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Direct Testimony and Schedules
David C. Harkness

Before the Minnesota Public Utilities Commission
State of Minnesota

In the Matter of the Application of Northern States Power Company
for Authority to Increase Rates for Electric Service in Minnesota

Docket No. E002/GR-19-564
Exhibit___(DCH-1)

Business Systems

November 1, 2019

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Schedules

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND OCCUPATION.

A. My name is David C. Harkness. I am the Senior Vice President, Customer Solutions for Xcel Energy Services Inc. (XES), the service company affiliate of Northern States Power Company, a Minnesota corporation (NSPM or the Company) and an operating company of Xcel Energy Inc. (Xcel Energy). I have spent the last decade as Senior Vice President and Chief Information Officer (CIO) at Xcel Energy.

Q. PLEASE SUMMARIZE YOUR QUALIFICATIONS AND EXPERIENCE.

A. I have more than 35 years of experience in Information Technology (IT), with 30 of those years in a management role. As I transition to my new role leading Customer Solutions, I remain a subject matter expert for Xcel Energy based on the past decade serving as Senior Vice President and Chief Information Officer (CIO), where I was responsible for the XES Business Systems organization, which provides IT services to Xcel Energy's shared services and the operating companies. In this role, I was also responsible for information technology disaster recovery.

Before I joined Xcel Energy and Northern States Power Company in November 2009, I spent six years at PNM Resources in New Mexico, where I first served as Senior Director, Business Process Outsourcing, then as Senior Director of Business Transformation and, finally, as Vice President and CIO. While in New Mexico, I was also appointed by Governor Richardson to New Mexico's Information Technology Commission, where I helped establish and direct the IT Strategy for the State of New Mexico. Prior to that experience, I

held several IT Leadership roles for McLeod USA, MCI, and Rockwell International, where I began my career in 1986.

My résumé is attached as Exhibit___(DCH-1), Schedule 1.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. I present and support the Company's capital and operation and maintenance (O&M) budgets during the period of the 2020-2022 multi-year rate plan (MYRP) for the Business Systems area. I also support the Company's Advanced Grid Intelligence and Security (AGIS) initiative, which consists of major grid modernization efforts to be completed in cooperation between Business Systems and the Xcel Energy business areas that will use the system.

Q. PLEASE PROVIDE AN OVERVIEW OF THE BUSINESS SYSTEMS AREA WITHIN XCEL ENERGY.

A. Business Systems provides IT services across Xcel Energy. Like all utilities, Xcel Energy must invest in computers, software, networks, mobile devices and other IT services each year in order to (among other things):

- Coordinate work in the field;
- Interact with customers;
- Operate and dispatch generation facilities;
- Run our transmission system;
- Provide information to our state and federal regulators;
- Purchase fuel;
- Bill and collect efficiently;
- Develop budgets and track expenditures;

- Manage vendors and vendor contracts; and
- Pay employees.

Each of these activities is necessary to provide reliable electricity and a positive customer experience. No relevant business, including utilities, can function without dependable and up-to-date IT capabilities for both customers and employees.

Q. CAN YOU ALSO PROVIDE AN OVERVIEW OF THE WORK BUSINESS SYSTEMS WILL BE PERFORMING OVER THE NEXT FEW YEARS?

A. Yes. Over the next three years, Business Systems will continue much of the fundamental IT work described in our last Minnesota rate case, including replacing aging technology; protecting customers and the Company against cyber security risks and attacks; and strategically enhancing our IT capabilities to improve our customer and employee experiences. We will continue to be flexible and nimble, addressing new technologies and needs as they emerge within the resources available to us.

Technology changes constantly. With a typical life of roughly three to seven years for NSPM (depending on the system), the average lifespan of IT assets is considerably shorter than it is for many business areas. Although we have been able to return great value from larger systems, on average our assets need attention frequently, especially related to unexpected technology changes.

With respect to replacing aging technology, we continue focus on making sure our employees have the basic technology tools needed for the provision of electricity to customers. While some of these tools (e.g. desk and laptop

computers, mobile phones, software versions) need to be patched, updated, or replaced on a reasonably regular basis to keep up, in other areas we have been able to strategically harvest maximum value from older systems and delay investments. In the last Minnesota rate case, I described how our capital and O&M investments would increase because we had previously delayed new investments to the maximum extent. We have now begun replacements for some of these systems. For example, we waited to update to the Windows10 operating system (which was released in 2015) until 2019.

In addition to keeping technology updated, we need to maintain the security of data belonging to our customers, our employees, and our business. Knowing that we will continue to identify new cyber security risks over the next several years, we must proactively make the necessary investments to ensure data security.

Moreover, there are areas where we not only need to replace old systems, but we also have the opportunity to enhance our capabilities and become more efficient. As an example, in 2018 we implemented Blue Prism Process Automation in the financial operations area. The project leverages automation technologies, such as robotic process automation, smart workflows, and natural language processing to streamline workloads. This helps ensure a better, more efficient, and faster financial close by leveraging technology to maximize our employees' time.

Additionally, in an era where customer's expectations are higher than they have ever been, we are turning our attention to enhancing our customers' experience with their utility and electric service by leveraging data, interactive

technology through the web and digital interfaces to improve our customers' options for energy usage, monitoring, and services. We are embarking on an enterprise-wide effort to advance and modernize the Xcel Energy customer experience, including updating existing systems such as our website and MyAccount through our Customer Experience Transformation programs, and enhancing the distribution grid and associated customer services with an eye toward the future through our Advanced Grid Intelligence and Security (AGIS) initiative.

Q. PLEASE PROVIDE A SUMMARY OF YOUR TESTIMONY.

A. In my Direct Testimony, I describe the Business System organization, as well as some of the IT and business continuity services we provide. I carry forward the discussion from our last electric rate case in Minnesota, illustrating that our capital and O&M investments have increased in light the rising importance of IT in our business. As technology continues to evolve, I explain the kinds of investments we are currently making, why they are important to meet our customers changing energy needs, and how we work to ensure reasonable costs for those investments.

I explain that we are proposing capital additions of approximately $146.3 million for 2020, $134.1 million for 2021 and $134.1 million for 2022 on a total Company basis.[1] I provide support for the key investments during the MYRP term (2020-2022).

I begin by walking through the major capital projects outside of AGIS that

[1] All costs in my testimony are stated on a NSPM total company basis unless otherwise noted.

comprise these budgets, organizing projects by our aging technology, cyber security, customer experience, enhancing capabilities, and emergent demand budget groupings.

I then discuss the Business Systems O&M budget for 2020 through 2022, which is driven by employee labor and non-labor costs, software maintenance, network communications, application development, and distributed systems such as servers, data storage, and desktop computer and printer maintenance. I explain why our O&M budget is reasonable and reflects the types of expenditures we must make to keep the technology side of our business running productively.

Next, I describe in detail why a major component of Business Systems' capital additions consist of our AGIS initiative, and how we have carefully planned for this needed investment. Building on introductory testimony by Company witness Mr. Michael Gersack and Distribution Operations testimony by Company witness Ms. Kelly Bloch, I explain Business Systems' role in developing the strategy, support, security, and implementation plans and activities for the components of AGIS, including the Advanced Data Management System (ADMS), Advanced Metering Infrastructure (AMI), the Field Area Network (FAN), Fault Location, Isolation, and Service Restoration (FLISR), and Integrated Volt-VAr Optimization (IVVO). I further explain how the Business Systems costs of the AGIS initiative were developed both for the term of this rate case multi-year rate plan (MYRP) from 2020-2022, as well as over the longer term for purposes of both the Company's concurrently-filed Integrated Distribution Plan (IDP) and the cost-benefit analysis supported by Company witness Dr. Ravikrishna Duggirala. Company

witness Mr. Christopher Cardenas provides additional discussion of how the AGIS initiative benefits customers through our Customer Care area.

Q. HOW HAVE YOU ORGANIZED YOUR TESTIMONY?

A. My testimony is organized into the following sections:

- *Section II* – Business Systems Overview
- *Section III* – Capital Investments
- *Section IV* – O&M Budget
- *Section V* – The Advanced Grid Intelligence and Security Initiative
- *Section VI* – Conclusion

II. BUSINESS SYSTEMS OVERVIEW

Q. PLEASE DESCRIBE BUSINESS SYSTEMS' KEY ROLES AND RESPONSIBILITIES.

A. Business Systems is the Company's centralized IT organization, providing technology services across all operating companies, including NSP-Minnesota. These services include support for the following business operations:

- *Foundational Technology Infrastructure.* Business Systems is responsible for providing support for each employee's hardware and software needs. This includes maintaining and updating the operating system used on employee computers and providing sufficient data storage capabilities. Business Systems is also charged with protecting the security of the Company's data from cyber attacks.
- *Systems Controls.* Business Systems provides technology support to our generation, transmission, and distribution units to help manage and operate the electric and gas systems. This includes providing and supporting software applications such as Supervisory Control and Data

Acquisition (SCADA), which is used to monitor the health of the transmission and distribution systems.

- *Customer Support*. We provide support for infrastructure and software that facilitate interactions with our customers. This includes maintaining the Customer Resource System (CRS), which is the Company's customer information system of record which generates approximately 4 million billing statements to Xcel Energy customers on a monthly basis. We also support the Interactive Voice Response (IVR) software that enables interaction with customers via telephone keypad or speech recognition. Business Systems is also responsible for maintaining the technology used for the Company's website that provides valuable information to customers about their accounts and Company operations including outages.
- *Corporate Support***.** We provide IT support for necessary corporate functions of the Company such as Human Resources and Financial Management. This includes providing and maintaining software applications that assist in the creation, tracking, reporting, and analysis of budget and forecast information.

Q. WHY IS BUSINESS SYSTEMS IMPORTANT TO THE COMPANY AND ITS CUSTOMERS?

A. Business Systems provides the technologies and supporting services necessary for system reliability and security, operational decision-making, and improved customer support and business capabilities. Technology is constantly advancing and evolving as a foundational aspect necessary to help any business meet its goals and objectives.

To operate in such an environment, we must be smart and proactive by

identifying and integrating technologies that will both advance our business and protect it from technological attacks. For example, the advancements in two-way communications, intelligent devices, and SCADA necessitate the integration of many systems to ensure effective use information and enable operational capabilities of new technologies. Identifying new technologies and integrating them into our system supports a smarter grid, system optimization, a more effective workforce with better-enabled employees, and more informed stakeholders through closer connections with external parties. These developments increase the importance of technology, and in turn Business Systems, to the Company and each of our stakeholders.

Q. HOW DOES BUSINESS SYSTEMS SUPPORT THE FUNCTIONS DESCRIBED ABOVE?

A. Along with our day to day work with the IT we have deployed, Business Systems makes capital investments and incurs O&M costs to support other business areas and functions across Xcel Energy as discussed above. I will discuss our capital investments and O&M trends in more detail below.

III. CAPITAL INVESTMENTS

A. Overview

1. The Prior 2016-2019 Multiyear Rate Plan

Q. WHAT WERE BUSINESS SYSTEMS' KEY STRATEGIC GOALS AND FOCUS DRIVING CAPITAL INVESTMENTS OVER THE LAST SEVERAL YEARS?

A. Through approximately 2015, Business Systems had a relatively steady level of IT investment. We were able to limit our capital investments in updating and replacing existing IT systems by continuing to make effective use of our current systems. During that time, we focused our incremental investments

largely on maintaining existing IT assets and took steps to maintain service levels while managing or reducing the capital additions associated with our systems. Due to the maturity of our systems, we were able to limit our investments in these years while garnering value from existing assets.

However, as noted in my Direct Testimony in our 2016 Minnesota electric rate case, the aging nature of our IT systems, along with changing business and regulatory requirements and evolving technologies, required the Company to enter a phase of replacement and upgrade of these systems beginning with rising capital expenditures since 2016.

The key strategic goals and focus driving capital investments are based on the four areas where the company has identified need to invest IT resources: (i) Asset Management, (ii) Finance, (iii) Human Resources, and (iv) Customer Experience.

Since the last MYRP, we strategically invested in our asset management and financial systems with the Productivity Through Technology (PTT) initiative. With PTT, the Company focused on replacing its General Ledger (GL), as well as several different work and asset management programs across business areas into an integrated, modernized Work and Asset Management (WAM) system. By moving to the SAP GL and WAM, the Company updated the core asset management and finance systems with an enterprise-wide application.

Looking forward to 2020-2022, the next areas of focus will be investing in our core human resources systems and updating the customer experience.

Q. HOW DID YOUR CAPITAL INVESTMENTS DURING THE COMPANY'S PRIOR MYRP FILING BREAK INTO CAPITAL BUDGET GROUPINGS THAT REFLECTED THOSE GOALS?

A. The five key areas driving information technology investments are:

- Replacing *aging technology*;
- Addressing evolving *cyber security* threats and requirements;
- *Enhancing the capabilities* of our business and our ability to serve customers;
- Implementing the *Productivity Through Technology* initiative; and
- Addressing *emergent demands* that arise in the course of managing changing technology needs for an adaptive business.

Q. FOR THOSE YEARS, CAN YOU PROVIDE A SUMMARY OF HOW YOUR INVESTMENTS FELL INTO THOSE CAPITAL BUDGET GROUPINGS?

A. Yes. Table 1 and Figure 1 below illustrate our actual capital expenditures for 2016-2018. Table 2 and Figure 2 below illustrate our capital additions for this same period.

Table 1

2016-2018 Actual Capital Expenditures (Dollars in Millions)			
NSPM	**2016**	**2017**	**2018**
Aging Technology	50.3	59.2	47.9
Cyber Security	5.2	6.1	6.8
Enhance Capabilities	14.5	12.8	26.5
AGIS	3.1	13.6	10.9
PTT	48.7	30.9	0.0
Total	**121.8**	**122.7**	**92.1**

Figure 1

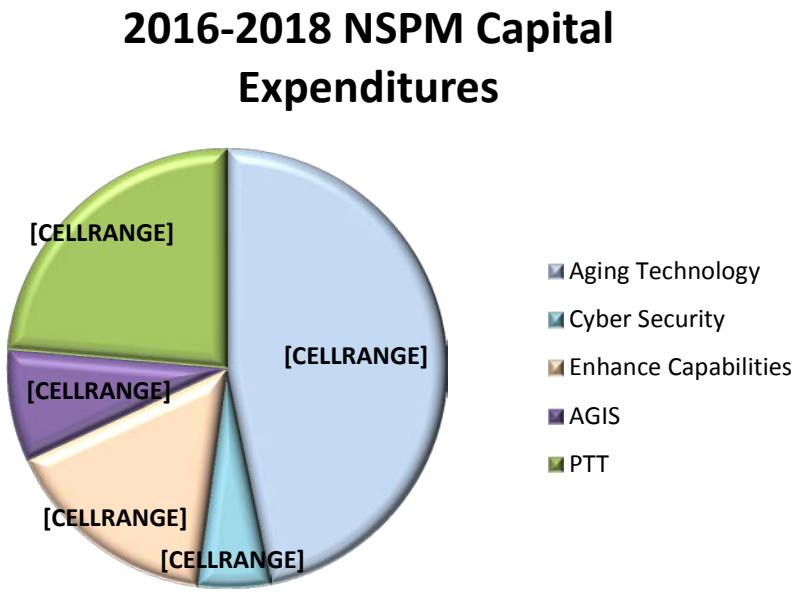
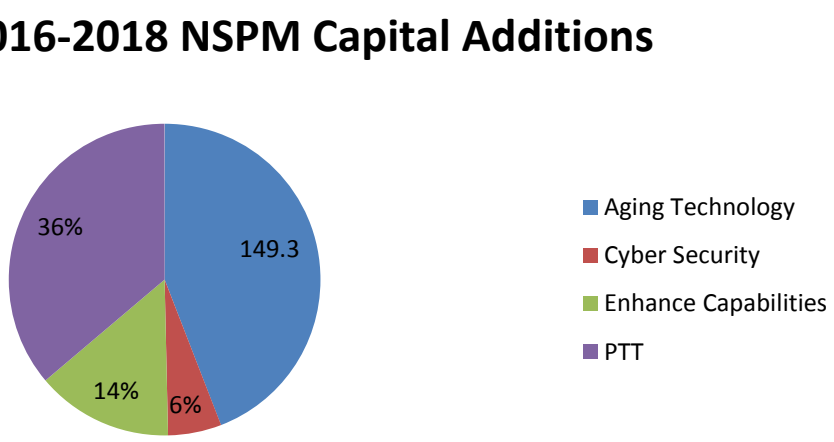


Table 2

2016-2018 Actual Capital Additions (Dollars in Millions)			
NSPM	**2016**	**2017**	**2018**
Aging Technology	65.5	35.5	48.3
Cyber Security	5.9	7.4	5.4
Enhance Capabilities	10.0	15.7	22.3
PTT	31.1	91.3	0.0
Total	**112.6**	**149.9**	**76.0**

Figure 2



Q. Can you explain why the amounts of your investments in these groupings changed over these three years?

A. Yes. Our investments vary year over year depending on the needs of existing technology systems. In addition, one of the most significant recent undertakings was the development of the new General Ledger and Work and Asset Management system – part of our PTT initiative that was discussed in our last rate case. The majority of the investments in the General Ledger were

undertaken in 2014 through 2015, with some preliminary work in 2013 and some post-implementation follow-up in early 2016. The General Ledger was placed in service at the end of 2015. Likewise, most of the Work and Asset Management implementation work was completed and placed in service by the end of 2017. As such, our 2018 capital investments were significantly lower than in the immediate prior years and we stopped utilizing the PTT budget grouping in 2018 and beyond.

As we turn to other initiatives, including the customer and distribution grid focus mentioned earlier, we will see a greater portion of our resources dedicated to those areas and increased investment levels over the next few years. Finally, as I describe below, the Emergent Demand account capital expenditures are invested to support other categories' capital projects, and therefore appear as capital additions under other categories.

Q. LOOKING AT THIS HISTORY, WHAT DO YOU CONCLUDE?

A. Business Systems' capital investments supports the technologies needed to provide electric service to our customers. Without ongoing investment in technologies, we would lack the tools to operate reliably and securely, support functional decision-making, enable communications and "smart" resources, and protect such fundamentally important resources as our grid, our customer information, our generation management, and our financial data.

Q. CAN YOU ADDRESS BUSINESS SYSTEMS' WORK IN 2019 SO FAR?

A. Yes. We have continued to invest in routine maintenance as well as projects to address outstanding business needs, with a focus on Aging Technology. As previously noted, we are placing our Next Generation Desktop system, which

updates our operating systems to Windows10, in-service the end of 2019. Although PTT will not in and of itself be a standalone focus of future capital investments, as with any new enterprise-wide system, we have also been working to continuously improve and maximize the performance of the General Ledger and Work and Asset Management platforms, with an ongoing focus (including in 2019) on user experience, automation and accuracy. We have also dedicated substantial resources to our AGIS initiative, including ADMS and components of FAN. Components of the FAN will be in service in 2019 and ADMS will be placed in service in 2020.

2. Overview of the 2020-2022 MYRP

Q. LOOKING AHEAD, WHAT ARE YOUR CAPITAL FORECASTS FOR 2020-2022 BY CAPITAL BUDGET GROUPING?

A. Our capital expenditure forecasts for 2020 through 2022 are set forth in Table 3 and Figure 3 below. Our capital addition forecasts for 2020 through 2022 are set forth in Table 4 and Figure 4. Our individual capital investment additions are also listed in Exhibit___(DCH-1), Schedule 2.[2]

[2] In some cases, rounding may result in a slight variation between some tables and Exhibit___(DCH-1), Schedule 2.

