General Joel B. King	ag-enra-spec-lit@michigan.gov kingj38@michigan.gov
Michigan Public Service Commission Staff Amit T. Singh Michael J. Orris Heather M.S. Durian Monica M. Stephens Lori Mayabb	singha9@michigan.gov orrism@michigan.gov durianh@michigan.gov stephensm11@michigan.gov mayabbl@michigan.gov
City of Ann Arbor and Michigan Municipal Association of Michigan Valerie J.M. Brader	ecf@rivenoak.com valerie@rivenoaklaw.com
Environmental Law & Policy Center, The Ecology Center, Union of Concerned Scientists, and Vote Solar Nicholas N. Wallace Daniel Abrams	nwallace@elpc.org dabrams@elpc.org
Utility Workers Union of America, Local 223 Benjamin L. King	bking@michworkerlaw.com

Michigan Energy Innovation Business Council, Institution for Energy Innovation, Foundry Association of Michigan, Advanced Energy United, and Energy Michigan Timothy J. Lundgren Laura A. Chappelle Justin K. Ooms	tlundgren@potomaclaw.com lchappelle@potomaclaw.com jooms@potomaclaw.com
The Kroger Company Kurt J. Boehm Jody Kyler Cohn Justin Bieber	kboehm@bkllawfirm.com jkylercohn@bkllawfirm.com jbieber@energystrat.com
Utility Workers Union of America, Local 223 Benjamin L. King	bking@michworkerlaw.com
We Want Green, Too and Soulardarity Amanda Urban Mark Templeton Jacob Schuhardt Sam Heppel Madison S. Wilson	t-9aurba@lawclinic.uchicago.edu templeton@uchicago.edu jschuhardt@uchicago.edu heppell@uchicago.edu madisonwilson@uchicago.edu
Great Lakes Renewable Energy Association Don L. Keskey Brian W. Coyer	donkeskey@publiclawresourcecenter.com bwcoyer@publiclawresourcecenter.com
Walmart, Inc. Melissa M. Horne	mhorne@hcc-law.com
Association of Businesses Advocating Tariff Equity Michael J. Pattwell Stephen A. Campbell	mpattwell@clarkhill.com scampbell@clarkhill.com
EVgo Services, LLC Nikhil Vijaykar	nvijaykar@keyesfox.com
International Transmission Company (ITC) Richard J. Aaron Courtney F. Kissel Olivia R.C.A. Flower Hannah E. Buzolits	raaron@dykema.com ckissel@dykema.com oflower@dykema.com hbuzolits@dykema.com
Michigan Cable Telecommunications Association Sean P. Gallagher	sgallagher@fraserlawfirm.com
PROTEC (The Michigan Coalition to Protect the Public Rights of Way) Michael J. Watza	mike.watza@kitch.com

{signature on following page}

The statements above are true to the best of my knowledge, information and belief.

Troposphere Legal, PLC
Counsel for MEC, NRDC, SC & CUB

Date: September 17, 2024

By: _____

Breanna Thomas, Legal Assistant
420 E. Front St.
Traverse City, MI 49686
Phone: 231-709-4000
Email: breanna@tropospherelegal.com

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of **DTE ELECTRIC COMPANY** for authority to increase its rates, amend its rate schedules and rules governing the distribution and supply of electric energy, and for miscellaneous accounting authority.

Case No. U-21534

Confidential Proof of Service

On the date below, an electronic copy of **Official Exhibits and Exhibit List of Citizens Utility Board of Michigan** was served on the following:

Name/Party	E-mail Address
Administrative Law Judge Hon. Sally L. Wallace	wallaces2@michigan.gov
DTE Electric Company Paula Johnson-Bacon Jon P. Christinidis John A. Janiszewski Breanne K. Reitzel Andrea E. Hayden	mpsc filings@dteenergy.com paula.bacon@dteenergy.com jon.christinidis@dteenergy.com john.janiszewski@dteenergy.com Breanne.reitzel@dteenergy.com Andrea.hayden@dteenergy.com
Michigan Attorney General Joel B. King	ag-enra-spec-lit@michigan.gov kingj38@michigan.gov
Michigan Public Service Commission Staff Amit T. Singh Michael J. Orris Heather M.S. Durian Monica M. Stephens Lori Mayabb	singha9@michigan.gov orrism@michigan.gov durianh@michigan.gov stephensm11@michigan.gov mayabbl@michigan.gov
City of Ann Arbor and Michigan Municipal Association of Michigan Richard J. Bunch	Rick2mi-maui.org
Environmental Law & Policy Center, The Ecology Center, Union of Concerned Scientists, and Vote Solar Nicholas N. Wallace Daniel Abrams	nwallace@elpc.org dabrams@elpc.org

Michigan Energy Innovation Business Council, Institution for Energy Innovation, Foundry Association of Michigan, Advanced Energy United, and Energy Michigan Timothy J. Lundgren Laura A. Chappelle Justin K. Ooms	tlundgren@potomaclaw.com lchappelle@potomaclaw.com jooms@potomaclaw.com
We Want Green, Too and Soulardarity Amanda Urban Mark Templeton Jacob Schuhardt Sam Heppel Madison S. Wilson	t-9aurba@lawclinic.uchicago.edu templeton@uchicago.edu jschuhardt@uchicago.edu heppell@uchicago.edu madisonwilson@uchicago.edu
Great Lakes Renewable Energy Association Don L. Keskey	donkeskey@publiclawresourcecenter.com
Association of Businesses Advocating Tariff Equity Michael J. Pattwell Stephen A. Campbell	mpattwell@clarkhill.com scampbell@clarkhill.com
EVgo Services, LLC Michael G. Oliva	moliva@fosterswift.com
International Transmission Company (ITC) Richard J. Aaron Courtney F. Kissel Olivia R.C.A. Flower Hannah E. Buzolits	raaron@dykema.com ckissel@dykema.com oflower@dykema.com hbuzolits@dykema.com
Electrify America, LLC Stephen Bright Rhiannon Davis Jigar Shah	steve.bright@electrifyamerica.com rhiannon.davis@electrifyamerica.com jigar.shah@electrifyamerica.com

The statements above are true to the best of my knowledge, information and belief.

Troposphere Legal, PLC
Counsel for MEC, NRDC, SC & CUB

Date: September 17, 2024

By: _____

Breanna Thomas, Legal Assistant
420 E. Front St.
Traverse City, MI 49686
Phone: 231-709-4000
Email: breanna@tropospherelegal.com