Table 3

2020-2022 Budgeted Capital Expenditures (Dollars in Millions)			
NSPM	**2020**	**2021**	**2022**
Aging Technology	52.6	57.9	53.8
Cyber Security	8.3	10.4	8.4
Enhance Capabilities	14.6	11.0	16.8
Customer	11.3	16.1	4.5
Emergent Demand	10.9	12.1	13.2
AGIS[1]	28.8	42.7	52.9
Total	**126.5**	**150.3**	**149.7**

Figure 3

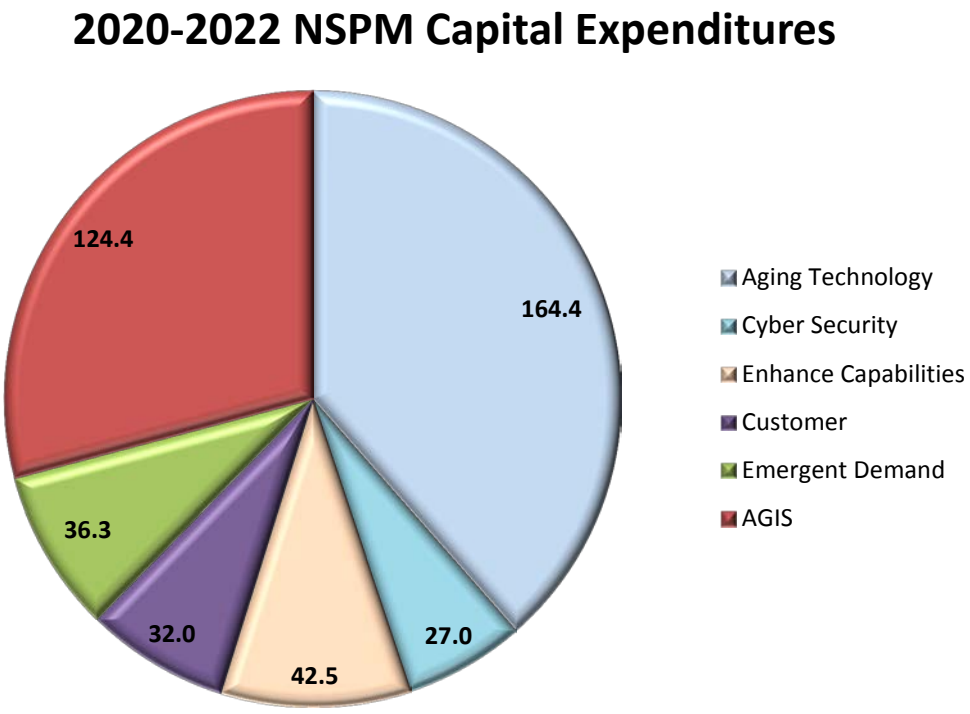
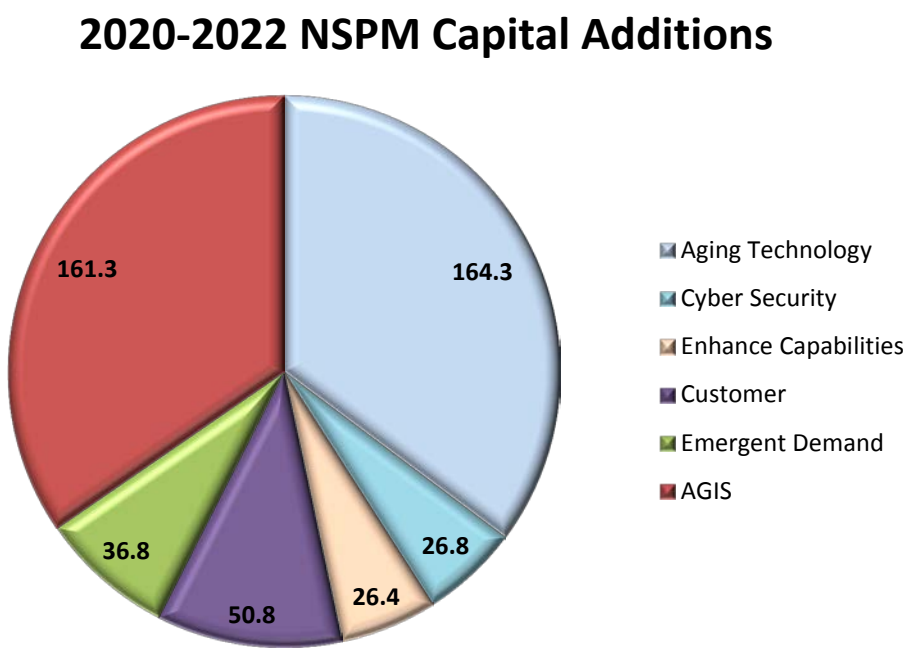


Table 4

2020-2022 Actual Capital Additions (Dollars in Millions)*			
NSPM	**2020**	**2021**	**2022**
Aging Technology	42.2	53.3	68.9
Cyber Security	6.0	11.8	9.0
Enhance Capabilities	6.9	2.0	17.5
Customer	15.6	23.1	12.1
Emergent Demand	9.1	15.0	12.8
AGIS[1]	66.6	28.9	65.8
Total	**146.3**	**134.1**	**186.0**

*There may be differences between the sum of the individual category amounts and Total amounts due to rounding.

Figure 4



As illustrated by Table 3 and Figure 3 above, Business Systems is devoting significant resources to Aging Technology and AGIS through 2022, as well as adding a new capital budget grouping specific to the Customer Experience.

Q. WHY DO CAPITAL ADDITIONS TOTALS DIFFER FROM CAPITAL EXPENDITURE TOTALS?

A. It is important to note that while the capital addition trend is directly affected by our capital expenditures, the capital additions trend may not mirror the capital expenditure trend and may fluctuate more depending on the length of time individual projects require to complete. The capital expenditure trend reflects the progress of the project through the months, whereas the capital addition trend reflects the total at the conclusion of the construction or implementation process when the asset is placed in service. Company witness Mrs. Laurie J. Wold addresses how the Company's overall capital additions align with budgeted capital additions in any given year.

Q. WHAT KEY INDIVIDUAL PROJECTS WILL YOU INVEST IN OVER THIS 2020-2022 TIME PERIOD?

A. In addition to AGIS and our focus on the customer experience, our aging network infrastructure is a key driver of increased investment and requires attention on an ongoing basis. Network connectivity is a critical operational foundation required for the Company to provide a safe and reliable product. Failure to replace aging network mechanisms increases the risk of component level failures resulting in systemic outages across service venues. Specific Business Systems projects to address the replacement of aging network infrastructure will be discussed in more detail later in the testimony.

Further, we will continue to invest in aging technology, cyber security, the need to enhance our capabilities, and inevitable emerging demands.

Q. CAN YOU PROVIDE AN OVERALL PICTURE OF YOUR CAPITAL EXPENDITURES AND CAPITAL ADDITIONS TRENDS FROM 2016 THROUGH THE END OF THE MYRP (2022)?

A. Yes. Our overall 2016 through 2022 capital expenditures and capital additions are set forth in Tables 5 and 6 below.

Table 5

2016-2022 Capital Expenditures							
NSPM	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
	Actual	**Actual**	**Actual**	**Forecast**	**Budget**	**Budget**	**Budget**
Business Systems	121.8	122.7	92.1	118.9	126.5	150.3	149.7

Table 6

2016-2022 Capital Additions							
NSPM	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
	Actual	**Actual**	**Actual**	**Forecast**	**Budget**	**Budget**	**Budget**
Business Systems	112.6	149.9	76.0	133.6	146.3	134.1	186.0

While capital expenditures differ in timing from capital additions as noted above, both Tables 5 and 6 illustrate that our Company investments in IT vary depending on the specific work that is necessary for our business and our customers. In the years when less investment is needed, we do not spend as much (although other areas of the Company may require those resources). Conversely, Business Systems capital expenditure levels necessarily increase in years when we are embarking on significant initiatives, and capital additions necessarily increase when those initiatives are placed in service. Overall, our investments are increasing as our industry, similar to many industries, rely increasingly on IT to serve customers and enhance their experience.

3. Challenges Facing the IT Business Area

Q. ARE THERE CHALLENGES UNIQUE TO BUSINESS SYSTEMS THAT CAN AFFECT THE COMPANY'S BUDGETING AND ACTUAL EXPENDITURES?

A. Yes. Technology changes constantly. As a result, issues with older software or equipment may not seem critical during budget creation but become critical if systems begin to show signs of issues or failure, or no longer serve their intended purpose. Additionally, cyber security threats are constantly in flux and may result in additional investment in a given year to ensure that cyber security tools and resources continue to change in response to new threats to our information systems. The result is that it is necessary to constantly monitor, and sometimes re-prioritize, the percent of our total dollars invested in each capital budget grouping.

Q. WHY IS THE ABILITY TO CHANGE THESE INVESTMENT PERCENTAGES IMPORTANT TO THE COMPANY AND YOUR CUSTOMERS?

A. Given the ever-changing nature of IT coupled with the potential materialization of new cyber security threats, Business Systems must have the flexibility in its budget to adapt to and promptly address emerging issues and risks. Our business and our service of customers depend on having reasonably current technology that allows the Company to perform its core functions in an effective manner.

Q. CAN YOU PROVIDE AN EXAMPLE OF CHANGES IN THE INFORMATION TECHNOLOGY WORLD THAT MAY AFFECT BUSINESS SYSTEMS IN THE YEARS AHEAD?

A. Yes. As the technology landscape continues to evolve, cloud computing is becoming a more prevalent way for companies to provide information technology services. This presents unique decision-making requirements as we look to future IT solutions, and also can present financial challenges because some cloud solutions might be treated as O&M whereas the same solution would be capitalized (and therefore earn a rate of return) when owned by the Company. The utility financial and regulatory model does not work as cleanly in an era when the line between a company-owned asset and a cloud solution is blurred.

Q. HOW DOES THIS CHALLENGE FACTOR INTO BUSINESS SYSTEMS PLANNING?

A. The utility prefers to choose the best solution for the situation without having to give greater weight to the asset-based model. Ultimately, the Company wants to level the playing field between traditional on premise data processing solutions and cloud computing solutions and not have to consider the existing

O&M and capital budget implications (e.g. that Company-owned systems are added to rate base and enable the utility to earn a return on the assets, whereas contracts that look like O&M are not traditionally given such a return). Scalability and flexibility will provide the Company the ability to choose the best option and make an efficient transition to cloud computing.

Q. WHAT ARE THE POTENTIAL BENEFITS OF CLOUD COMPUTING?

A. In some cases there may be cost benefits associated with transitioning to cloud computing because third-party service providers can offer pricing that is leveraged across many customers. Additionally, cloud computing benefits may also include having the most up to date technology available, upgrades that are less disruptive to business operations and increased security. Cloud computing arrangements will need to be evaluated to determine the best solution based on technology, cost and other factors.

Q. HOW IS THE COMPANY GOING TO MAKE THE TRANSITION TO INCREASE UTILIZATION OF CLOUD COMPUTING?

A. The Company will need to continue to create a decision framework to identify when leveraging cloud technology may improve business objectives, productivity, and the customer experience. For example, one area we believe cloud computing could be advantageous is improving the customer experience. Examples of an improved customer experience might include enhanced communications regarding outage information, billing, mobile, and product services and offerings.

Q. CAN YOU OFFER AN EXAMPLE OF A PROJECT THAT MIGHT BE HOSTED IN THE FUTURE?

A. Yes. Amazon storage is an example of a project that could be "hosted" (e.g. a solution owned by Amazon but contracted back to the Company). Normally the Company would locate storage on premise in a data center such as the one at 414 Nicollet Mall. Hosting the solution with Amazon will provide speed to market (no set up time, the ability to manage capacity constraints, and scalability) and some applications may be more beneficial when residing in the cloud. For example, if there is a power outage at a data center we might also lose the outage management system, whereas a hosted solution means the systems are not tied to occurrences within the Company.

Q. ARE THERE ALSO POTENTIAL DOWNSIDES TO HOSTED SOLUTIONS?

A. Yes. In some cases, the Company wants to own assets to have direct control over and the ability to protect company and customer security. In addition, in some instances the Company may want the ability to control software and upgrades, to have control of data, and to control ongoing cost management. While hosted solutions are becoming more available and popular among vendors, the circumstances of each project will have to be evaluated to determine whether owned vs. hosted is best option based on technology requirements and costs.

Q. WHAT IS THE FINANCIAL TREATMENT OF HOSTED SOLUTIONS?

A. When capital policy requirements are met, the Company will capitalize a hosted solution in a similar way as an on-premise solution. In other scenarios, the on-premise storage is capital because the Company effectively takes ownership of the hardware and/or code, while others are O&M when they do

not meet Capital Asset Accounting capitalization requirements. Ms. Laurie J. Wold's Direct Testimony explains capital and O&M treatment of hosted solutions in detail.

Q. IS THE COMPANY PROPOSING ANY PARTICULAR APPROACH TO HOSTED SOLUTIONS IN THIS PROCEEDING?

A. At this time, we are simply seeking to identify the issue because the prevalence of cloud-based solutions is increasing. While we do not expect significant changes to our business model in the years of the MYRP, we believe this is a good example of how technology evolves quickly, raising questions and creating unexpected potential impacts that are worthy of discussion within the regulatory framework.

Q. MORE GENERALLY SPEAKING, SHOULD CUSTOMERS BE CONCERNED THAT SPECIFIC PROJECT NEEDS AND PLANS WILL LIKELY EVOLVE DURING ANY GIVEN MULTI-YEAR PERIOD?

A. No – rather, we make these adjustments to better serve our businesses' and our customers' most pressing needs in a cost-effective way. When the need arises to accelerate a project, we assess the situation to make sure we are doing so for the right reasons and in a prudent manner. Similarly, we assess potential project delays or cancellations to make sure we are still meeting business and customer needs in a reasonable way.

Q. EVEN IF YOUR INVESTMENT PERCENTAGES CHANGE FROM THE CURRENT FORECAST, WILL BUSINESS SYSTEMS STILL MANAGE ITS OVERALL CAPITAL INVESTMENTS TO ITS OVERALL BUDGET?

A. Yes, but history shows that our budgets are a conservative indicator of our

investments. Ultimately, we plan to invest in technologies and supporting services as necessary to ensure system reliability and security, to facilitate operational decision-making, and to provide the necessary levels of support to our customer support and business capability functions.

Q. WHAT DO YOU CONCLUDE ABOUT BUSINESS SYSTEMS' 2020 – 2022 CAPITAL INVESTMENT FORECASTS?

A. I conclude that our capital forecasts represent an accurate, reasonable, and representative picture of our investments over these years. History demonstrates that the Company will make the investments necessary to serve customers safely and reliably, even if our forecasts are too low. Therefore, these forecasts can be relied on to set just and reasonable rates for our customers.

B. Business Systems Investment Strategy

1. Key Investment Needs

Q. WHAT ISSUES ARE DRIVING BUSINESS SYSTEMS' STRATEGIC CAPITAL PLANNING?

A. As I discussed above, the six key areas driving information technology investment remain replacing aging technology, addressing evolving cyber security threats and requirements, enhancing capabilities, enhancing the customer experience, addressing emergent demands, and the AGIS initiative.

a. Aging Technology

Q. WHAT ARE THE PRIMARY ISSUES FACING THE COMPANY WITH REGARD TO AGING TECHNOLOGY?

A. Business Systems supports the operations of the Company with a large and growing IT infrastructure. Information assets are no different from physical assets in that they are subject to aging, technological obsolescence, and increasing maintenance costs. A reasonably up-to-date infrastructure is necessary for the Company to continue to meet increasingly demanding data security, reliability, and compliance requirements, as well as the service expectations of our customers. For example, some aging technologies are not equipped with the most current data security measures, meaning they are more vulnerable to attack. In addition, the recovery of aging technologies after an outage can be compromised if those systems are no longer supported by their vendor.

Another area of IT that must keep pace with current needs is our Company's data storage capabilities. The increasing use of technology across the organization is resulting in the need to store, transmit, and manage ever larger amounts of data, and our systems must be able to keep up with these growing data storage needs. While solutions such as routine information purging and data warehousing can help reduce the impact of this data "explosion," they are not sufficient to fully mitigate it. As a result, we need to increase our storage capacities and the speed and flexibility of our networks, and improve our tools to cost effectively manage our data and information.

Q. HOW DOES THE COMPANY DETERMINE WHEN AN EXISTING TECHNOLOGY NEEDS TO BE REPLACED?

A. Business Systems strives to maximize our technology investments by maintaining existing software and hardware until the risk and costs associated with keeping these aging technologies in place require attention. For instance, new software systems are often necessary when the existing software is no longer supported by the vendor.

A recent example is the Company's Distributed Energy Management System (DEMS) Upgrade. This plan leverages a long-term solution to keep our transmission system supported and secure, over multiple phases, to maximize value and minimize customer cost over time. The first DEMS project was in the previous 2016 NSPM rate case. At that time, we did a complete replacement for the NSP Energy Management System (Dynamic EMS - DEMS) with the GE product that went live in May of 2016 for NSP. The project included a completely new hardware, network, and software environment(s). This project started at the end of 2012, because EMS replacements are complex and there is no margin for error; they need to be 100 percent functional when placed into production.

The current DEMS project in the upcoming MYRP is driven by a contractual agreement to upgrade DEMS to a newer version within six years of the executed contract. The new hardware and network components with the upgrade project will enhance our cyber security posture and enable greater segmentation for this critical system. The new operating and application software will also help with security since they will remain in support by the vendors. But by completing the work in phases and not upgrading to

subsequent operating systems and infrastructure until necessary, the Company maximized its initial investment and value to customers.

b. Cyber Security

Q. PLEASE SUMMARIZE THE CYBER SECURITY ISSUES FACING THE COMPANY.

A. There are key four cyber security issues the Company must address: (1) keeping hackers out of our systems; (2) detecting hackers if they attempt to gain access to our systems; (3) removing hackers that gain access to our systems; and (4) returning our systems to their original state if hackers gain access. As the number of cyber threats, attacks, and regulatory requirements continues to increase in volume and complexity, it is imperative that the Company establishes and maintains the proper tools to protect the integrity and confidentiality of our data and our systems. Given the unpredictability of these threats, it is important that these tools and resources continue to change in response to new threats to our information systems.

It is important to note that cyber security is not simply a matter of implementing a standardized base of security controls and processes that cover all the regulatory and legal requirements. Effective cyber security also requires filling the security gaps that would exist if we focused solely on regulatory and legal compliance. Many large financial companies that have had their data hacked in recent years were compliant with regulatory and legal requirements.

Q. WHAT IS BUSINESS SYSTEMS DOING TO ADDRESS THOSE CYBER SECURITY ISSUES?

A. The Company has taken great strides to address cyber security issues. This includes creation of a dedicated Enterprise Security Services business unit to focus on these issues, implementing new technologies and new systems, partnering with federal agencies to learn about new threats and solutions, and in-sourcing the Company's disaster recovery services. I will address each of these initiatives in turn.

First, ESS exists to manage our overall cyber security posture, implement processes and plans to be able to quickly mitigate any adverse events, respond appropriately and effectively to large scale events that would otherwise cause significant harm to the bulk electric system and/or natural gas delivery systems, and ensure regulatory compliance.

Second, to meet the needs and demands of today's security requirements, Business Systems has implemented multiple security systems and technologies. We have implemented technologies to date that include: Vulnerability Management, Advanced Threat Protection, Security Forensic tools, Advanced Firewalls, Intrusion Prevention Devices, and a Security Incident and Event Management system to correlate all the data and bring visibility to what is happening on our infrastructure.

Third, we have enhanced our partnerships with both regulatory and state/federal agencies to ensure we are tapped into the stream of information available regarding impending threats and attacks. These agencies include

Edison Electric Institute, National Infrastructure Advisory Council, American Gas Association, the Federal Bureau of Investigation, and Homeland Security.

Finally, our disaster recovery services have implemented an isolated infrastructure and computing platform to enable thorough testing of all recovery plans to ensure full recoverability. We have also revisited and revised the recovery plans for critical systems and continue to expand into secondary systems.

c. Enhancing Capabilities

Q. HOW DOES BUSINESS SYSTEMS ASSIST IN ENHANCING CAPABILITIES FOR THE COMPANY?

A. Technology can offer the opportunity to improve productivity, enhance communications between systems and between people, and use data more efficiently. A simple example that illustrates this point is the mobile phone. Mobile phones were not necessarily invented to solve a problem with land-based telephone lines or service. However, as they emerged and became increasingly sophisticated, they have changed our society. We have needed to adapt and learn how to derive as much efficiency as possible from what have become wireless mobile computing devices. This is just one example of how Business Systems must constantly evaluate new technologies to help the business areas increase efficiencies and enhance communications between systems that benefit the Company and our customers.

Q. HOW DOES BUSINESS SYSTEMS DETERMINE WHICH CAPABILITY-ENHANCING TECHNOLOGY TO IMPLEMENT?

A. The key is to identify these new technologies and to implement only those technologies that can offer efficiency benefits that outweigh their implementation costs. Business Systems works prudently with various business units to evaluate new technologies to determine whether they can be used to improve the efficiencies in the way tasks are completed, data is used, or in the way communications are conducted within the organization and with external stakeholders, including our customers. For example, adding land mobile radios at our nuclear facilities and, going forward, within the Twin Cities metropolitan area, enhances our ability to conduct secure communications between work crews across highly sensitive locations.

d. Customer Experience

Q. WHAT IS XCEL ENERGY REFERRING TO WHEN IT DISCUSSES A "CUSTOMER EXPERIENCE"?

A. The customer experience refers to the Xcel Energy customer's direct interactions with the Company, whether by digital platforms, through the call center, in person, or otherwise. To manage that experience, we must have in place both system tools and customer interfaces that work for the customer, supporting their satisfaction with our service and their overall experience with our company.

Q. WHAT IS THE CUSTOMER EXPERIENCE PROGRAM?

A. As discussed by Company witness Mr. Gregory Chamberlain, Xcel Energy's enterprise-wide strategic priorities are to lead the clean energy transition, enhance the customer experience, and keep bills low. While all of our work

puts the customer front and center, it has been several years since we have invested significantly in our primary customer touch points and relationship management tools. In support of the enterprise focus on enhancing customer experience, we launched a new Customer Experience Transformation (CXT) program in April 2019 to help create smarter and simpler experiences for our employees and customers. This multi-year, five track effort is designed to transform customer experiences, improve customer satisfaction and employee engagement, and continue to drive more efficient operations.

CXT is a program with a defined budget and timeline developed to work strategically on enhancing our digital channels, developing a data fabric model and migrating our customer and business data into the model, and designing, building, testing, and deploying the foundational components to allow the first two to operate. More specifically, we are utilizing more modern technologies that our customers have come to expect through experiences with other companies including interactive websites, account management options, and smart phone applications.

As we utilize more modern technologies for our customers, we will simultaneously need to invest in new capabilities like data science, design, and development. We are also utilizing our employees' innovative thinking to align with our customers' needs and expectations.

Q. HOW DID XCEL ENERGY INITIATE THE PROCESS OF IDENTIFYING THE NEED FOR THE CUSTOMER EXPERIENCE TRANSFORMATION?

A. On a regular basis we survey our customers to determine their satisfaction in how we deliver services and engage them in our market research studies to help inform opportunities for us to improve customer experiences. We also

worked with one of our strategic partners to evaluate a number of potential initiatives against the ability to enhance customer satisfaction and the ability to make our employees more effective, as well as the cost and duration to complete these potential initiatives.

Q. PLEASE DISCUSS THE CUSTOMER RESEARCH THAT INDICATES THE NEED FOR IMPROVEMENTS IN THE COMPANY'S DIGITAL INTERACTIONS WITH CUSTOMERS?

A. Across Xcel Energy, we continuously capture customer feedback regarding their interactions with us to understand if we are meeting their needs and what areas we should focus to improve the customer experience. In 2016, we implemented a new customer experience measurement practice that is centered on capturing customer satisfaction on key customer service channels including our contact center, website and our mobile app. Since launching that practice, we have captured over 370,000 customer responses that provides a clear understanding of satisfaction levels per channel and what factors drive customers to have lower satisfaction.

One of the key takeaways is that customers expect a seamless and simple interaction and that our digital platforms (such as our website, MyAccount, mobile app, and Customer Connection) are falling short of expectations. Customer satisfaction is low and/or has declined at the same time customer satisfaction with non-digital forms of interaction (contact center agents, IVR, and email correspondence) remain very high. We particularly noted declining satisfaction with respect to our billing and payment platforms, as well as new customer digital interactions and outage response digital communications. A

September 2019 report on this data is attached to my Direct Testimony as Exhibit___(DCH-1), Schedule 4.

Q. WHAT BENEFITS AND GOALS WERE IDENTIFIED TO EVALUATE POTENTIAL WAYS TO ADDRESS THESE CUSTOMER INTERESTS?

A. We focused our core goals on four areas, set forth below:

1. Customer Satisfaction: An indication of the impact an initiative will have on our customer's satisfaction and contribution to their experience with Xcel Energy. *e.g. effort required for resolution, first contact resolution, outage restoration time.*
2. Employee Satisfaction: An indication of the impact an initiative will have on our employee's satisfaction with and contribution to Xcel Energy. *e.g.. retention, project ownership.*
3. Cost Efficiency: Estimated cost savings resulting from each initiative. Estimates are reflected in long-term run-rate. *e.g. reduction in average time to completion, reduced call volumes, decreased manual intervention.*
4. Customer Optionality: Giving customers service options that meet their needs and give them choices in how they manage and utilize their electric services. *e.g. increased conversion rate, new product offerings, electronic scheduling and notification of progress*

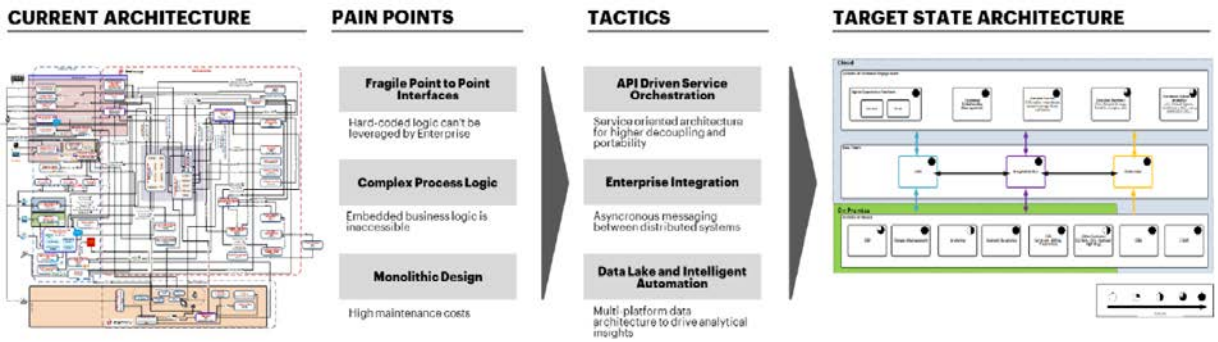
Q. ARE THERE BARRIERS TO MEETING THESE CUSTOMER NEEDS AND EXPECTATIONS UNDER THE COMPANY'S CURRENT CUSTOMER-FACING PLATFORMS?

A. Yes. Our current systems were not designed to be a customer relationship management system. Our legacy systems handle a significant volume of transactions on a daily basis and, over time, the amount of data that they store

and manage builds and increases. The number of systems that they have to interact with has grown as well, as illustrated in the left-hand side of Figure 5 below. As a result, those interconnected systems have to work harder in order to stay reliable and responsive. As those systems were implemented and their connections built along the way, the integration and data technologies required to efficiently build out a more layered architecture in a cost effective manner were not available.

The technologies and approaches that are available today allow us to more efficiently achieve the layered approach. An improved architecture, shown on the right side of Figure 5, allows us to offload the pressure that has been placed on those applications and the information they contain. The architecture allows us to organize and centralize relevant data so that it can be used in multiple ways without directly impacting them. In doing so, we will simplify access to information and will be prepared to efficiently support increasing customer, business, and security demands.

Figure 5



Q. CAN YOU PROVIDE SOME REAL-WORLD EXAMPLES OF THE LIMITATIONS OF THE CURRENT CUSTOMER EXPERIENCE?

A. Yes. As one example, today a current developer customer will utilize our online form to request new service for a development of a new home or complex of homes. Once the application is completed and submitted, that application is received by our internal builder's call line representative, who will then manually input the same information into our ordering system to start the process. When the developer wants to get a status on the new order, he will need to call our builder's call line, but the customer service representative will only know what designer the work has been assigned to – no additional information. Once the designer starts to work on the order, neither the developer nor our builder's call line will know the status of the job. In the future, the developer will be able to create the order online, which will in turn automatically create an order in our system and provide the builder's call line representative with a view of the status. That same status will be available to our customer, the developer, in any channel they choose to contact us.

As another example, today when a customer would like to report a problem that requires one of our technicians to come to their home, they are given a 3-4 hour window when the service technician will arrive but no ability to know the status. In the future, the customer will be able to utilize any one of our channels to choose the appropriate time, and during the window provided, the customer will be able to see information regarding the technician, including a picture and the current time period when the technician should arrive, providing more convenience for the customer and an additional level of security knowing who will be coming to service their request.

Another example relates to our online bill payment option for customers. When a customer wants to pay their bill online today, they must know the account number to log on and complete the transaction. In the future, we will be able to allow them to choose a more easily maintained user ID to access their account information.

Finally, today when customers call our contact center and begin in our automated system, they are required to push buttons to choose the options they are calling to execute. In the future, there will be natural language support to allow the customer to speak their options in normal spoken language to complete transactions.

Q. CAN YOU EXPLAIN MORE ABOUT HOW THE COMPANY IDENTIFIED AN APPROPRIATE MEANS TO ADDRESS THESE AREAS AT THIS TIME?

A. Yes. We worked with Ernst & Young, a company with years of experience helping customer design effective customer experiences across many industries, to evaluate which activities across the Xcel Energy service platform (from payment and billing options, new service start-ups, service help, mobile application options, and the like), affected which core service aspect and benefited our Company goals.

We shared our customer survey results, as discussed earlier in this section of my testimony, to inform this evaluation. We also worked with customers and employees to rank the value vs. the complexity of various aspects of the customer experience. In particular, based on feedback we received, we ranked which aspects were highest value and least complex (and vice versa) from both the customer and employee perspective.

This information allowed us to prioritize efforts to improve the customer experience by identifying those with the greatest impact on our core goals, the highest value, and the least complexity (relatively speaking).

Q. WHAT REGULATED ASPECTS OF THE CUSTOMER EXPERIENCE ROSE TO THE TOP OF THIS ANALYSIS?

A. We identified that we could improve the customer experience in a timely manner, with high value to customers and reasonable complexity and cost levels by focusing on the following three areas: (1) Customer Assistance ("Get Help") platforms, including making it easier for customers to find information on their services, usage, billing and payment, as well as the ability to have multiple channels to address their needs, such as MyAccount, the Company website (xcelenergy.com), and Xcel Energy mobile applications; (2) Service Initiation ("Start Service"), which relates to starting electric or gas service; and (3) Electric Vehicle support. The Company's analysis is set forth in Exhibit___(DCH-1), Schedule 5 to my Direct Testimony.

As Company witness Ms. Bloch identifies in her testimony, electric vehicle support and advancement is already in development at the Company. Consequently, our Customer Experience Transformation focuses on the customer connection and customer service platforms. Ms. Bloch supports the electric vehicle budgets in her testimony.

Q. WHAT WORK DID THE COMPANY ULTIMATELY DETERMINE IS NECESSARY TO IMPROVE THE CUSTOMER EXPERIENCE IN TODAY'S UTILITY LANDSCAPE?

A. The CXT program is, ultimately, a series of foundational investments in platform infrastructure and data analytics and automation that are intended to

improve the Company's digital interfaces with customers. Planned work and investments to improve the customer experience are divided into four project areas: Digital Channel Platforms (including MyAccount, the Company's website, Xcel Energy mobile applications, and new customers and real estate developers' initial connections with the Company (Customer Connect); the Customer Relationship Management (CRM) Platform (currently SalesForce); Platform Infrastructure and Technology Maintenance; and Data Analytics and Automation. Most of this work is being completed during the MYRP period.

Q. WHY IS IT WORTHWHILE TO INVEST IN MEETING THESE NEEDS NOW?

A. In today's evolving technology market, utility customers' expectations are not set exclusively by utility companies; rather, high expectations are being set by companies like Google, Apple and Amazon, who show customers what is possible and lead them to expect responsive, integrated, and problem-solving interactions with their service providers. Living in an era where customer's expectations are higher than they have ever been, the Company must be prepared to meet our customer's needs to remain a trusted provider of their energy services.

Additionally, customer satisfaction in providing services is at the core of what we do at Xcel Energy. With evolving technical capabilities, we have an opportunity to enhance our relationships with customers and provide them new options. Customers may not be very motivated by electricity itself, but they depend on what electricity enables them to do. With our customers experience at the center of who we are as a company, we can connect with them in a way that creates value they can measure. If we do not, we risk becoming a source of frustration rather than a source of service.

Q. HOW IS THE COMPANY IMPLEMENTING THESE PROJECTS?

A. As mentioned earlier in my testimony, we are utilizing a five-track process to enhance the customer experience. Our multi-faceted effort is based on integrating several considerations that are all central to our business:

- *Experience:* the customer experience.
- *Strategy:* the governance structures and processes necessary to guide the process.
- *People:* the internal talent and business capabilities that allow our people to work collaboratively.
- *Foundation:* the fundamental technology architecture necessary to carry out the vision.
- *Innovation:* forward-looking perspective that anticipates future needs to prepare our systems to the best extent possible.

Q. WHAT PROGRESS HAS THE COMPANY MADE ON THIS INITIATIVE TO DATE ?

A. We are approaching this program in phases, each of which includes several "Waves" to meet our goals and stages of deployment. We are currently in Wave 2 of 3 in the first phase, with initial deployments occurring in 2020 and throughout the MYRP. The program began by identifying the customer enhancements that are important to achieving our goal of making it easier to do business with Xcel Energy. A number of as-is processes were documented to determine how our customers interact with us, the possibilities to provide new value for the customer, and lastly the most efficient and effective ways to delivery that service were completed for services like new customer connection and our service channels.

After identification of the enhancements, we turned to understanding system requirements and the necessary tools and software applications required to effectively build the desired functions. We also began procurement of the tools and software. In addition, we identified the need to develop, test, stage, and deploy our applications in an application cloud environment, and developed the functional designs, including security.

I will walk through the individual components of this program under each year of the MYRP, later in my testimony.

e. AGIS

Q. HOW IS BUSINESS SYSTEMS ASSISTING IN MODERNIZING THE DISTRIBUTION GRID?

A. Business Systems plays a key role in developing the IT systems and systems integration that are necessary to develop a more advanced distribution grid. We work hand-in-hand with Distribution and Customer Care to develop a plan that will bring our distribution grid into the future, making it more responsive, interactive, supportive of distributed energy resources, and informative to customers. We will also be utilizing data and information from the AGIS initiative to enhance our customer experience program. I address the AGIS initiative, including its several components supported by Business Systems, in extensive detail in Section V of my Direct Testimony.

2. Reasonableness of Overall Budget

Q. HOW DOES THE BUSINESS SYSTEMS AREA ESTABLISH A REASONABLE CAPITAL BUDGET FOR A GIVEN YEAR?

A. The appropriate annual capital budget for Business Systems is based on a partnership between corporate management of overall finances and the business needs we identify for our constituents. Company witness Mr. Gregory J. Robinson explains how the Company establishes overall business area capital spending guidelines and budgets based on financing availability, specific needs of business areas, and overall needs of the Company.

The Business Systems area itself employs a "bottom up" approach to planning for the needs our business area addresses. Business Systems will continue to use a portfolio prioritization and balancing process to determine the needs we must address and decide how to allocate limited funds according to the highest business priorities, including the greatest risks our IT systems face in each year. The portfolio is regularly prioritized and balanced to support established strategic objectives using predefined portfolio management criteria, the organization's desired risk profile, portfolio performance metrics, and capacity constraints. These projects are then rolled up to total budgeted costs by capital budget groupings. Often the desired initial budget exceeds the spending guidelines, which then require review meetings with managers, directors, and vice presidents to assess the requested budget and determine the right course of action.

Because this happens throughout the Company, a higher or lower percentage of the Company's overall resources may be allocated to Business Systems in any given year, depending on the priority of needs throughout the Company.

Ultimately, corporate leadership determines the amount of money to be allocated to Business Systems for each year, as part of the total budget development for the Company.

Q. HOW DOES BUSINESS SYSTEMS MANAGE ITS BUDGETED PROJECTS TO THE OVERALL CAPITAL BUDGET ALLOTTED TO IT?

A. Once the Business Systems allotment is known, the Technology Investment Council has final approval for either maintaining the portfolio "as is" or adjusting the portfolio within the established budget thresholds. The purpose is to determine whether the projects included in the budget are sound, viable, and worthy of funding, support, and inclusion in the Company's IT portfolio. The process of adjusting the portfolio may include:

- Adding new projects that have been selected and prioritized for inclusion in the budget;
- Identifying projects that are not authorized based on the review process; or
- Eliminating projects to be suspended, reprioritized, or terminated based on the review process.

3. Project Budgeting and Development

Q. HOW IS THE BUDGET FOR A PROJECT DEVELOPED INITIALLY?

A. Business Systems' budget development, project prioritization, and project management leverages an established IT Governance process. IT works with each business area to determine its specific IT needs, and then these needs are prioritized based on a particular set of factors. Specifically, each Business Systems area is responsible for partnering with a specific business unit within the organization to determine that area's long-term strategic objectives, and

identify whether IT investments can enable achievement of those objectives. In turn, these priorities are converted into a proposed Business Systems budget.

The IT Governance process also monitors the end-to-end project implementation lifecycle for each proposed project, from its conception to in service, to help keep the project within budget and on schedule, and performs as expected for the specified business objective. The IT Governance process also oversees and must approve any changes in project scope or budget at the corporate level based on overall Company priorities and spending levels.

Q. HAS ANYTHING CHANGED IN THE IT GOVERNANCE PROCESS SINCE THE PREVIOUS RATE CASE?

A. Yes, since the previous rate case, the function of what was formerly the IT Governance process is in process of being replaced by the Technology Investment Council. Our IT capital investments continue to be driven by the needs of Xcel Energy's business areas. However, due to the rapid pace of technology, it was determined that additional focus would be beneficial for leadership across the Company to better understand technology, communication, and the decision making process. Previously Business Systems prioritized IT projects internally with some engagement from Business Leaders. The new IT Governance process established with the Technology Investment Council is intended to broaden the enterprise perspective when selecting the project portfolio and making the tradeoff decisions across all business areas.

Q. HOW ARE PROJECT IDEAS CONVERTED INTO THE BUSINESS SYSTEMS BUDGET?

A. From the idea stage, project ideas are grouped and evaluated, ranked, and selected based on a common set of filters. This process weighs a multitude of criteria including: (1) the financial and non-financial benefits of a project, (2) the potential for other existing technologies to address the business need, and (3) the degree to which the project is needed to meet regulatory requirements or to ensure system reliability and security. This categorization process allows Business Systems to evaluate the benefits and risks associated with each project idea, and results in a list of ranked project ideas.

Q. WHAT IS THE NEXT STEP AFTER THE PROJECT IDEAS ARE RANKED?

A. The Technology Investment Council reviews the ranked project ideas to determine which projects should be implemented and included in the Business Systems budget. This process requires further refinement of the budget figures for each project, and prioritization of possible projects until a final budget is set.

Q. HOW ARE PROJECTS GOVERNED ONCE APPROVED FOR INCLUSION IN THE BUDGET?

A. Business Systems employs a gated approval process called the "Governance Gates Process" to oversee IT projects throughout their lifecycle. Projects move through specific gates or approvals from the Technology Investment Council and other stakeholders as they progress. The Governance Gates Process enables regular review of project metrics (schedule, scope, deliverables), and institutes corrective action plans or modification as appropriate.

Q. PLEASE IDENTIFY THE DIFFERENT GATES OR APPROVALS THAT ARE PART OF THE IT GOVERNANCE GATES PROCESS.

A. The five gates that each capital project must garner before it is initiated and ultimately placed in service are as follows: (1) Approval to Initiate; (2) Alignment to Design; (3) Alignment to Build ; and (4) Alignment to Launch (5) and Project Closure.

a. Approval to Initiate

Q. WHAT HAPPENS ONCE AN IDEA HAS BEEN INCLUDED IN THE BUDGET?

A. Once the Technology Investment Council determines that a project should move forward, the first governance gate is "Approved to Initiate," which is the official start of the capital project. Approval to initiate includes a delivery checklist, a stakeholder identification and analysis, an official project plan, risk logs, and operational readiness.

b. Alignment to Design

Q. What is the next required approval in the IT Governance process?

A. The next gate is the "Alignment to Design." The purpose of this approval is to ensure that the initial budget and schedule have been adequately documented since the "Approval to Initiate" gate, and that the strategy is appropriately developed to move the project forward.

Q. WHAT HAPPENS WITH A PROJECT UPON APPROVAL OF THIS GATE?

A. Upon approval of this gate, the project profile, requirements, security project risk assessment, budget, and schedule are assessed and modified as appropriate.

c. Alignment to Build

Q. WHAT IS THE NEXT APPROVAL REQUIRED IN THE IT GOVERNANCE PROCESS?

A. The next gate is "Alignment to Build." This approval provides the final check of a project before construction begins to ensure that the proposed design meets the identified needs and any technical problems are resolved.

Q. WHAT OCCURS AT THIS STEP IN THE PROCESS?

A. At this gate, the detailed design of a project is reviewed and validated by an IT Technical Review Board to ensure that the project satisfies its intended business objectives. Overall project status, technical solutions, software products, documentation, and definitive estimates are reviewed to ensure completeness and consistency with design standards and to resolve any technical issues with the project. After approval is obtained at this gate, the project team will begin to build and deploy the project.

d. Alignment to Launch

Q. WHAT IS THE NEXT APPROVAL REQUIRED IN THE IT GOVERNANCE PROCESS?

A. The next gate is "Alignment to Launch." This is a formal inspection conducted by the IT Technical Review Board to determine whether the technology solution is ready to be placed in service. The business unit sponsoring the solution must also approve the project at this stage, and confirm that it meets the business unit's objectives, and that the operational procedures and tools (such as user training) are in place to ensure its successful and secure operation in the production environment.

e. Project Closure

Q. WHAT IS THE FINAL APPROVAL REQUIRED IN THE IT GOVERNANCE PROCESS?

A. The final gate is "project closure." This gate is the formal close out of the project verifying the solution has been transitioned to operational steady state and storing all project artifacts.

f. Changes in Planned Projects

Q. AS A PROJECT MOVES THROUGH DEVELOPMENT, DOES BUSINESS SYSTEMS TAKE STEPS TO MONITOR VARIANCES BETWEEN ITS ACTUAL EXPENDITURES AND ITS BUDGET?

A. Yes. In each key area of Business Systems, management monitors actual versus budget expenditures for both capital and O&M on a monthly basis. Any deviations are then evaluated to determine whether costs are appropriate. In addition, action plans are developed to mitigate variations in actual to budgeted expenditures. These mitigation plans may either reduce or delay other expenditures to support the overall authorized budget. If authorized budget adjustments are required, they are identified and approved at an appropriate level of management.

Q. DO EMPLOYEES WITHIN THE BUSINESS SYSTEMS DEPARTMENT ANTICIPATE AND MANAGE DEVIATIONS FROM THE BUDGET?

A. Yes. Employees in Business Systems with budget responsibility have budgetary goals that are incorporated into their performance objectives. Performance is measured on a monthly basis to ensure adherence to the goals and provide for an action plan to address any variances.

Q. DOES BUSINESS SYSTEMS ALSO ENCOUNTER TIMES WHEN IT MUST CHANGE PROJECT PLANS?

A. Yes. For some projects, the complex nature of the project implementation and long lead times mean we must plan for the project and carry it out over a long period of time. In these situations, we typically know what the project will be but may need to adjust project cost expectations, timelines, or scope as the details of the project become more certain over time.

Other projects may have shorter lead times, a lower priority, or other reason why they are important but could be delayed if a higher priority comes to light. However, we remain obligated to manage to our budget and use the IT Governance process to re-prioritize projects within a year to stay within our overall budget.

Q. DO CHANGES IN PROJECT METRICS PRIOR TO IN-SERVICE REQUIRE APPROVAL FROM THE IT GOVERNANCE PROCESS?

A. Yes. Any change to the budget, schedule, or scope of a project must be approved by the IT Governance process to ensure that the change is necessary and well-documented and brought forward to the Technology Investment Council.

We must seek approvals in addition to the IT Governance process, including possibly Corporate Governance approval, if costs of larger projects exceed certain pre-approved levels.

Q. PLEASE EXPLAIN THE PROCESS TO ACCOMMODATE NECESSARY UNFORESEEN CAPITAL INVESTMENTS THAT OCCUR DURING THE PLANNED CAPITAL INVESTMENT YEAR.

A. We utilize the portfolio prioritization and balancing process to evaluate new demand or changes to existing project budgets and determine the most appropriate course of action to take. Newly identified projects must still proceed through the Gates process and any may push other projects further down the priority list. In other situations, we may be able to accommodate a new project or expanded project scope or cost by approving an appropriate distribution of funds from the Emergent Demand account.

Q. WHAT IS THE EMERGENT DEMAND ACCOUNT?

A. The Emergent Demand account is a capital investment account created to ensure we are able to meet the unanticipated aging technology, cyber security threats, and efficiency needs that inevitably emerge in each year. Given the ever-changing nature of technology and emerging risks, it is not possible to identify all projects that may arise or become critical in a given year. For example, it is not always possible to predict what kind of security risk might be created by hackers as technology continues to develop. In other situations, as we develop a project with a particular scope we may determine that additional benefits or long-term cost savings could be captured by expanding the scope of the project. The Emergent Demand account allows the Company to address such issues without necessarily delaying or cancelling previously-planned projects or otherwise absorbing unplanned work and costs.

4. Capital Cost Controls

Q. IN ADDITION TO THE IT GOVERNANCE PROCESS, DOES BUSINESS SYSTEMS UNDERTAKE OTHER ONGOING STEPS TO CONTROL ITS COSTS?

A. Yes. Business Systems is continually taking steps to control costs. These efforts may include: increasing or decreasing the scope of outsourced services, increasing or decreasing the use of consultants, and changing service providers. We also use competitive bidding practices and a multi-vendor sourcing strategy where possible, which enables the Company to utilize a combination of internal and external resources to minimize costs and maximize efficiencies in running our systems.

In addition, Business Systems actively interacts with other IT organizations to learn how they control costs. For instance, I am the chair of the Edison Electric Institute/American Gas Association Technical Advisory Council (TAC). The TAC is a group of utility CIOs that meet to discuss IT issues, including how to manage costs. Through our participation in such groups, we are able to monitor and implement industry best practices for managing technical projects and controlling costs.

Q. CAN YOU PROVIDE MORE INFORMATION ABOUT THE COMPANY'S COMPETITIVE BIDDING PRACTICES?

A. Yes. I note that wherever possible for the Company's key capital projects, the project team used, or will use, a competitive bid process to ensure that: (1) costs remain in-line with the approved budget; (2) Xcel Energy receives quality service at a fair price; and (3) business value is delivered per the agreed requirements. In addition, the project costs and schedules for these projects were based on internal experience with similar implementations and, in most

cases, coupled with input from third-party consultants who we commissioned to ensure that the projects will deliver functionality that supports organizational objectives.

Generally, the only times a competitive bid process cannot be used are (1) during upgrades to software or hardware components already provided by a vendor, in which engaging other providers would require a complete system overhaul; or (2) the limited times when multiple vendors are not available to undertake the necessary work or provide the necessary technology.

Q. CAN YOU IDENTIFY OTHER SPECIFIC COST CONTROL MEASURES THE COMPANY HAS UNDERTAKEN TO MANAGE COSTS IN RECENT YEARS?

A. Yes. In our last rate case, we discussed efforts to renegotiate contracts with key vendors and our effort to use a multi-vendor sourcing strategy to maintain competition between them for our business. Those benefits are ongoing. One new example is our increased use of fixed bid versus time and materials agreements with vendors for project delivery activities. This improvement places a shared burden on the service providers to ensure costs remain within the expected totals.

Q. CAN YOU EXPLAIN IN MORE DETAIL WHY A MULTI-VENDOR SOURCING STRATEGY IS BENEFICIAL?

A. Yes. Business Systems relies on approximately 133 different vendors for 99 percent of the capital investments and O&M support, with our top ten vendors comprising 61 percent of our total costs in 2018. By utilizing multiple vendors, we require these vendors to compete against each other for our business and create an incentive to keep the price of their services

competitive. Also, having multiple vendors available minimizes the risks associated with relying solely on one vendor. Overall, we are constantly managing spend, ensuring alliance with our budget, and looking for opportunities to control or reduce costs.

5. Cost Allocation to the Company

Q. HOW DO CAPITAL PROJECTS EXECUTED BY BUSINESS SYSTEMS AFFECT THE MINNESOTA JURISDICTION?

A. Many of the Business Systems projects are planned and budgeted at the Xcel Energy Services or operating company level, and implemented throughout our system. Most projects benefit multiple jurisdictions – as when we implement new software throughout Xcel Energy – and therefore must be allocated or assigned to the appropriate operating companies.

In instances where a project is more fully-dedicated to the Minnesota jurisdiction, a greater portion of the project costs may be assigned to Minnesota. In some cases where projects are dedicated wholly to Minnesota, as with the land mobile radios we purchased specifically for our nuclear plants discussed in our prior rate case, those costs may be directly assigned to Minnesota. Overall, Xcel Energy cost allocations are discussed by Company witness Ms. Melissa Schmidt.

Q. IS THE OVERALL LEVEL OF BUSINESS SYSTEMS CAPITAL ADDITIONS REASONABLE?

A. Yes. In each year, Business Systems capital additions are necessary to maintain stability and reliability of the IT systems used by employees to serve Minnesota customers, efficiently manage business operations, protect

company data and information, and meet evolving regulatory and legal requirements. Overall, they support important investment strategies that focus on the key IT needs of the Company and our customers while balancing the need for overall cost containment and prioritization.

6. Major Capital Projects

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?

A. This section of my testimony discusses the major planned investments Business Systems anticipates for 2020 through 2022. While the AGIS initiative encompasses a series of major capital projects, that complex suite of grid advancement tools is discussed in a separate section of my testimony due to its integrated nature and the series of compliance requirements specific to our grid modernization efforts.

Q. HOW DID BUSINESS SYSTEMS IDENTIFY ITS MAJOR PLANNED INVESTMENTS OVER THE PLAN PERIOD?

A. To identify these investments, we looked for unique projects that will require a greater than normal quantity of Business Systems resources to complete.

Q. WHAT MAJOR CAPITAL PROJECTS DOES BUSINESS SYSTEMS ANTICIPATE COMPLETING OVER THE PERIOD OF THE COMPANY'S MYRP REQUEST?

A. As depicted below in Table 7, we anticipate undertaking six major capital projects from 2020 through 2022, excluding the AGIS initiative that is discussed later in my testimony. These capital additions include:

Table 7: 2020-2022 Major Capital Projects
($ in millions)

Project	2020	2021	2022
Core HR Application (Payroll Benefits)	0.0	0.0	28.6
Security Technology Refresh	5.3	11.6	8.3
DEMS Upgrade Dynamic EMS (DEMS) Environment Phase 4	15.8	0.0	0.0
Customer Service Console - Single Screen	1.0	9.5	0.0
Software Defined Data Center Refresh 2021	0.0	8.4	0.0
NSPM Total	**22.1**	**29.6**	**36.9**

Some of these projects, including the Customer Service Console Investments and Security Technology Refresh, will continue over multiple years, with portions of the project placed in service as they are put to use each year. The major capital projects we expect to complete during the plan period, as well as the additional key projects we anticipate completing in 2020, 2021, and 2022, are discussed in more detail under each plan year, below.

C. 2020 Capital Additions

Q. WHAT CAPITAL ADDITIONS IS BUSINESS SYSTEMS PROPOSING TO MAKE IN 2020?

A. The total NSPM Business Systems 2020 capital additions are budgeted to be approximately $79.7 million. This capital addition budget includes the capital budget groupings, listed below in Table 8, that align with the key investment needs described earlier in my testimony, plus the "Emergent Demand" category that exists to support project changes in the other capital budget groupings. I will walk through the major projects for 2020 in each grouping in this section of my testimony, speaking to capital additions. All dollars are

stated in millions.

Table 8: 2020 Total Capital Additions

2020 Capital Additions	2020 Total
Aging Technology	42.2
Cyber Security	6.0
Enhance Capabilities	6.9
Customer	15.6
Emergent Demand	9.1
NSPM Total	79.7

1. Aging Technology

Q. ARE ANY CAPITAL PROJECTS TO REPLACE AGING TECHNOLOGY INCLUDED IN THE 2020 TEST YEAR?

A. Yes. We anticipate that investments in aging technology for 2020 will total $42.2 million, as depicted below in Table 9.

Table 9: 2020 Aging Technology Capital Additions

2020 Aging Technology IT Investments	2020 Total
DEMS Upgrade (Dynamic EMS Environment)	15.8
Annual Refresh	7.3
Network Infrastructure Investments	8.2
Aging Technology (16 small projects)	10.9
NSPM Total	42.2

a. DEMS Upgrade (Dynamic EMS Environment)

Q. PLEASE DESCRIBE THIS PROJECT.

A. DEMS is the Company's critical system for supporting transmission Supervisory Control and Data Acquisition (SCADA) the Generation, Generation Dispatch, Market Participation and Reliability Coordination. The NSPM phase of this project is part of a five-year effort to replace the Energy Management System (EMS), a critical technology that is used for the monitoring and management of the bulk electric system by our transmission system. The EMS interfaces with field devices that collect information about the health of the bulk electric system. This real-time, two-way communication provides Transmission and Distribution Operations the ability to remotely control the flow of electricity during outage and maintenance periods, which is a key driver of our ability to maintain efficient and reliable service to our customers.

The DEMS project is primarily driven by a contractual agreement with General Electric (GE) to upgrade DEMS to a newer version within six years of the executed contract. Without an upgrade, the Company's DEMS system will not evolve with the GE product, which may impact the Company's ability to get vendor support for any software system issues. Additionally, there is a known risk of hardware failure due to equipment and overall infrastructure being at the end of its life. The upgrade will also provide enhanced capability regarding the Transmission Security Model (TSM) to help reduce risk if/when field communications fail. The upgrade also provides an improved security posture and will employ the Company's new Operation Technology (OT) network and infrastructure.

Q. HOW DOES DEMS INTERACT WITH THE AGIS INITIATIVE COMPONENTS, DESCRIBED LATER IN TESTIMONY?

A. The DEMS system is used to manage the resources inside the substation fence – the Transmission SCADA. DEMS interfaces to ADMS via Inter Control-Center Communication Protocol (ICCP) and is tightly coupled for this control. ADMS manages resources outside of the substation fence for distribution (such as relays and capacitors).

b. Annual Refresh Projects

Q. PLEASE DESCRIBE "ANNUAL REFRESH" PROJECTS.

A. Like any asset, our technology infrastructure must be refreshed. We refresh smaller components on regular cycles and annually budget for these replacements as routine projects, as they are critical to our everyday functions. These projects include replacing aging equipment (like individual computers) based on a pre-determined rolling life-cycle, annual updates to software and hardware to meet demand growth, and replacement of equipment that fails or is unable to meet our needs. A summary of the refreshes we plan to undertake is set forth in Table 10 below.

Table 10

2020 Annual Refresh Capital Additions	**2020 Total**
Annual Network Refresh	1.9
Annual PC Refresh	2.7
Annual Storage Refresh	1.7
Annual Server Refresh	1.0
NSPM Total	7.3

Q. CAN YOU DESCRIBE THE DIFFERENT TYPES OF TECHNOLOGY THAT ARE COVERED BY EACH OF THESE REFRESH WORK ORDERS IN TABLE 10 ABOVE?

A. Yes. These refreshes cover:

- *Annual Network Refresh:* Planned replacement of network devices (switches, routers, radios, channel banks and voice systems) due to aging technology, out-of-support equipment, security vulnerabilities, and to enable new required capabilities.
- *Annual PC Refresh:* Planned replacement of aging desktop and laptop computers, as well as those that are lost or inoperable.
- *Annual Data Storage Refresh:* Replaces data storage hardware that is no longer cost-effective to support, or that presents significant risk to operations due to aging components or lack of vendor support.
- *Annual Server Refresh:* Planned replacement of aging servers.

Q. CAN YOU PROVIDE AN EXAMPLE OF HOW A REFRESH PROJECT WORKS?

A. Yes. An example of this type of project is our Annual Planned PC Refresh project. We use a "rolling PC Lifecycle refresh" approach, which replaces approximately 25 percent of the desktop computers annually based on the four-year average lifespan of a desktop computer. This lifecycle program was established in 2007 to ensure that the personal computers maintain their functionality and are compatible with existing software and other systems.

Within our Annual PC Refresh list, we also know that Annual Unplanned PC Refreshes will be needed. Unplanned refreshes cover PCs that must be replaced outside the pre-determined rolling life-cycle refresh. These are devices that may fail prematurely. It also covers new business demand, such as increases in computer user headcount. The project budget is based on

historical trends and forecast demand growth.

Q. HOW DOES BUSINESS SYSTEMS DEVELOP ITS BUDGETS FOR REFRESH PROJECTS?

A. While the budget methodology varies depending on the nature of the assets to be refreshed, generally a refresh budget is determined by one or more of the following factors:

- The number of devices or systems that will reach end of life during the budget period. This is typically based on an established lifecycle plan. For example, PCs, mobile data terminals, and portable meter reading devices have a four-year life. Thus approximately 25 percent of them are replaced in an average year.
- The number of devices expected to permanently fail outside warranty, and in the case of portable devices, the number expected to be damaged, lost, or broken. This is based on historical trends.
- Planned incremental growth in demand (e.g., data storage, network bandwidth, number of computer users, new physical sites, etc.). This is based on Company and industry trends and known business plans.
- The devices or systems that must be replaced to meet new security, software compatibility, or business requirements.
- The devices or systems for which vendor support will cease or become prohibitively expensive.

c. Network Infrastructure Investments

Q. PLEASE DESCRIBE THIS PROJECT.

A. This project includes the detail design, planning, installation and commissioning of equipment that comprises an expansion and privatization of

the company's corporate Wide Area Network (WAN) across our service territories. The Wide Area Network work includes network infrastructure investments to support connection between the Company's various locations together and providing the pathway to enable critical business services. Investments support communication services for our business and substations, including the SCADA connectivity for monitoring and control of the grid. In addition, enterprise services are delivered to enable end users to connect to corporate applications like email, SAP (the General Ledger and Work and Asset Management systems), and internet access. For 2020-2022, the project focus is to support the NextGen Windows 10 upgrade, Analog circuit replacement (retirement of copper circuits), new substations, and new wide area network which supports virtual hosting and windfarms. This is a multi-year project, with various components placed in service as assets are deployed.

2. Cyber Security

Q. ARE ANY CAPITAL PROJECTS TO ADDRESS EVOLVING CYBER SECURITY THREATS AND REQUIREMENTS INCLUDED IN THE 2020 TEST YEAR?

A. Yes. We anticipate that investments in cyber security for 2020 will total $6 million. I address the Security Technology Refresh project that comprises the majority of the 2020 cyber security capital additions below.

Q. PLEASE DESCRIBE THE SECURITY TECHNOLOGY REFRESH PROJECT.

A. Security Technology Refresh investments provide prevention, detection, containment, and corrective services to protect the company from security incidents, and assist in the recovery from any adverse events. It is imperative to refresh our technology to ensure continued compliance with regulatory

requirements for customer data and overall corporate security objectives, while reducing our business's and our customers' exposure to evolving cyber security risks and vulnerabilities.

Examples of 2019 projects include the Multi-Factor Authentication (MFA) Project which addresses evolving threats related to password theft as hackers employ increasingly complex methods to get employees usernames and passwords. MFA mitigates this risk by requiring different authentication means in addition to simple user names and passwords. Another example is the Security Services Upgrade which is a project to improve the monitoring system for the Security Operations Center (SOC), as well as alerts to intrusions across enterprise technology. The software is the access control system for Xcel Energy and NSPM, supporting all card readers. This system needs to be upgraded to ensure compatibility with operating systems and technology.

Cyber security investments support the availability, integrity, and confidentiality of our information systems, and help ensure that we meet our legal and regulatory obligations and risk management objectives.
Continually evolving cyber security threats and associated regulatory structure require ongoing investment into annual security technology refreshes.

3. Enhancing Capabilities

Q. ARE ANY CAPITAL PROJECTS TO ENHANCE COMPANY CAPABILITIES INCLUDED IN THE 2020 TEST YEAR?

A. Yes. As depicted in Table 11 below, we anticipate that investments planned to enhance capabilities for 2020 will total $6.9 million. None of the individual

projects are more than $2 million.

Table 11

2020 Enhance Capabilities Investments	**2020 Total**
Enhance Capabilities Other (9 Projects)	6.9
NSPM Total	**6.9**

Q. WHAT ADDITIONAL INVESTMENTS IS THE COMPANY MAKING TO FURTHER ENHANCE CAPABILITIES IN 2020?

A. The Company is making technology investments to provide enhanced capabilities across many areas in 2020, albeit without any one particularly large project. For example, enhanced network systems to support new wind farms, mobile engineer support, and customer experience enhancements are planned to ensure the ability of the company embrace renewable energy and meet customers where they are. Other examples include investments to improve asset management to make sure that the company continues to invest as efficiently as possible.

4. Customer Experience

Q. ARE ANY CAPITAL PROJECTS TO ENHANCE THE CUSTOMER EXPERIENCE INCLUDED IN THE 2020 TEST YEAR?

A. Yes. We anticipate that 2020 investments in the customer experience effort will total $15.6 million. The 2020 capital additions for these projects are set forth in Table 12 below:

Table 12

2020 Customer Experience Investments	2020 Total
Digital Channel Platforms	6.9
Customer Relationship Management	1.5
Platform Infrastructure and Technology Maintenance	1.7
Data Analytics and Automation	4.5
Other	1.0
NSPM Total	**15.6**

Each of these is a multi-year project with individual programs, as set forth in Exhibit___(DCH-1), Schedule 6. I describe each project and individual program in more detail below.

a. Digital Channel Platforms

Q. PLEASE DESCRIBE THIS PROJECT.

A. Through this project, we will build out, enhance, and redesign several components of our customers' digital interactions with the Company

This work includes enhancing and modernizing our online digital platforms, including MyAccount, our mobile application, and our customer facing website, www.xcelenergy.com. It also involves building out our New Customer Connections channel, enhancing our Contact Center, and utilizing "Single Screen" technology.

Q. CAN YOU DESCRIBE THE MYACCOUNT, XCELENERGY.COM, AND MOBILE APPLICATION WORK IN MORE DETAIL?

A. Yes. This work will provide a new digital presence for our customer channels, improving optionality, providing more user-friendly interfaces, and offering more capabilities for customer data management. As part of the xcelenergy.com, mobile app, and MyAccount re-design and re-platform, we will conduct a content, user experience, and visual design heuristic assessment to identify pain points for the customer and optimize the experience for each individual. In addition to the functions the customers have today, the re-design will allow them to request additional services, see status of any requests, and make appointments for any service issues. The MyAccount re-platform will allow for customers to set up their preferences, pay their bills or set up automatic payment options, and receive information on their energy usage. Our goal is to share the same usage information a call center representative would see with our customers, to increase customers' options and to allow them to interact with Xcel Energy in the manner they choose.

Q. PLEASE DESCRIBE THE NEW CUSTOMER CONNECTION WORK.

A. Today, the New Customer Connection (NCC) applies to trade partners and Company customers who are building new construction and need to engage with the utility for net-new electric and gas services. An online form can be utilized, but will then need to be re-entered to begin the ordering process, with no ability to view the status on any automated channels.

We will be building out our Customer Connect channel, which will provide a better experience for builders, developers, and other larger Commercial & Industrial customers who engage with Xcel Energy to request new, resumed,

or stopped service. Specifically, we will revamp the customer interface to provide better information to customers about the phase or status of their line extension process, improve the builders' call line, and improve the process for communicating with parties engaged in that process.

These improvements will allow the Company to better partner with developers, contractors and do-it-yourself homeowners as they manage their projects from start to completion. They will be able to receive and give updates on their projects in real time, giving them control and transparency to better plan their business needs. Through account preferences, timely and accurate notifications about status, as well as a flexible appointment capability, these enhancements will provide Company employees, trade partners and homeowners with a more seamless and collaborative experience.

Q. PLEASE PROVIDE MORE INFORMATION ABOUT THE CONTACT CENTER WORK.

A. This program involves redesigning our Contact Center for customers. Specifically, natural language processing will be inputted into the contact center to field inbound calls and reroute the caller to the proper call agent. This will assist the customer to get to a subject matter expert regarding their issue and resolve the issue more quickly. This improvement will also reduce the number of times it is necessary for a customer service agent to reroute calls. Finally, this work will streamline the visibility of customer information to call center specialists, enabling them to respond to customer questions more immediately with necessary information at hand.

Q. PLEASE PROVIDE MORE INFORMATION ABOUT THE SINGLE SCREEN PROGRAM.

A. Currently, Company call center agents utilize numerous screens when communicating with customers on the phone. Combining numerous screens into one screen that contains all the information needed for our agents will simplify the experience for our employees and benefit customers who will receive the information they need more quickly and efficiently. The "Single Screen" work will also be integrated with Artificial Intelligence capabilities to help decipher what the inbound call is most likely about, and help identify the most immediate fix to the issue. In addition, the single screen will show the agent the current bill, history of payments, and payment plan options that are tailored specifically to the caller. Finally, this screen will suggest support offerings for the customer's home that can help save money or simplify their energy experience.

b. Customer Relationship Management (CRM) Platform

Q. PLEASE DESCRIBE THIS PROJECT.

A. This project involves building out our existing Salesforce CRM tool to better understand and serve our customers. The redesigned platform will enable us to track the different relationships with our customers, whether that is commercial, residential, industrial or on a different basis. It will allow for real-time business updates to mobile applications, automated updates to the customer mobile application without requiring customers to manually update the application itself, and updates to MyAccount with minimal development support, all supporting improved customer and employee experiences.

Better CRM management will enable us to both identify previous searches and efforts taken by Company employees on behalf of the customer, and support

a 360 degree view of existing customer location(s), energy applications, and preferences, much of which will be available to the employee efficiently through the Single Screen program. It will also provide insight into customer billing patterns to allow us to serve customers better, by counseling and advising them on conservation options, management tools, and other service options.

Q. IS THE COMPANY CONTINUING TO USE SALESFORCE FOR ITS CRM PLATFORM?

A. Yes. We went through a platform selection process to select Salesforce, as set forth in Trade Secret Exhibit___(DCH-1), Schedule 7. We evaluated several solutions with similar capabilities, and noting improvements to the platform, ultimately chose to remain with Salesforce because it is our existing platform and therefore offers efficiencies in integration, time to market, and planning that would not be available by starting with a new solution altogether.

This is a multi-year project that was initiated in 2019, with the new system being placed in service primarily in 2021, followed by some post-implementation work expected in 2022.

c. Platform Infrastructure and Technology Maintenance

Q. PLEASE DESCRIBE THIS PROJECT.

A. As noted earlier in my testimony, Xcel Energy's technological architecture has become increasingly intertwined, with core systems running at maximum capacity to support the need for emerging capabilities. To relieve the pressure from these critical core systems, new data layers will be added to aggregate key information and manage extra capabilities, while providing flexibility and added capacity. To accomplish this, we will develop an Automatic Program

Interface (API), which is a set of routines, protocols, and tools for building software applications to ensure our software components can "talk" to each other. The API platform will personalize and save preferences for our employees and customers. The platform infrastructure also includes our operations model connectivity and security, and our data architecture and governance.

This work will allow the legacy applications to function in the manner they were designed, eliminating significant current customization that is very costly to maintain. When correlated to the CRM and other platforms, based on the customer data the home screen will be directly tied to the customer's needs from Xcel Energy. For a green user (a customer wanting to have renewable sources available), their screen may highlight the ability to pay slightly more for renewable energy. Or a cost-conscious consumer may highlight the ability to lower their bills based on energy consumption data. The personalized experience will help customers easily and efficiently access the information they need.

d. Data Analytics and Automation

Q. PLEASE DESCRIBE THIS PROJECT.

A. This project develops the systems for data architecture and governance, analysis, metrics, and baselines for our customer platforms, as well as systems automation. The work will allow us to both automate processes that currently require manual intervention, such as eliminating manual removal of staging of code, as well as automating running of scripts and testing. Ultimately, with this work we will add a Customer Data Platform layer to the Company's technological architecture, which will act as a central repository of data from

the Company's core systems and third party vendors. It will also provide expedited consumption of data by other systems and eliminate more legacy point-to-point interfaces. For the customers, the data layer will be where the Company can store data in one location to use on all channels. The data will be accessible from all channels to eliminate the need for redundant input.

Additionally, we are investing in analytics to help understand customer personas, preferences, and previous issues of our customers. This will help our call center agents assist incoming calls in an expedited fashion with all the information they need, as previously noted with respect to our digital interfaces. Artificial Intelligence (AI) and Natural Language Understanding (NLU) will be used in conjunction with each other, and with data in the CRM, to simplify the customer call experience and reroute the caller to the correct department. This will also help gather all the required information, so that the right solution for the customer will be more easily recognizable to the Company employee.

5. Emergent Demand

Q. DOES BUSINESS SYSTEMS HAVE CAPITAL COSTS THAT SPREAD ACROSS ALL KEY AREAS?

A. Yes. Given the ever-changing nature of technology and emerging cyber security risks, it is not possible to identify all projects that may be needed in a given year. To ensure that we are able to meet our overall objectives, a number of years ago we created the Emergent Demand account as an efficient way to fund important and unexpected projects.

Q. HOW DOES THE EMERGENT DEMAND ACCOUNT HELP ENSURE THAT BUSINESS SYSTEMS MEETS ITS KEY OBJECTIVES?

A. The Emergent Demand account provides Business Systems with the ability to assess and address, as appropriate, emerging technology needs as they arise.

For instance, we may identify a risk associated with existing technology that needs to be addressed earlier than initially planned. In other instances, we might begin implementing new software and then learn of a new function that is cost-effective to adopt at the same time the project is implemented.

Whether the funding requirement is from a scope change to an existing project, or to address a new risk or a new identified need, the Emergent Demand account allows us to effectively ensure adequate funding for projects that cannot always be predicted in our fast-changing environment.

Q. IS THIS HOW BUSINESS SYSTEMS HAS ALWAYS MANAGED EMERGENT NEEDS OF THE ORGANIZATION?

A. No. Because our project budgets typically do not contain contingencies, prior to creation of the Emergent Demand account in 2013 we had to delay or cancel previously-planned projects or absorb unplanned work and costs when a new technology or critical need was identified. These changes would often disrupt the parts of the business relying on our original plan, and would impact other long-term plans that affect the Company, our customers, or both.

Q. WHAT PROCESS WAS USED TO ESTABLISH THE TEST YEAR EMERGENT DEMAND ACCOUNT BUDGET?

A. Beginning with the timeframe of our last Minnesota rate case, to develop the Emergent Demand budget, we reviewed our experience with the Emergent Demand account and tailored the budget for future years to forecasted spending levels. As indicated in Table 1 above, the 2016-2018 Emergent Demand accounts were completely distributed to other projects. The 2020-2022 budget level was established by reviewing the capital plan then creating an Emergent Demand funding level for each budget year based on business priorities, balanced by the overall business area capital spending guidelines. Using this forward-looking approach, we felt we could reduce the dollars in the Emergent Demand account and thereby direct a greater percentage to specific projects. We continue to refine the Emergent Demand budget with each new budgeting cycle, removing dollars from this capital budget grouping and assigning them to projects that have become more definite in scope and planning.

Q. ARE THERE ADDITIONAL BENEFITS TO BUDGETING FOR AN EMERGENT DEMAND ACCOUNT?

A. Yes. In addition to the needs and benefits I previously discussed, an Emergent Demand Account allows us to more comprehensively vet requested changes in individual project scope than would be practical with a project-specific contingency arrangement. In addition, including a contingency within every project budget for unforeseen circumstances assumes that every project will need a contingency amount. Rather than estimating an overall contingency to handle both project-specific and broader emergent issues that face the organization, we use the Emergent Demand Account to distribute

funding solely to those projects that require emergent funding.

Q. ARE THERE TIMES WHEN A CONTINGENCY IS NEEDED DESPITE THE EMERGENT DEMAND ACCOUNT?

A. Yes, but only on a limited exception basis. As I discuss in more detail below, for example, we determined that it was appropriate to add a contingency to the AGIS project. This is due to the size, scope, schedule, and complexity involved in replacing and remediating the older systems. We also included a contingency in the DEMS project to account for the size of the total project, the total annual budgets, identified risks, and understood scope and requirements.

Q. IS THE BUSINESS SYSTEMS BUDGET HIGHER THAN PREVIOUS YEARS BECAUSE OF THE EMERGENT DEMAND ACCOUNT?

A. No. As I discussed above, Business Systems previously funded emergent issues by reallocating dollars from existing, planned projects. With the establishment of the Emergent Demand account, we approximated the level of funding for it by assessing our project plans and then only including projects in our plan that would maintain our approved level of spending. As a result, Business Systems has fewer projects than it might have otherwise to enable the funding of the Emergent Demand Account.

Q. HOW ARE REQUESTS FOR FUNDING FROM THE EMERGENT DEMAND ACCOUNT HANDLED?

A. Any request for funds from the Emergent Demand Account must be approved by the Technical Investment Committee. The Technical Investment Committee closely scrutinizes each request to determine whether it is

reasonable and necessary as previously described for other Business Systems projects. The Emergent Demand Account therefore provides another layer of governance for existing projects, because they must receive an additional round of approval before being allocated funds from the Emergent Demand Account.

D. 2021 Capital Additions

Q. WHAT CAPITAL ADDITIONS IS BUSINESS SYSTEMS PROPOSING TO MAKE IN 2021?

A. The total NSPM Business Systems 2021 capital additions are budgeted to be approximately $105.2 million. This capital additions budget includes a number of projects that are categorized in Table 13 below according to the capital budget groupings described earlier in my testimony.

Table 13: 2021 IT Capital Additions

2021 Capital Additions	2021 Total
Aging Technology	53.3
Cyber Security	11.8
Enhance Capabilities	2.0
Customer	23.1
Emergent Demand	15.0
NSPM Total	105.2

1. Aging Technology

Q. ARE ANY CAPITAL PROJECTS TO REPLACE AGING TECHNOLOGY INCLUDED IN THE 2021 PLAN YEAR?

A. Yes. We anticipate that $53.3 million will be spent to replace aging technology assets in 2021 as shown in Table 14 below.

Table 14: 2021 Capital Aging Technology IT Investments

2021 Aging Technology IT Investments	2021 Total
Software Defined Data Center Refresh 2021	8.4
MT Security Computer System Upgrade	3.3
Facility IT Investments Placeholder	2.8
Planned Converged Refresh	2.5
DRMS Phase II (Demand Response Management System)	2.3
Annual Refresh	6.2
Network Infrastructure Investments	15.8
Aging Technology small (17 projects)	11.9
NSPM Total	53.3

There are five significant individual projects beginning in 2021, which are Software Defined Data Center Refresh 2021, Monticello Security Computer System Upgrade, IT Investments for Facilities, Planned Converged Refresh, and DRMS Phase II (Demand Response Management System) Phase II. I discuss these five projects in more detail below.

Additionally, there is one significant 2021 project that I described earlier that is continuing from 2020. This project is the Network Infrastructure Investments. As previously noted, this project is being placed in service as

assets are deployed and are being used to perform their intended function. In addition, refreshes are ongoing as illustrated in Table 14 above, which are discussed in greater detail below.

a. Software Defined Data Center Refresh 2021

Q. PLEASE DESCRIBE THIS PROJECT.

A. The Software Defined Data Center Refresh project is an undertaking an update to the data centers located in Minneapolis, Minnesota, Amarillo, Texas, and Golden, Colorado. The software is currently at the end of its life and is supporting approximately 120 critical applications including customer facing applications and SAP, as well as many other non-critical applications. This project will bring the technology to be current and ensure coverage under maintenance agreements, and refresh both storage and server hardware. This project also refreshes the software that operates the data center.

b. Monticello Security Computer System Upgrade

Q. PLEASE DESCRIBE THIS PROJECT.

A. The Security Computer System (SCS) is the heart of physical security for the existing nuclear facility located in Monticello. It performs many of the security functions for the facility including door locking/control, hand-geometry verification, alarming to Security officers, video call-ups for alarms, etc. The existing SCS was installed in 2014. To continue to maintain the system and remain in compliance with Regulatory Cyber Security requirements as set forth in 10 C.F.R. § 73.54, the system must be upgraded with supported hardware (Servers, Workstations, Network Switches, etc.) and software (Windows Operating System, ARINC's Advanced Information Management software, etc.)

The upgrade includes the hardware and software components to the latest hardware platform and software version supported and tested by the vendor. The life span for these systems is approximately 7-8 years based on hardware/software lifecycles. If the hardware and software components are end-of-life or unsupported, then the site will be unable to maintain the system to meet cyber security compliance and actual risk of a cyber security and/or physical security events.

The SCS is a Direct Impact Critical Digital Asset (CDA), meaning it has a direct impact on the physical security of the facility. Direct Impact CDAs require all cyber security controls to be met which will no longer be practical with unsupported software or hardware. Not being in compliance with our Cyber Security Plan puts the Company at risk for actual security vulnerabilities as well as potential Nuclear Regulatory Commission (NRC) violations approved by the Cyber Security Plan is NRC per 10 C.F.R. 73.54 regulation. Additionally, as the hardware and software is no longer supported the likelihood of failures and potential recovery time increases. Anytime the system is in operation, it requires significant security compensatory measures and additional man-hours along with the actual increased security risk.

c. IT Investments for Facilities Upgrades

Q. PLEASE DESCRIBE THIS PROJECT.

A. New service centers or offices are built as needed to support growing or expanding communities. These investments represent the necessary IT network infrastructure needed to connect these sites, and based on the total facilities investments in our facilities plans. This includes the construction of Main Distribution Frames (MDF), Intermediate Distribution Frames (IDF),

cabling to connect workstations and phones, deployment of wireless access points, and the installation of any routers, switches and/or firewalls to secure the site. Individual service centers may require varying amounts of work. Examples of typical projects include moving IDF, MDF, switches, and/or routers.

d. Planned Converged Refresh

Q. PLEASE DESCRIBE THIS PROJECT.

A. The purpose of this project is to handle growth in the environment and increasing requirements to store business data. The current plan is to migrate away from Direct-Attached Storage (DAS) and Network-Attached Storage (NAS) to Storage Area Network (SAN), which is more equipped to handle growth and disaster recovery scenarios because the storage solution (SAN) has the ability to scale to multiple data centers. In turn, this provides business continuity and disaster recovery through backup redundancy and separation of physical location. SAN is more advanced technology, shares a dedicated high-speed network that pools storage devices with multiple servers, which is not an existing capability under the existing solution.

e. Demand Response Management System (DRMS) Phase II

Q. PLEASE DESCRIBE THIS PROJECT.

A. This project will complete the installation of DRMS to address the Company's existing compliance and financial risks from MISO for not delivering MW performance. In addition, this project will position the Company to grow demand response in the future to increase customer choice and align with changing independent system operator (ISO) requirements by providing consolidated capability to manage projects, accrue customer enrollments, and

manage and dispatch resources. Specifically, this project replaces old and retiring systems, including the Yukon and Varolii applications, which put the Company at severe compliance and financial risk due to increase potential for system failure.

f. Annual Refresh Projects

Q. DO YOU ALSO ANTICIPATE UNDERTAKING REFRESHES IN 2021?

A. Yes. As discussed above, we must refresh certain hardware devices on a regular basis to address end-of-life issues, maintain reasonably current technology, and replace systems that fail or break unexpectedly. Our 2021 budget for Annual Refreshes is set forth in Table 15 below:

Table 15

2021 Annual Refresh Capital Additions	2021 Total
Annual Network Refresh	1.0
Annual PC Refresh	2.8
MDT Annual Refresh	2.4
NSPM Total	6.2

Q. WHAT IS THE MDT REFRESH?

A. Field workers employ the use of mobile data terminals (MDTs), which need to be refreshed fairly regularly due aging, lost or damaged MDTs used by field workers. Technology in the field may involve a mixture of tablets and cell phones and not involve a standard MDT for employees. This forecast is based on existing MDT technology.

MDT refresh is normally an annual project, but we have not been updating MDTs annually in our effort to maximize value from these devices while planning a strategy to consider other communication options that are available with new technology. However, we will not be able to avoid MDT refreshes indefinitely, and therefore have included dollars in our 2021 budget to ensure adequate support for MDTs.

g. Network Infrastructure Investments

Q. PLEASE DESCRIBE THIS PROJECT.

A. This project continues the detail design, planning, installation and commissioning of equipment that comprises an expansion and privatization of the company's corporate Wide Area Network (WAN) across our service territories, as discussed earlier in my testimony. The portion of this ongoing project that will be in service in 2021 includes deploying routers, switches, firewalls and wireless infrastructure. It also includes services for the design and implementation of these systems.

This is a multi-year project, with various components placed in service as assets are deployed.

2. Cyber Security

Q. ARE ANY CAPITAL PROJECTS TO ADDRESS EVOLVING CYBER SECURITY THREATS AND REQUIREMENTS INCLUDED IN THE 2021 PLAN YEAR?

A. Yes. Our in-service cyber security investments for 2021 are expected to total $11.8 million. However, there is only one significant individual project for 2021, which is the Security Technology Refresh project that is continuing from 2020 and which I described earlier in my testimony. As noted previously,

this project is being placed in service as the individual pieces of technology are refreshed.

3. Enhancing Capabilities

Q. ARE ANY CAPITAL PROJECTS TO ENHANCE COMPANY CAPABILITIES INCLUDED IN THE 2021 PLAN YEAR?

A. Yes. Our investments to enhance capabilities and be placed in service in 2021 are expected to total $2.0 million as depicted below in Table 16.

Table 16

2021 Enhance Capabilities IT Investments	2021 Total
Enhance Capabilities Small (3 projects)	2.0
NSPM Total	2.0

4. Customer Experience

Q. ARE ANY CAPITAL PROJECTS TO ENHANCE THE CUSTOMER EXPERIENCE INCLUDED IN THE 2021 PLAN YEAR?

A. Yes. We anticipate that 2021 investments in the customer experience effort will total $23.1 million. The 2021 capital additions for these projects are set forth in Table 17 below:

Table 17

2021 Customer Experience Investments	2021 Total
Digital Channel Platforms	5.7
Customer Relationship Management	11.0
Platform Infrastructure and Technology Maintenance	1.8
Data Analytics and Automation	4.7
NSPM Total	**23.1**

These capital additions reflect continuation of the Customer Experience projects identified for 2020, with the majority of the CRM project being placed in service in 2021. The detailed schedule of individual programs is set forth in Exhibit___(DCH-1), Schedule 6, and was discussed earlier in my Direct Testimony.

5. Emergent Demand Account

Q. DOES BUSINESS SYSTEMS INCLUDE AN EMERGENT DEMAND ACCOUNT IN ITS 2021 BUDGET, AS IT DID FOR 2020?

A. Yes, although the dollar amounts are not the same given the different IT needs of our Company in different years. At the time we developed our 2021 budget, the Emergent Demand Account included $15 million allocated to the Company based on business priorities for the year, balanced by the overall business area capital spending guidelines.

Q. WHAT ARE SOME RECENT EXAMPLES OF EMERGENT DEMAND PROJECTS?

A. Three recent examples in which Emergent Demand dollars were utilized to complete unanticipated work include:

- New NSP wind farms required network access, and those project costs were not in original Business Systems budgets;
- The Enterprise Service Bus was in need of additional licenses due to more usage than anticipated; and
- The Company implemented Blue Prism, which was pursued to provide automation and assist with the financial monthly close, and provide efficiencies and future cost avoidance among the finance teams.

Q. IS THE EMERGENT DEMAND BUDGET SIMILAR IN 2021 TO THE 2020 BUDGET?

A. The emergent demand category is slightly lower in 2021. This is due to the projects approved for this year and confidence in the budget making process.

E. 2022 Capital Additions

Q. WHAT CAPITAL ADDITIONS IS BUSINESS SYSTEMS PROPOSING TO MAKE IN 2022?

A. The total NSPM Business Systems 2022 capital additions are budgeted to be approximately $120.2 million. This capital additions budget includes a number of projects that are categorized below in Table 18 according to the capital budget groupings described earlier in my Testimony.

Table 18

2022 Capital Additions	2022 Total
Aging Technology	68.9
Cyber Security	9.0
Enhance Capabilities	17.5
Customer	12.1
Emergent Demand	12.8
NSPM Total	**120.2**

1. Aging Technology

Q. ARE ANY CAPITAL PROJECTS TO REPLACE AGING TECHNOLOGY INCLUDED IN THE 2022 PLAN YEAR?

A. Yes. We anticipate that investments in aging technology for 2022 will total $68.9 million, as depicted below in Table 19.

Table 19: 2022 Capital Aging Technology IT Investments

2022 Aging Technology IT Investments	2022 Total
Core HR Application (Payroll Benefits)	28.6
ITSM Modernization, Including CMDB	3.1
Planned Converged Refresh	2.3
Network Infrastructure Investments	10.8
Annual Refresh	7.0
NMS 2.X Upgrade Project	6.4
Aging Technology small (12 projects)	10.6
NSPM Total	**68.9**

Within the Aging Technology capital budget grouping, there are three significant individual projects beginning in 2022: Core HR Application (Payroll Benefits), NMS 2.X Upgrade Project, and ITSM Modernization - Including CMDB. Additionally, there are two significant individual projects for 2022 that are continuing from 2021 and which I described earlier in my testimony –the Planned Converged Refresh, and Network Infrastructure Investments projects. As noted previously, these projects are being placed in service as assets are deployed and are being utilized to perform their intended function. In addition, refreshes are ongoing as illustrated above in Table 19 and are discussed in greater detail below.

a. Core HR Application (Payroll Benefits)

Q. PLEASE DESCRIBE THIS PROJECT.

A. This project will replace the multiple existing core Human Resources (HR) software systems and vendors at Xcel Energy - PeopleSoft, TIME, myHR, Talent Management, Learning Management System, Workforce Planning, and Workforce Analytics – with a single, integrated software solution will be

determined during an RFP for the project. These applications comprise the core human resource system, provide payroll, benefits administration, and job record tracking to employees and retirees of the Company.

Q. WHY IS IT NECESSARY TO REPLACE THESE SYSTEMS AT THIS TIME?

A. From a technology perspective, we are running systems that are no longer supported by the vendors. The version of PeopleSoft we are on has not been updated since 2010 and is no longer supported by the vendor, creating risk from a technology and security perspective. Our TIME entry system runs on the mainframe, which is targeted to be retired in 2023-2024. The TIME application, PeopleSoft, and internal HR processes are tightly integrated and not replacing each of them within the same program will increase risk and costs to the initiative.

Q. ARE THERE ADDITIONAL REASONS FOR COMPLETING THIS PROJECT?

A. Yes. Xcel Energy is required to maintain compliance with federal, state, local, and industry regulations through reporting, audits, and process controls. Selection of an integrated HR solution will provide Xcel Energy with the ability to process and analyze integrated workforce information from a single source. This will optimize data-driven workforce decisions and better support workforce planning to meet company objectives.

The integration and modernization of HR systems will also enhance the employee experience through a single personalized interface; provide self-service capabilities that are accessible from a desktop, laptop or mobile device; optimize HR service delivery capabilities; increase and provide more efficient options (chat, chatbots, incident tracking, knowledge base, etc.) for employees

to obtain support; and provide capabilities to be more agile in aligning system functionality to evolving business processes. It will also allow us to gain efficiencies in onboarding employees by streamlining processes and eliminating paper forms, and optimize workforce decisions to better support workforce planning.

Q. WHAT IS THE BASIS FOR THE COST ESTIMATE FOR THIS PROJECT?

A. The primary work on the project will start in 2020 and run through 2022, when it will be placed in service. The project cost estimate is based on our work with third party HR consulting firm to assess various options from an information-gathering perspective, as well as internal cost estimates. We have utilized outside services to benchmark software applications and evaluate vendors. Finally, we are also conducting an RFP and vendor selection process scheduled to be complete in December 2019.

b. NMS 2.X Upgrade Project

Q. PLEASE DESCRIBE THIS PROJECT.

A. The Outage Management System (OMS) is the enterprise solution for the electric trouble distribution control centers outage event management. OMS is critical to outage restoration and generally critical to the Company's operations. Business Systems and Distribution Operations leadership has affirmed that the OMS, with its mission critical role, must be on a vendor supported application version. Oracle NMS version 1.12, which is the current version running at the Company, runs out of extended support in December, 2021. To ensure the OMS remains on a vendor supported version, a project effort is needed to upgrade NMS from application version 1.12 to NMS 2.x. This upgrade to a more recent version of NMS will be a technical upgrade and

will not include any customizations or extensive reconfigurations.

c. Information Technology Service Management (ITSM) Modernization - Including Configuration Management Database (CMDB)

Q. PLEASE DESCRIBE THIS PROJECT.

A. This project will upgrade ITSM to enable functionality to support overall enhancements and improved user experience by seamlessly handling all IT requests via one starting point. This functionality will help manage software maintenance costs and save time tackling manual administrative tasks. It includes setting up a new software design and implementation of a new application and implement key enhancements to improve usability and support process improvement.

d. Annual Refresh Projects

Q. DO YOU ALSO ANTICIPATE UNDERTAKING REFRESHES IN 2022?

A. Yes. As discussed above, we must refresh certain hardware devices on a regular basis to address end-of-life issues, maintain reasonably current technology, and replace systems that fail or break unexpectedly. Our 2022 budget for Refreshes is set forth in Table 20 below:

Table 20

2022 Annual Refresh Capital Additions	2022 Total
Annual Network Refresh	1.6
Annual PC Refresh	3.2
Annual Server Refresh	2.2
NSPM Total	**7.0**

2. Cyber Security

Q. ARE ANY CAPITAL PROJECTS TO ADDRESS EVOLVING CYBER SECURITY THREATS AND REQUIREMENTS INCLUDED IN THE 2022 PLAN YEAR?

A. Yes. Our cyber security capital additions for 2022 are expected to total $9 million. However, there is only one significant individual project for 2022, which is the Security Technology Refresh project that is continuing from 2021 and which I described earlier in my testimony. As noted previously, this project is being placed in service as the individual pieces of technology are refreshed.

3. Enhancing Capabilities

Q. ARE ANY CAPITAL PROJECTS TO ENHANCE COMPANY CAPABILITIES INCLUDED IN THE 2022 PLAN YEAR?

A. Yes. Our investments to enhance capabilities for 2022 are expected to total $17.5 million, as depicted below in Table 21.

Table 21

2022 Enhance Capabilities IT Investments	2022 Total
Enterprise Data Analytics	4.4
Video Conferencing enablement	2.6
Application Virtualization	2.5
Enhance Capabilities Small	2.4
Transmission Asset Health Analytics	5.6
NSPM Total	**17.5**

a. Enterprise Data Analytics

Q. PLEASE DESCRIBE THIS PROJECT.

A. Deep analysis of data including customer, marketing, meter data, transmission planning, generation, and financial are critical to the continuous improvement of the enterprise. This is budget item will fund analytics initiatives that strategically add value to the business. This will include a data science tool deployed to the Enterprise Data and Analytics team to provide collaboration across business areas.

b. Transmission Asset Health Analytics

Q. PLEASE DESCRIBE THIS PROJECT.

A. This project will deploy a Transmission Asset Health Analytics (TAHA) system that will combine different types of asset data and explore capabilities to perform data mining, predictive modeling, and advanced analysis for our transmission system. The current modeling process uses basic Excel formulas and regular maintenance schedules to prioritize maintenance work. This is largely done in an Excel spreadsheet and is 3-4 month effort to update data annually. Moving forward, we are developing an Asset Health Analytics system for the Transmission organization that will provide the analytics for maintaining and replacing the right equipment at the right time. The ability to better understand the present state of the assets and opportunities to identify targets for further investigation, reduce corrective maintenance, right-size planned maintenance, streamlines test reporting and processes, defer transmission maintenance and repair costs, and better defines risk will benefit customers by allowing us to focus maintenance on assets most likely to fail. This improves the life of the asset and reduces unplanned outages that would impact customers.

c. Video Conferencing enablement

Q. PLEASE DESCRIBE THIS PROJECT.

A. This project will standardize conference rooms with a small, medium, large, and bay configuration and will include the ability to engage in video conferences. Video conferencing enablement will provide technology reducing travel expenses and increasing employee productivity. This project includes necessary hardware and software.

d. Application Virtualization

Q. PLEASE DESCRIBE THIS PROJECT.

A. The project will effectively and efficiently manage our existing application installations and maintenance, with a focus on improving our software deployment lifecycle (SDLC) through automation and virtualization. Automation means looking at the current manual processes and introducing technology tools that will automate those processes. Virtualization means exploring a way to use applications from your computer that are actually installed in the data center or in the cloud, which will create people efficiencies and process efficiencies. Application virtualization allows applications that do not run in the current Operating System (OS) to run virtually. Application virtualization reduces system integration and administration costs by maintaining a common software baseline across multiple diverse computers in an organization. It allows incompatible applications to run side-by-side with applications that have the ability to run in the current OS.

4. Customer Experience

Q. ARE ANY CAPITAL PROJECTS TO ENHANCE THE CUSTOMER EXPERIENCE INCLUDED IN THE 2022 PLAN YEAR?

A. Yes. We anticipate that 2022 investments in the customer experience effort will total $12.1 million, with the capital additions for 2022 set forth in Table 22 below:

Table 22

2022 Customer Experience Investments	2022 Total
Digital Channel Platforms	5.0
Customer Relationship Management	1.3
Platform Infrastructure and Technology Maintenance	1.6
Data Analytics and Automation	4.2
NSPM Total	**12.1**

These capital additions reflect continuation of the projects identified for 2020. The detailed schedule of individual programs is set forth in Exhibit___(DCH-1), Schedule 6, and is discussed in detail earlier in my testimony.

5. Emergent Demand Account

Q. DOES BUSINESS SYSTEMS INCLUDE AN EMERGENT DEMAND ACCOUNT IN ITS 2022 BUDGET, AS IT DID FOR 2020 AND 2021?

A. Yes, although the dollar amounts are not the same given the different IT needs of our Company in different years. The 2022 Emergent Demand Account budget includes $12.8 million allocated to the Company based on forecasted business priorities for the year, balanced by the overall business

area capital spending guidelines. We have not yet distributed funding from the 2022 Emergent Demand Account.

Q. WHAT DO YOU CONCLUDE WITH RESPECT TO THE OVERALL LEVEL OF BUSINESS SYSTEMS CAPITAL COSTS THE COMPANY IS SEEKING TO RECOVER IN THIS RATE CASE?

A. The overall level of Business Systems costs is reasonable, as shown by the above discussion, and is necessary to support an appropriate level of service to our customers. Finally, the costs included in our 2020 through 2022 capital budgets are representative of the types of work we must do year over year.

IV. O&M BUDGET

A. O&M Overview

Q. WHAT IS INCLUDED IN YOUR O&M BUDGET?

A. The Business Systems O&M budget consists of costs related to the operation and maintenance of existing IT assets such as software systems, computers, printers, phones, radio systems, and servers. It also includes annual software contract and license fees, as well as maintenance agreements, for existing software and hardware. In addition, the O&M budget includes non-capitalized costs associated with developing, enhancing, and maintaining new or existing IT systems.

Q. WHAT ARE THE OVERALL TRENDS FOR BUSINESS SYSTEM'S O&M EXPENSES?

A. Beginning in 2012, as we entered a new phase of capital investment, our costs began to increase – largely because new IT capital investments often require additional licensing fees, other operational costs, and more complex

maintenance. This was reflected in the 2016 test year in our most recent rate case. From 2016 through 2018, Business Systems O&M costs increased largely due to our need to maintain new GL and WAM assets while also maintaining prior IT capital investments. Looking ahead to 2020 through 2022, we anticipate continued cost increases reflecting the addition of new capital investments and AGIS investments.

Q. HOW DO YOU RECONCILE THESE HIGHER BUDGETS WITH THE NEED TO ENSURE CUSTOMER VALUE FOR COMPANY INVESTMENTS?

A. Our customers have benefited from lower O&M and capital costs through the years where we deferred and avoided technology investments by harvesting maximum value from our current systems. However, as previously discussed, we could not defer investments in dated technology or old hardware indefinitely and need to make investments to continue to serve our customers and to protect them and our business from cyber security and system failure risk. Without making these investments, we could not provide reliable, quality service to our customers.

Q. WHAT IS THE COMPANY'S BUSINESS SYSTEM'S O&M BUDGET FOR THE 2020 TO 2022 TEST YEAR?

A. The total Business Systems O&M budget for the 2020 test year is $111.3 million, 2021 is $124.6 million, and 2022 is $128.7 million. The basis for this budget is set forth in detail below, utilizing the same categories of O&M utilized in our most recent rate case.

Q. WHAT ARE THE BASIC CATEGORIES OF THE O&M BUDGET?

A. The three-year Business Systems O&M budget can be broken down into 12

categories comprising approximately 99 percent of the Business Systems test year O&M budget: (1) Network Services; (2) Software Licenses and Maintenance; (3) Company Labor; (4) Distributed System Services; (5) Application Development and Maintenance; (6) Contract and Consulting; (7) Shared Assets; (8) Hardware Purchases and Maintenance; (9) Employee Expenses; (10) Mainframe; (11) Equipment Maintenance; (12) Donation, Dues, and Fees. The remaining costs in the Business Systems O&M budget pertain to small individual costs, such as administrative and office supplies. Table 23 below shows the 2020-2022 Business Systems O&M budget by category:

Table 23

Business Systems 2016-2022 O&M Budget by Category ($'s millions) NSPM							
Cost Category	**2016 Actuals**	**2017 Actuals**	**2018 Actuals**	**2019 Forecast**	**2020 Budget**	**2021 Budget**	**2022 Budget**
Network Services	19.0	17.9	18.1	17.4	15.9	15.9	15.8
Software License and Maintenance	20.4	22.5	24.5	26.2	30.9	32.6	33.9
Company Labor	11.6	14.5	17.2	21.4	26.6	27.4	28.2
Distributed Systems Services	9.4	3.7	2.9	2.3	2.1	2.2	2.3
Application Development and Maintenance	9.7	8.6	7.8	9.8	9.3	9.3	9.0
Contract and Consulting	9.6	9.4	9.1	9.2	7.2	7.2	7.1
Shared Assets	-7.1	-8.6	-1.6	1.7	4.5	3.9	11.3
Hardware Maintenance and Purchase	1.6	1.6	2.8	3.2	3.5	3.4	3.4
Employee Expenses	0.7	1.2	1.3	0.9	1.1	1.1	1.1
Mainframe	0.8	0.8	1.1	1.3	1.6	1.5	1.5
Equipment Maintenance	0.9	0.9	0.5	0.6	1.1	1.1	1.2
Donations, dues, and Fees	0.1	0.1	0.0	0.1	0.1	0.1	0.1
Other	1.3	1.1	1.9	-3.3	1.4	1.5	1.5
AGIS[1]	0.0	0.0	0.1	0.6	6.1	17.6	12.5
Total	**78.0**	**73.6**	**85.7**	**91.4**	**111.3**	**124.6**	**128.7**

Q. WHAT ARE THE MAJOR COST DRIVERS OF THE 2020-2022 BUSINESS SYSTEMS O&M BUDGET?

A. Of the categories listed above, I would describe four as primary drivers of our Business Systems budget: (1) Company Labor; (2) Shared Assets; (3) Software

License and Maintenance; and (4) AGIS. I describe each of the budget categories later in my testimony, and explain why network needs, licensing costs, labor costs, and the ongoing security needs to keep our software maintenance up to date is increasing in the Company's business as usual IT costs. AGIS costs are a new primary driver and explained in Section V my testimony.

Q. HOW DOES THE 2020-2022 BUDGET COMPARE WITH 2018 ACTUAL COSTS?

A. The 2020 budget is 29.9 percent higher than the 2018 actual costs; 2021 costs are 13.3 percent higher than 2020; and 2022 costs are 3.3 percent higher than the 2021 costs. The primary drivers of the increase are the support cost for the new software maintenance, increased shared asset costs, and insourcing efforts, which are offset in Contract and Consulting, Distributed Systems Services, and Application Development and Maintenance. AGIS O&M costs are also a major driver of budget increases for 2020 - 2022 budgets as shown in Section V of my Direct Testimony. Exhibit___(DCH), Schedule 3 provides a detailed breakdown of O&M costs by general ledger account.

Q. TABLE 23 ABOVE INDICATES THAT BUSINESS SYSTEMS' 2017 ACTUAL O&M WAS LOWER THAN THE 2016 ACTUAL. CAN YOU EXPLAIN WHY THIS IS THE CASE?

A. Yes. For 2017, the Shared Assets allocation was less than in the prior year, and there were savings from moving labor internally away from ADM and DSS. However, our GL and WAM projects were in service at the end of 2018, which increased licensing and ongoing maintenance costs. As the need for IT services continues to increase in today's businesses and we pursue the AGIS initiative, we do expect higher O&M for Business Systems during the

MYRP.

B. O&M Budget Process

Q. HOW DOES THE COMPANY SET THE O&M BUDGET FOR THE BUSINESS SYSTEMS BUSINESS UNIT?

A. Our O&M budget process is similar to our capital budget process in that both are based on a partnership between corporate management of overall finances and the business needs we identify. Company witness Mr. Gregory Robinson explains how the Company establishes business area O&M spending guidelines and budgets based on financing availability, specific needs of business areas, and overall needs of the Company. Overall, we establish a reasonable annual O&M level that allows Business Systems to complete priorities that are important to providing a reasonable level of services to the Company and our customers.

Q. DOES BUSINESS SYSTEMS EVER NEED TO CHANGE THE USE OF O&M FUNDS DURING THE FINANCIAL YEAR?

A. Yes, there are times when O&M funds are shifted within Business Systems during the year, typically to address unplanned requirements. For example, during 2019, the O&M spend was lower in the Operations and Infrastructure group, which allowed for some additional software maintenance and licensing expenses to be incurred while Business Systems in total remained within their anticipated forecast.

Q. HOW DOES THE COMPANY DETERMINE CHANGES IN THE BUSINESS SYSTEMS O&M BUDGET?

A. As part of the Company's annual budget process, Business Systems performs a review of existing services and expected new services to determine budget needs for future years. This includes an evaluation of annual contract cost escalators for vendors, annual merit increases, changes in the quantity of services estimated to be consumed and new services. This information is reviewed and evaluated through the budget process and a budget is established for Business Systems for future years.

Q. PLEASE EXPLAIN HOW THE BUSINESS SYSTEMS BUSINESS UNIT MONITORS O&M EXPENDITURES.

A. As previously described for the capital budget, Business Systems management monitors actual versus budget expenditures for both capital and O&M efforts on a monthly basis. Deviations are evaluated and action plans are developed to mitigate variations in actual to budgeted expenditures. These mitigation plans may either reduce or delay other expenditures to support the overall authorized budget. If authorized budget adjustments are required, they are identified and approved at an appropriate level of management.

C. O&M Budget Detail

1. Network Services

Q. WHAT ARE NETWORK SERVICES?

A. This category includes costs related to the maintenance of existing circuits, phones, microwave and radio systems, and other IT network infrastructure assets. Network activities provide operation and management of the Company's internal and external data transmission requirements. Network

services are budgeted based on a price times a quantity. These costs are dependent upon Xcel Energy's service usage levels and the number of assets in use. As more IT infrastructure is put in place, network maintenance costs increase.

Q. WHAT NETWORK ENHANCEMENTS COST CHANGES ARE YOU ANTICIPATING FOR THE TEST YEAR?

A. Network system in 2020-2022 reflects the increased usage of the organization's network to support new applications and demand for greater speed and capacity to support existing systems. These usage and demand needs increase each year, as technology advances, new requirements or capabilities are identified and sites are added. Fortunately, the costs are decreasing due to various actions taken by The Company including the insourcing of work previously performed by IBM and terminating that contract and changing the vendors who manages our network circuits.

Network services also encompass the need to upgrade and replace aging components of the network. For example, the SCADA circuits that have been in place for many years for transmission and distribution purposes are based on analog technology. That technology is now digital and those new circuits require maintenance to keep current. Another example is the Company's investment in expanding the wireless network to aid productivity. This expansion places new assets in service that must be maintained.

Overall, costs in this category are decreasing by $1.5 million 2019 to 2020 and budgeted to remain flat in 2021 and 2022.

Q. PLEASE DISCUSS EFFORTS TO CONTAIN NETWORK SERVICES COSTS.

A. Cost savings have been achieved as a result of the elimination of the Company's contract with IBM in 2019. In addition, we have operated much of our older network equipment without maintenance, opting for a time and material repair strategy as needed and thereby reducing costs.

2. Software Licenses and Maintenance

Q. WHAT IS SOFTWARE LICENSES AND MAINTENANCE?

A. This category includes expenses for payments to vendors for license agreements associated with various applications and desktop tools used by the Company to perform services. These payments cover updates, support patches, fixes and technical support.

Q. WHAT SOFTWARE LICENSE AND MAINTENANCE COST CHANGES ARE YOU ANTICIPATING FOR THE 2020-2022 MYRP?

A. There are three major drivers of increase to the 2020-2022 budgets, stemming overall from increasing costs in the industry. First, software costs are driven by net new projects. Second, there are increased licensing costs driven by users and upgrades. Third, maintenance and support must be updated to limit vulnerabilities. Overall, software license and maintenance costs have increased from $30.9 million in 2020 to $32.6 million in the 2021 budget and to $33.9 million in 2022.

Q. PLEASE DISCUSS EFFORTS TO MINIMIZE INCREASES IN SOFTWARE MAINTENANCE COSTS.

A. There are several efforts used to reduce the growth in this category. First, we evaluate the need for maintenance support on applications that will be

replaced. For example, as part of our upgrade to Windows 10 we are evaluating and removing software applications that will no longer be needed or are not compatible. Second, we evaluate the usage of desktop software to determine if the usage justifies the continued need for a product. For example, if a computer user has not used a software product recently, we redeploy the license to another user, thereby avoiding the need to purchase a new license. Finally, we renegotiate contracts with larger vendors as part of the renewal process to reduce costs. For example, we might extend the term of a maintenance agreement in order to receive a larger discount.

3. Company Labor

Q. WHAT COMPANY LABOR COSTS ARE INCLUDED IN THE BUSINESS SYSTEMS O&M BUDGET?

A. Our labor costs include the cost associated with all employees in the Business Systems department.

Q. WHAT COMPANY LABOR COST CHANGES DO YOU ANTICIPATE FOR THE 2020-2022 MYRP?

A. Labor costs for the MYRP are $26.6 million in 2020 and increase to $27.4 million in the 2021 budget and to $28.2 million in the 2022 budget. The increase from 2019 to 2020 is largely due to in-sourcing efforts, where at the same time contract labor costs decreased in the areas of Distributed Systems Services and Application, Development, and Maintenance. Salary and merit pay increases also contributed to the increase in 2020. For the years 2021 and 2022, internal labor increases are largely attributable to increases in salary resulting from earned merit pay increases.

Q. PLEASE DISCUSS EFFORTS TO MINIMIZE INCREASES IN COMPANY LABOR COSTS.

A. Business Systems thoroughly reviews requests for increases in employee headcount through a process that includes a business justification that demonstrates the need, associated risks with not approving the request, and alternatives considered. This process has worked effectively for many years and we believe has limited the historic growth in headcount.

4. Distributed Systems Services

Q. WHAT IS DISTRIBUTED SYSTEMS SERVICES?

A. This category includes expenses related to support and maintenance of servers, data storage, personal computers, printers, and similar components of the overall computing environment.

Q. WHAT DISTRIBUTED SYSTEMS SERVICES COST CHANGES DO YOU ANTICIPATE FOR THE TEST YEAR?

A. Growth in the number of servers is largely driven growth and by capital projects that were placed in service in the past few years, such as the, General Ledger, and others. As the number of servers grows, so does the amount of storage because each new server requires storage to function. Since the 2016 NSPM electric rate case, we had an increase in servers of 3,340, bringing the total to 5,580. Overall, Distributed Systems Services costs are $2.1 million in 2020, $2.2 million in 2021, and $2.3 million in 2022. These costs are less than 2018 and 2019 due to insourcing of steady state work to Company employees.

Q. PLEASE DISCUSS EFFORTS TO MINIMIZE INCREASES IN DISTRIBUTED SYSTEMS SERVICES COSTS.

A. To reduce cost growth and implement savings in this area, the Company renegotiated server and storage costs as part of our IBM contract renegotiation and has hired internal employees to manage this function, and has implemented data retention rules to curb storage growth. For example, all email is purged after 90 days in a user's inbox. Despite these efforts, however, storage growth increased from 3.75 PB since 2016 to 10 PB today, which is a 167 percent increase.

5. Application Development and Maintenance

Q. WHAT IS APPLICATION DEVELOPMENT AND MAINTENANCE (ADM)?

A. ADM includes costs of services to develop, enhance, maintain, and consult on new or existing IT software and hardware applications.

Q. WHAT ADM COST CHANGES DO YOU ANTICIPATE FOR THE TEST YEAR?

A. ADM costs have remained relatively flat for the past several years, due largely to the 2017 contract renegotiation with IBM offset by added programs such as SAP. In addition, we continue to thoroughly evaluate our application portfolio on a regular basis, to limit new development for those applications that will be replaced in the near future. Overall, ADM costs are $9.3 million in 2020, $9.3 million in 2021, and $9.0 million in 2022.

6. Contract Labor and Consulting

Q. WHAT COSTS ARE INCLUDED IN THE BUDGET AS CONTRACT LABOR AND CONSULTING?

A. These costs consist of fees and expenses for professional consultants or

knowledge-based experts that are not employees of the Company. This category also includes staff augmentation through staffing agencies.

Q. WHAT CONTRACT LABOR COST CHANGES DO YOU ANTICIPATE FOR THE TEST YEAR?

A. Contract labor costs are expected to remain relatively flat at $7.2 million for 2020, $7.2 million for 2021 and $7.1 million for 2022. The 2018 actuals and 2019 forecast are higher than the 2020-2021 budgets due primarily to brining on steady state work as Company employees.

7. Shared Asset Allocation

Q. WHAT IS SHARED ASSET ALLOCATION?

A. This category reflects the allocation of Business System costs to or from the NSPM operating company, depending on where the asset was purchased and how an investment will be utilized between Xcel Energy operating companies. The dollars associated with this category are, in a sense, a true-up of costs related to a certain investment by assigning to the appropriate jurisdiction(s). This number fluctuates in part on the basis of the jurisdiction in which an investment is purchased, consistent with our cost allocation policy. For example, the dollars in this account will decrease when an asset is purchased in NSPM but is also utilized in other operating companies.

8. Hardware Purchases and Maintenance

Q. WHAT IS INCLUDED IN THE HARDWARE PURCHASE AND MAINTENANCE CATEGORY?

A. Our hardware maintenance costs relate largely to vendor contracts we maintain to support hardware systems. This cost category also includes

miscellaneous hardware equipment purchases, such as for batteries, memory cards, keyboards, headsets, and related technical tools.

Q. WHAT HARDWARE PURCHASES AND MAINTENANCE COST CHANGES TO DO ANTICIPATE FOR THE TEST YEAR?

A. Costs for this category are expected to fluctuate based on the work being performed and is budgeted for $3.5 million in 2020, $3.4 million in 2021, and $3.4 million in 2022. The major ongoing driver is related to the maintenance costs required to support the new software.

9. Employee Expenses

Q. WHAT EMPLOYEE EXPENSES ARE INCLUDED IN THE BUSINESS SYSTEMS BUDGET?

A. These costs are primarily related to employee travel, occurring on an as-needed basis.

Q. WHAT EMPLOYEE EXPENSE COST CHANGES DO YOU ANTICIPATE FOR THE TEST YEAR?

A. Costs for employee expenses are budgeted at $1.1 million annually for 2020-2022. The budget is similar to the past three year average of $1.1 annually for employee expenses.

Q. PLEASE DISCUSS EFFORTS TO MINIMIZE EMPLOYEE EXPENSES COSTS.

A. We encourage employees to limit expense to the greatest extent possible. Simple efforts help contain costs, such as using technology like video-conferencing as a measure to reduce travel related employee expenses. Overall, we encourage a conservative approach and limit approval of planned

travel accordingly.

10. Mainframe

Q. WHAT ARE MAINFRAME COSTS?

A. These are costs for maintaining the centralized applications running on the mainframe computer, which serve multiple business needs such as batch processing for customer billing and meter reading.

Q. WHAT MAINFRAME COST CHANGES DO YOU ANTICIPATE FOR THE TEST YEAR?

A. Mainframe costs are expected to remain flat at $1.6 million for 2020 and $1.5 million for 2021 and 2022.

11. Equipment Maintenance

Q. WHAT EQUIPMENT MAINTENANCE COSTS ARE INCLUDED IN THE BUSINESS SYSTEMS BUDGET?

A. This category includes the usage costs of multi-function copier/printers used by all employees across the Company.

Q. WHAT EQUIPMENT MAINTENANCE SERVICES COST CHANGES DO YOU ANTICIPATE FOR THE TEST YEAR?

A. Equipment Maintenance is expected to remain relatively flat at $1.1 million for 2020 and 2021 and increase to $1.2 million in 2022.

12. Donations, Dues, and Fees

Q. WHAT DONATIONS, DUES, AND FEES ARE INCLUDED IN THE BUSINESS SYSTEMS BUDGET?

A. These costs cover our participation in organizations that supply best practices

guidance for IT, such as Gartner Consulting. Also included are costs for fees paid to regulatory agencies for compliance related items.

Q. WHAT CHANGES IN DONATIONS, DUES, AND FEE COSTS DO YOU ANTICIPATE FOR THE TEST YEAR?

A. Costs for the 2020- 2021 are budgeted at $.1 million annually, which is similar to expenses in previous years.

13. Other

Q. WHAT COSTS REMAIN IN THE "OTHER" CATEGORY?

A. This category includes very small purchases for administrative materials, fleet expenses, and internal building moves.

Q. WHAT CHANGES IN "OTHER" DO YOU ANTICIPATE FOR THE TEST YEAR?

A. Costs in this category are $1.4 million in 2020 and 2021, and $1.5 million in 2022.

Q. WHAT DO YOU CONCLUDE ABOUT BUSINESS SYSTEMS' O&M COSTS OVERALL?

A. We have worked hard in recent years to contain O&M costs, which is reflected in the number of O&M categories with flat expense levels and budgets between past and future years. Where costs are rising, this is due to increased investment in capital, and increased demand for technology services such as network and data support. In turn, these increases in demand are consistent with the overall direction and rising needs for IT services in all types of businesses. As such, our O&M cost levels reflect prudent management and cost containment.

V. THE ADVANCED GRID INTELLIGENCE AND SECURITY INITIATIVE

A. Introduction

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?

A. In this section, I discuss the IT integration and cyber security support for the Company's Advanced Grid Intelligence and Security (AGIS) initiative and provide detailed support for the recovery of associated costs incurred by the Business Systems organization, including both capital and O&M. As discussed by Mr. Gersack, the Company is requesting approval to recover the costs of the capital investments and O&M expense for the components of AGIS that we propose to implement during the MYRP, and is also requesting that the Commission certify these projects so the Company may request recovery of costs for 2023 and later in subsequent rider filings (subject to all other requirements of rider recovery). Accordingly, while I focus this discussion somewhat on the term of the multi-year rate plan, I also provide support for the IT portions of the broader AGIS initiative, consistent with the Company's Integrated Distribution Plan (IDP) being filed concurrently with this rate case.

Q. HOW IS THIS SECTION OF YOUR TESTIMONY ORGANIZED?

A. I first describe the AGIS initiative and present an overview of the Business Systems and IT services that will integrate the various components of the AGIS initiative.

I then discuss the cyber security measures that will protect the more intelligent, interactive electric distribution network as well as the underlying

data it gathers. I describe the Company's security principles, and explain the protection that will be implemented to secure customer endpoints and the communications network that facilitates the movement of data through the advanced grid. Overall, I explain how the Company continually identifies and implements cyber security best practices to protect customers and the distribution grid. Reliable delivery of electricity is of paramount importance, protecting the integrity and security of this system is included with that responsibility.

I then discuss the IT infrastructure that will support all aspects of the AGIS initiative. I discuss each component, the implementation plan, and the associated costs for Business Systems. While the more visible components of the AGIS initiative are described by other Company witnesses, supporting IT infrastructure and integration of the components of AGIS will allow new applications and field devices to communicate with and deliver data to the Company's "back office applications." In other words, IT enables the software applications that support the Company's customer service needs, billing, payment remittance, service order management, outage management, meter reading, and asset inventory lifecycle management applications to utilize the customer data, outage data, and other information supplied by the advanced distribution grid.

This discussion includes the implementation plan for the Company's IT integration efforts, which will begin in 2020 and will continue as AGIS components are implemented during the term of the multi-year rate plan. I also describe the IT support necessary to facilitate certain customer interaction

points, such as a customer internet portal that utilizes communications with advanced meters to provide timely energy usage information to customers.

Finally, I provide support for the capital and O&M costs related to the IT integration and cyber security for AGIS for which we are requesting recovery in this case. In turn, these costs flow through the Company's cost-benefit analysis presented by Dr. Duggirala and Mr. Gersack. Because hardware and software systems and integration work are critical foundations of the AGIS initiative but do not provide quantifiable benefits until they are deployed and utilized in conjunction with distribution systems, my discussion of customer cost-benefit analyses is limited to costs.

Following is an outline of the remainder of this section of my testimony. A more detailed outline including subheadings can be found in the Table of Contents.

- AGIS Overview
- IT Support for AGIS
- Distribution Grid Cyber Security
- AGIS Components, Implementation, and IT Costs
    1. Introduction and Overview
    2. Grid Modernization Efforts to Date
        - *ADMS*
        - *TOU Pilot*
    3. AMI
        - *AMI Overview*
        - *AMI Integration*
        - *AMI Costs*

4. The FAN
    - *FAN Overview*
    - *Interrelation of FAN with Other AGIS Components*
    - *FAN Benefits*
    - *FAN Implementation*
    - *FAN Costs*
    - *Minimization of Risk of Obsolescence for FAN*
    - *Alternatives to FAN*
5. FLISR
6. IVVO
7. AGIS IT Overall Costs and Implementation

Q. HOW IS THE COMPANY PRESENTING ITS OVERALL SUPPORT FOR THE AGIS INITIATIVE?

A. A discussion of the overall AGIS initiative is provided in the Direct Testimony of Company witness Mr. Michael C. Gersack. In addition to my testimony, information on the AGIS distribution system components and customer benefits and other considerations is provided in the Direct Testimonies of Company witnesses Ms. Kelly A. Bloch and Mr. Christopher C. Cardenas. The AGIS cost and benefits analyses are provided in the Direct Testimony of Company witness Dr. Ravikrishna Duggirala.

B. AGIS Overview

Q. WHAT IS AGIS?

A. The AGIS initiative is a comprehensive plan that will advance the Company's electric distribution system, provide customers with more choices, and enhance the way the Company serves its customers. AGIS provides the

foundation for an interactive, intelligent, and efficient grid system that will be even more reliable and better prepared to meet the energy demands of the future.

Q. TO PROVIDE A FRAMEWORK FOR THE REMAINDER OF YOUR TESTIMONY, PLEASE IDENTIFY THE CORE COMPONENTS OF AGIS.

A. The core components of AGIS are the Advanced Distribution Management System (ADMS); Advanced Metering Infrastructure (AMI); the Field Area Network (FAN); Fault Location Isolation and Service Restoration (FLISR); and Integrated Volt-VAr Optimization (IVVO). More specifically:

- *Advanced Distribution Management System (ADMS)* is a foundational system for operational hardware and software applications. It acts as a centralized decision support system that assists control room personnel, field operating personnel, and engineers with the monitoring, control and optimization of the electric distribution grid. ADMS also includes the data enhancements for the Geospatial Information System (GIS), which is a foundational data repository that provides location and specification information for all of the physical assets that make up the distribution system. ADMS uses this information to maintain the as-operated electrical model and advanced applications.
- *Advanced Meter Infrastructure (AMI)* is an integrated system of advanced meters, communication networks, and data processing and management systems that enables secure two-way communication between Xcel Energy's business and operational data systems and customer meters. AMI provides a central source of information that is shared through the communications network with many components of an intelligent grid design.

- *Field Area Network (FAN)* is the communications network that will enable communications between the existing communications infrastructure at the Company's substations, ADMS, AMI, and the new intelligent field devices associated with advanced grid applications.
- *Fault Location Isolation and Service Restoration (FLISR)* involves software and automated switching devices, as an additional component of the ADMS, that reduce the frequency and duration of customer outages. These automated switching devices detect feeder mainline faults, isolate the fault by opening section switches, and restore power to unfaulted sections by closing tie switches to adjacent feeders as necessary.
- *Integrated Volt-VAr Optimization (IVVO)* is a significant additional component supported by ADMS, as it automates and optimizes the operation of the distribution voltage regulating and VAr control devices to reduce electrical losses, electrical demand, and energy consumption, and provides increased distribution system injection capacity to host DER.

C. IT Support for AGIS

Q. WHAT ROLE DOES INFORMATION TECHNOLOGY PLAY IN THE ADVANCED DISTRIBUTION NETWORK?

A. As discussed in the Direct Testimony of Mr. Gersack, the Company envisions an increasingly intelligent, automated, and interactive electric distribution system that utilizes advancements in sensing, controls, information, computing, communications, materials and components. This greater intelligence and automation is dependent on information technology to share and analyze information, integrate systems, and support the advanced infrastructure in a timely and efficient manner. In turn, through the AGIS

initiative the more advanced distribution system will be able to better meet customers' energy needs, while also integrating new sources of energy and improving grid reliability.

Q. PLEASE INTRODUCE THE WORK THAT WILL BE REQUIRED OF BUSINESS SYSTEM TO SUPPORT THE AGIS INITIATIVE.

A. Overall, Business Systems is responsible for the IT integration of AGIS systems and data with other back office applications existing at the Company. For example, Business Systems will implement the FAN that allows intelligent field devices, ADMS, AMI, and other systems to connect. Business Systems has already implemented many foundational components of the AMI software for use in Colorado, and in Minnesota for the Residential Time of Use (TOU) pilot. This same software will provide features and data processing to support a full Minnesota rollout, and will be enhanced to support Minnesota requirements for capacity, performance, security, and functionality. From the AMI head-end, a combination of new or enhanced interfaces will be built to transfer the data to other applications, such as ADMS, the meter data management system, the billing and customer service system, and the asset inventory management system.

Implementing AGIS will require the various interfaces to transfer large volumes of data in a small amount of time. We will also be obtaining significantly more data from the field devices than we have in the past. This additional data will require additional space for storage and a data management plan to ensure we are keeping the necessary data only for as long as it is needed. The new software, additional server hardware, and increase in

quantity of data stored will all need to be supported, which will require an increase in our support staffs.

Q. WHAT DO YOU MEAN BY IT INTEGRATION?

A. By IT integration, I refer to the need to integrate the technical components of the AGIS initiative (*i.e.*, the ADMS, AMI, FAN, FLISR, and IVVO systems) with other Company applications to allow the efficient, timely, and secure transfer of data between AGIS systems and other Company systems. The goal of integration is to ensure new applications and data are able to communicate with our existing applications so we are able to use the data to improve Company operations and provide a better customer experience.

As one example, AMI meter data must be communicated to the ADMS for operations and management of the grid, and to back-office applications such as billing and customer care for the data to be used consistently and as effectively as possible. As the business processes are defined or refined, the necessary data and applications requiring the new data gathered from the AGIS components will be identified. Interfaces will be designed or significantly enhanced to transfer the data between the applications. New interfaces to support the new business processes will require significant labor to design and implement. We will need to use existing tools, such as an Enterprise Service Bus (ESB),[3] to make the implementation and support of the interfaces consistent and efficient.

[3] The ESB is a type of software platform that works behind the scenes to aid application-to-application communication. The ESB can be thought of as a "bus" that picks up information from one system and delivers it to another.

Q. TO WHAT EXTENT DOES BUSINESS SYSTEMS ANTICIPATE ENHANCEMENTS TO BACK-OFFICE APPLICATIONS MAY BE NECESSARY AS A RESULT OF AGIS?

A. The new AMI field devices will provide data we have not stored in our systems before and this data will be in larger quantities than we have obtained before. As a result, effective use and communication of this data will require upgrades to many of our existing business processes. While our project plans have identified these upgrades and enhancements, there may be some additional requirements that will not be fully determined until the AGIS initiative is approved and final requirements are determined.

Q. CAN YOU DISCUSS FURTHER THE TYPES AND VOLUME OF DATA YOU WILL BE RECEIVING FROM THE FIELD AND MANAGING AS A RESULT OF AGIS IMPLEMENTATION?

A. Yes. The volume of data will increase by orders of magnitude. Related to AMI metering, we will have the capability to obtain data from meters many times a day – and will be able to provide this data to customers on a daily basis (or more frequently) via the customer data web portal or smartphone application. Not only will the advanced meters provide energy usage data, they can also measure voltage, current, frequency, and power quality. Additionally, these meters can detect outage events, restoration events, tampering, energy theft events, and perform meter diagnostics. This is in contrast to our current metering system which generally provides energy usage data once per month for billing purposes.

In addition to the meter data, the advanced grid components FLISR and IVVO will provide outage and voltage information that will be used for outage response as well as for grid management and planning purposes.

To support the new data and processes, the Company will need to enhance some software applications to accommodate new fields and increase the applications data storage capacity and processing.

Q. WHY DOES THE COMPANY NEED TO INTEGRATE THE COMPONENTS OF THE AGIS INITIATIVE WITH OTHER COMPANY SYSTEMS?

A. To realize the benefits of advanced grid capabilities and coordinate service delivery to customers as well as the work of our personnel, it is essential that we integrate our systems to coordinate timely, accurate information. Integration of systems ensures that new AGIS systems and components distribute and receive information that is synchronized across all impacted business processes. Integration is fundamental to keep large volumes of data timely, accurate, and consistent between systems of record. Integration is also key to securing the technologies we are deploying.

Conversely, compromising the integration of systems would significantly diminish the customer experience and reduce the processing and decision making that is required to manage energy services that our customers want. Lack of integration would require that customers and Company employees obtain different information from different sources or applications, creating the risk of error and making it more difficult and more time consuming to obtain and provide information, which can results in additional costs.

As the use of integrated systems matures, the Company will be able to use information from many different, integrated sources to assist in managing the electric grid and maximizing the benefits of AMI for our Minnesota electric customers.

Q. HOW WILL AMI AND BACK OFFICE APPLICATIONS BE INTEGRATED?

A. The Company will connect the AMI meter with the AMI head-end software that sends commands to meters and receives data from the meter using the FAN communication network. From the AMI head-end, data will be distributed to back office applications to enable the Company and customers to use this data in a meaningful way. ADMS data from field devices, including advanced meters, will also be distributed to various back office applications, to enable the Company to manage the distribution grid more effectively and efficiently.

Q. ARE THERE ASPECTS OF IT INTEGRATION FOR THE AGIS INITIATIVE THAT WILL HAVE TO BE DEVELOPED AS THE PROGRAM IS IMPLEMENTED?

A. Yes. While we know a great deal of the integration work that will be necessary, the full extent of the IT work to be completed in Minnesota cannot be completely anticipated ahead of time due to the need for additional filings and the need for future decisions that will depend on technology advances as time goes on. For example, as discussed by Mr. Cardenas, we will be submitting separate filings with the Commission for approval of opt-out provisions and to enable remote connection/disconnection capabilities. Once these proceedings are completed and requirements are finalized, we will be working on details to implement these processes, ensuring they comply with Minnesota requirements that may be established. As time progresses, we will also learn additional information regarding the level and type of application enhancements that will be needed. Therefore, a contingency has been added to the current cost estimates. Once those details are finalized and project plans are refined accordingly, we will be able to further refine project cost estimates. I describe our current cost estimates later in my testimony, after

first describing how the Company is hardening the advanced grid against cyber threats.

D. Distribution Grid Cyber Security

Q. HOW IS CYBER SECURITY INTEGRAL TO THE AGIS PLAN?

A. Cyber security is a significant element of the AGIS plan. It starts with identification and protection of all components of the intelligent grid, both for the protection of customers and for the reliable and safe delivery of energy to customers. Also included are detective controls at strategic locations to provide early notification of suspicious behavior or anomalous activity. Further, the Company plans, refines and exercises to react appropriately to threats to the intelligent grid.

Q. DOES XCEL ENERGY HAVE A CYBER SECURITY BUSINESS AREA?

A. Yes. In addition to Business Systems, the Company has a dedicated Enterprise Security Services (ESS) business unit that encompasses both cyber and physical security, security governance and risk management, and enterprise resilience and continuity services. This combination of services is designed to cover analysis of vendor risks, alignment of the technology with security standards, secure solution design and deployment, integration with Company solutions including user access management and system monitoring and incident response, as well as threat analysis and planning for continuity of business operations in the event of a disruption.

The Company's security risk management program provides Company leaders with information about threats and the level of security risks, so that mitigations and responses can be planned that are proportional to the risk.

The separation of ESS from Business Systems is a beneficial organizational structure in that it provides multiple layers of security oversight on an enterprise-wide basis, not just under the IT organization. ESS staff and programs, however, are tightly integrated into the AGIS program, and the ESS costs specifically related to AGIS are included in the Business Systems AGIS budget presented below.

Q. WHAT ARE SOME OF THE GENERAL TYPES OF SECURITY RISKS THAT MUST BE TAKEN INTO ACCOUNT FOR ANY UTILITY DISTRIBUTION SYSTEM AND CUSTOMER METERS?

A. First, devices in the field must be protected proportionately. Consequently, unlike internal business technology, the distribution components are out in the field and at customers' residences; devices can only be hardened so much, and security must also rely on other controls. Additionally, although even legacy distribution systems and meters are vulnerable to physical tampering and disabling, adding a communications network enhances the potential impact of a security compromise. In short, the endpoints and the communications between them all require security protections.

Q. DOES IMPLEMENTATION OF THE AGIS INITIATIVE SOLVE SOME OF THE CYBER SECURITY CHALLENGES PRESENTED BY THE COMPANY'S CURRENT DISTRIBUTION GRID?

A. Yes. For example, our current meter reading technology was implemented beginning in the 1990s; thus, it does not have state-of-the-art access controls, encryption technologies, or monitoring capabilities. Further, it is not capable of two-way communications, and the security architecture it is built upon is inadequate. The two-way communication enabled with AMI metering

provides additional information to the Company about changes to the meter that can help prevent and identify meter theft and tampering, as described by Mr. Cardenas.

Further, the addition of a communication network provides additional capabilities and services to our customers, as well as greater insight into our system, but can also increase the potential impact of a cyber security compromise. The addition of a Company-owned Field Area Network is a prudent approach to this concern. A private network allows Company to better control the integrity of the devices on its network and the data exchanged with those devices. The alternative, a public network, would expose the devices to increased risk because the Company would not be in control of the network.

Overall, while the implementation of the AGIS initiative solves certain existing issues, it also presents different challenges to security than a less advanced grid, and requires its own comprehensive security strategy.

Q. CAN YOU PROVIDE MORE SPECIFIC INFORMATION REGARDING THE SECURITY RISKS THE COMPANY IS ADDRESSING AS PART OF THE AGIS INITIATIVE?

A. Yes. Security controls are designed for each component and system implemented as part of the AGIS initiative. The security risks associated with the AGIS components can be organized into three primary areas: compromise of meters and devices; exploitation of the communications channels; and security lapses once data is within the corporate environment. There are also security risks related to the web portal, as well as future customer applications and new products and services that will be enabled by the advanced grid.

First, advanced meters and other networked devices have an integrated network interface card (NIC) that enables them to connect to the WiSUN network. The Company leverages both physical and cyber security controls to protect NICs from unauthorized access.

Second, a compromise of the WiSUN and WiMAX networks that carry traffic to and from the meters and field devices could lead to disruption or alteration of information needed for grid management. Therefore, protecting the integrity of the communication devices and channels that allow the advanced grid to perform at expected levels is paramount. It is also important to implement the correct level of monitoring and alerting, configured to identify potentially anomalous activity, so that both proactive and reactive responses are appropriate and efficient.

Third, the primary risk to systems and information that reside within the Company's corporate environment is from unauthorized access – where a criminal or unqualified employee access sensitive data or issues commands to the grid. There are many controls in place to prevent and detect such behavior.

Q. DOES THE COMPANY EMPLOY BEST PRACTICES FOR CYBER SECURITY?

A. Yes. Security practices include a security controls governance framework, which leverages industry best practices including the National Institute of Standards and Technology (NIST), Cyber Security Framework (CSF). The Company's security policies and standards incorporate regulatory compliance requirements and security controls designed to protect against CIA (Confidentiality, Integrity and Availability) breaches. This framework serves

as the basis for project security requirements as well as periodic internal security technology control assessments.

1. Cyber Security Principles

Q. WHAT ARE THE CYBER SECURITY BEST PRACTICES FOR XCEL ENERGY?

A. The Company's cyber security program may best be described in terms of the five categories of controls outlined in the NIST CSF: identify, protect, detect, respond, recover. Combining these for "defense in depth" adds multiple layers of protection and detection including defenses at each endpoint and throughout the network. Controls within these layers include:

- Asset management – maintain an inventory and securely configure assets, so we know what to protect as well as what is authorized to access our networks ["Identify"];
- Protection – user access controls, encryption, digital certificates and other controls to ensure the confidentiality, integrity and availability of data ["Protect"];
- Vulnerability management – in addition to scanning equipment for known security vulnerabilities, the company monitors emerging threats ["Detect"];
- Monitoring and alerting – identify potentially anomalous activity so that both proactive and reactive responses are appropriate and efficient ["Detect"];
- Incident response – analyze information using playbooks and escalate to the Enterprise Command Center, the Company's 24x7 watch floor operation designed to prepare for, respond to, and recover from any potential hazard that may impact customers, Company assets, operations, or its reputation ["Respond"]; and

- Disaster recovery and business continuity planning – to efficiently maintain and restore grid operations in the event of a cyber attack ["Recover"].

Cyber security threats are monitored and as new types of threats emerge, the Company adjusts our "defense in depth" strategy accordingly.

Q. HAS XCEL ENERGY IMPLEMENTED THE CYBER SECURITY BEST PRACTICES YOU DESCRIBED?

A. Yes. These cyber security controls will be applied to the technology to be implemented as part of the AGIS initiative to identify and protect all components of the intelligent grid and help ensure the reliable and safe delivery of energy to the Company's customers. The following discussion explains how these controls are being applied, at the endpoints, on the communications channels, and within the corporate environment.

2. Endpoint Protections

Q. FIRST, WHAT DO YOU MEAN BY ENDPOINT?

A. An endpoint in this context refers to the intelligent devices on our system. This includes the AMI meter and head-end, but also includes communication devices such as routers or switches. As a point of reference, the concept of "endpoints" is not limited to distribution system field devices; it also includes other end user devices, such as Company personal computers and network servers. However, my testimony is focused on distribution grid devices.

Q. WHAT IS ENDPOINT PROTECTION?

A. Endpoint Protection is the installation and/or enablement of protective and detective cyber security controls to thwart malware and external influences from causing unexpected, unwanted or invalid behavior at an endpoint.

Q. WHAT TYPES OF ENDPOINT PROTECTION HAS XCEL ENERGY IMPLEMENTED?

A. Xcel Energy's Endpoint Protections include: (1) Access Controls including Authentication and Authorization; (2) System Patching; and (3) Data Validation and Protection. These endpoint protections were specified as cyber security controls in the AMI vendor selection process, as they are essential to protect the devices and the data that are handled by AMI meters and headend servers. The vendor selection process is described later in my testimony and in Ms. Bloch's testimony. Authentication and Authorization is integral to Access Control for any type of endpoint so that logical access to endpoints can only be performed by duly authorized personnel.

Q. PLEASE DESCRIBE ACCESS CONTROL.

A. The first item of protection, Access Control, is to confirm that only necessary and authorized users have access to the individual devices. This not only includes the devices that are installed on the consumer's premises, but also the devices that facilitate communication and control of the data flowing to the consumer. There are potentially many avenues of compromise with respect to unauthorized access to devices. This is a key consideration and will be addressed through strong authentication methods, which include multi-factor authentication methods described below.

Q. PLEASE DESCRIBE AUTHENTICATION AND AUTHORIZATION.

A. Authentication is a method by which a user affirms their identity. In its simplest form, it involves a user ID and password. Where technically feasible, Xcel Energy requires multi-factor authentication so that a user must not only know their password, they must also possess a physical or logical token. This minimizes the ability of an unauthorized user to steal passwords and access our assets and information.

Authorization is the process of determining and configuring the minimum level of access required by a user or an automated system. Granting undue permissions to devices that comprise the intelligent electric distribution system could lead to unauthorized or inadvertent changes and instability. Complying with a least-privilege principle ensures that only necessary and authorized individuals have the ability to make administrative changes.

Sound access controls include periodic review of access levels and removing access when it is no longer needed.

Q. PLEASE DESCRIBE SYSTEM PATCH MANAGEMENT.

A. Device and system manufacturers periodically issue updates to software and firmware to improve performance, add features, or address security vulnerabilities. A robust system patch management process incorporates asset inventories, secure receipt of patches from the vendor, testing and deployment to the field. The Company's threat intelligence and vulnerability management teams monitor for and inform support teams of known security vulnerabilities that require patching. Keeping current with vendor patches helps reduce the

possibility that a criminal can use a known exploit to compromise our systems or data.

Q. PLEASE DESCRIBE DATA VALIDATION AND PROTECTION.

A. A final defensive layer between the various endpoints is data validation. As data is sent from endpoints at consumer premises, data validation at the head-end must take place. If data values received from the consumer endpoint do not fall within a range of expected values, then either the data must be assumed compromised and discarded, or secondary validation must take place to measure the integrity of the data received. This validation will provide yet another level of detection and protection for the intelligent electric distribution system.

Each of these endpoint protections will support the overall security of the AGIS technology.

3. Communication Network Security Protections

Q. AS PART OF IMPLEMENTING CYBER SECURITY, DOES THE COMMUNICATION NETWORK ALSO NEED TO BE PROTECTED?

A. Yes. The communication network that facilitates data movement from the endpoint at the consumer premise to the utility's control center must also have a high level of security built into the architecture to ensure confidentiality, integrity, and availability of the intelligent electric distribution network.

Q. WHAT ARE THE PROTECTIONS XCEL ENERGY APPLIES TO THE COMMUNICATIONS NETWORK?

A. The equipment that makes up the communication network deploys the endpoint protections previously discussed. Additional key controls for the communications pathways include the use of firewalls to restrict which systems can interact and what ports and protocols they can use; encryption to minimize the opportunity to intercept and alter data traffic; monitoring and log review as well as response to suspected security events.

Q. PLEASE DESCRIBE HOW FIREWALLS ARE USED TO PROTECT COMMUNICATIONS.

A. Firewalls are placed in multiple areas of the network between the customer meter and the company data center/head end. By default, all traffic through a firewall is blocked, and authorized only after a thorough review and change process. With a firewall, any unauthorized, unregistered devices that attempt to join the network or communicate to/from devices are blocked.

Q. PLEASE DESCRIBE ENCRYPTION.

A. Encryption uses complex mathematical algorithms to obscure data prior to and during its travels through the communications network. It also prevents data from being altered. Only authorized parties to the transaction (sender and receiver) have the "keys" to encrypt and decrypt data.

Q. DOES EVERY COMMUNICATION CHANNEL OR MEDIUM NEED TO HAVE THE SAME LEVEL OF PROTECTION?

A. Yes. The FAN solution described earlier in my testimony employs multiple technical protocols (WiMAX and WiSUN), as well as cellular. In order to ensure an efficient and holistic approach is taken to the intelligent electric

distribution network, it must interoperate with all available communication mediums. The equipment that facilitates the specific communication medium must not impede the security controls placed on any of the equipment identified above. Therefore, all security controls should work independently of the specific communication medium.

4. Security Protections within the Corporate Environment

Q. DO ANY PROTECTIONS NEED TO BE APPLIED TO ACCESS TO INFORMATION ONCE IT RESIDES WITHIN THE COMPANY HEAD END SYSTEMS?

A. Yes. Company systems reside in data centers with physical access protections – only authorized users are able to enter these locked facilities on Company property. Data accessed from the control centers travels from the systems in the Company data centers over the corporate network. At the control center, application users must follow the same rules for authentication, authorization, and least privilege.

Data from the intelligent electric distribution network passes through multiple defense-in-depth controls on its way back to the systems in the corporate data centers. Communication will pass through multiple firewalls to ensure that only authorized devices are communicating on authorized ports/protocols. Additionally, a protocol-aware Intrusion Detection System/Intrusion Prevention System (IDS/IPS) will inspect the traffic to ensure tampering has not been performed on the data packet. Once the data has been delivered to the systems responsible for consuming this information, only authorized processes will have the ability to act upon this information.

The Company segments its networks, so that critical operational systems and information are kept separate from business data and operations including email. This segmentation adds a significant barrier should a criminal compromise a corporate user's account. In addition to using firewalls between networks, the Company requires the use of multi-factor authentication when accessing systems from outside the control center.

5. Other Security Protections

Q. DOES LOG MONITORING HAVE A ROLE IN THE DEFENSE OF THE NETWORK?

A. Yes. Devices that reside on the intelligent electric distribution network that have the ability to log various pieces of information and send those logs to an intelligent collector are sending them to the Security Incident and Event Management (SIEM) system. This system will collect, analyze, report, and alert on various security activity. All anomalous activity and known bad events, will be sent to the 24x7 Cyber Defense Center personnel responsible to investigate and take action upon those events. The SIEM will analyze events across systems and networks, correlating seemingly-unrelated activities for analysis and response. Additionally, copying logs to the SIEM frequently allows for better forensics than relying on source system logs which may be altered after-the-fact. Log data will be retained for an appropriate period of time to ensure any auditing activities will have sufficient data to perform a satisfactory review.

Q. DOES PROACTIVE CHANGE MANAGEMENT HAVE A ROLE IN THE DEFENSE OF THE SOLUTION?

A. Yes. In this context "change management" or "change control" is the process used to identify, analyze and approve changes to the technology environment,

before those are implemented. The Company has a robust change process for computer systems, based on ITIL (formerly an acronym for Information Technology Infrastructure Library) that includes not only the steps above, but also creation of business justification, post-implementation testing (PIT) steps, and instructions for backing out a change that fails PIT. This level of rigor helps minimize unintended consequences of changes to software. Without a sufficient level of oversight and change governance, the integrity and security of individual devices, and ultimately the network, could be impacted. The absence of a sufficient level of oversight and change governance could result in the loss of information, disruption of communication, or an impact to the integrity of the data. Therefore, strict adherence to change management will be incorporated into this effort.

Q. PLEASE DESCRIBE HOW THE COMBINATION OF THESE CONTROLS IS APPLIED TO PROTECT DATA FROM THE AMI METERS

A. The Company intends to secure the smart meter by applying "defense in depth." The meter will be physically sealed and monitored to detect tampering. Meter communications will be encrypted to protect the privacy of our customers. Communications travel on the company's private FAN, hopping between authorized devices that have been registered onto the network. Firewalls control the information that travels in and out of the corporate network. The head-end validates the integrity of the data received.

The Company will actively monitor the communications path between the meters and the company data centers to promptly detect and respond to any anomalous activity. Additional monitoring of the head end system will alert the CDC to security events for investigation.

Q. DOES LIFE-CYCLE MANAGEMENT OF DEVICES HAVE A ROLE IN THE COMPANY'S IMPLEMENTATION OF CYBER SECURITY BEST PRACTICES?

A. Yes. The overall success of cyber security within the intelligent electric distribution network will be dependent upon the life-cycle management process of the equipment that makes up this network. Safeguarding this equipment is dependent upon an accurate inventory of all devices that enable this solution. Furthermore, each device must have a known and valid configuration.

Q. HOW WOULD LIFE-CYCLE MANAGEMENT OF DEVICES BE ACCOMPLISHED?

A. Life cycle management starts with selection and acquisition of devices. Cyber security requirements are provided to vendors of meters and all new distribution field devices and compliance to those requirements factors into the selection process. Additionally, the internal security practices of each vendor that will have access to Xcel Energy data is evaluated. Gaps are communicated to the vendor and remediation is requested. Xcel Energy leaders consider these gaps, or security risks, when making their purchasing decisions.

Assets are inventoried prior to deployment. In addition to operational maintenance, security patching is done when required, and approved configuration records updated. Once an asset has reached the end of its useful life, confidential and confidential restricted information is removed and the asset is destroyed.

Q. DO MONITORING AND ANALYSIS OF COMMUNICATIONS HAVE A ROLE IN THE COMPANY'S IMPLEMENTATION OF CYBER SECURITY BEST PRACTICES?

A. Yes. Continuous monitoring of this solution is important to ensure the integrity and security of the system. As conditions change within the distribution network, Distribution Operators will closely monitor the values to ensure continuous and reliable delivery of electricity to our consumers. So too must the cyber security personnel provide continuous monitoring of the systems and the communications that support the continuous and reliable operations of the equipment responsible for the delivery of electricity.

Q. WOULD OTHER ITEMS NEED TO BE MONITORED AND EVALUATED TO ENSURE THE SECURITY OF THE INTELLIGENT ELECTRIC DISTRIBUTION SYSTEM?

A. Yes. Data integrity is also an item that must be monitored and evaluated. By confirming the returned data values fall within an expected range, the integrity of the distribution control system can be maintained. Injecting bad data is a mechanism used to compromise the integrity and availability of a system without actually taking direct control over it. This would be a potential indicator of compromise to the intelligent electric distribution network and an immediate investigation would need to commence to verify whether a real attack is occurring or has occurred.

Q. HOW HAS THE COMPANY APPLIED LEARNINGS FROM OTHER UTILITIES OR BUSINESSES THAT HAVE FACED CYBER SECURITY CHALLENGES?

A. Recognizing the increased security risk of deploying intelligent devices to facilitate customer and distribution grid operations, the Company through the ESS Threat and Vulnerability Management (TVM) group has analyzed known distribution system cyber attacks, including those in Ukraine. Through

analysis including a tabletop walk through of the Ukraine attacks, the Company has evaluated existing controls that would avert such attacks. TVM continues to monitor intelligence sources and work with our partners and other utilities to understand and anticipate threats to the Company.

6. Cyber Security Costs

Q. DO YOU HAVE ANY SEPARATE COST ESTIMATES FOR THE IMPLEMENTATION OF CYBER SECURITY FOR THE AGIS INITIATIVE?

A. No, there is not a separate cost estimate for overall cyber security. Cyber security costs are part of the application development and integration efforts described above, as they permeate all aspects of this work. As such, the costs estimates provided in Section D for the IT integration of AGIS components include costs for deployment of cyber security as part of the AGIS initiative. However, the budget does include a separate line item for project management with respect to cyber security. I discuss security project management costs in Section D, and Mr. Gersack addresses overall program management costs for AGIS implementation in his testimony.

7. Cyber Security Summary

Q. WHAT ARE YOUR CONCLUSIONS REGARDING CYBER SECURITY WITH RESPECT TO AGIS?

A. AGIS will bring exciting benefits to our customers, but those benefits are achievable only with a robust interconnected network and flow of data that present cybersecurity challenges. The controls I discussed above will help protect both the consumer and the distribution network, detect attacks or attempted compromise occurrences, and respond in a timely manner to limit and/or prevent impact to the consumers or to the Company. These cyber

security controls are seen as a best practice, and align with the Cyber Security Framework (CSF) to Identify, Detect, Protect, Respond and Recover to known and unknown risks.

E. AGIS Components, Implementation, and IT Costs

1. Introduction and Overview

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?

A. In this section, I discuss each of the AGIS components and provide detailed support for the recovery of forecasted capital additions and O&M costs for the Business Systems organization related to the AGIS initiative for the MYRP period 2020 through 2022. I also provide support for the Company's request for certification of the AGIS projects, as presented by Mr. Gersack, to allow the Company the opportunity to request recovery of costs for 2023 and beyond in a later rider filing. Mr. Gersack provides an overview of and policy support for the Company's AGIS initiative and certain Program Management costs, and Ms. Bloch provides support for the AGIS costs related to the Distribution organization.

Q. DO YOU ALSO DISCUSS BENEFITS OF AGIS FROM A BUSINESS SYSTEMS PERSPECTIVE?

A. No. IT by itself does not provide isolated benefits without the implementation of the Distribution aspects of the AGIS projects, but the benefits of AGIS could not be achieved without IT integration. Mr. Gersack, Ms. Bloch, and Mr. Cardenas are the primary witnesses describing the customer benefits driven by AGIS.

Q. CAN YOU DESCRIBE IN MORE DETAIL HOW THE COMPANY IS SUPPORTING ITS AGIS COSTS IN THIS RATE CASE FILING?

A. Yes. AGIS costs are incurred by both Distribution and the Business Systems (IT) organization for each of the AGIS programs. There are IT components for each of the AGIS components (ADMS, AMI, FAN, FLISR, and IVVO). Business Systems is responsible for all IT components of the program. This includes the ADMS and AMI software installation and interface development to all appropriate legacy applications. In addition, IT is primarily responsible for the development and installation of the FAN components (with a portion of the installation to be completed by Distribution Operations), and network connectivity from the meters to all software components. I provide the primary support for the costs and processes for these components of these AGIS programs.

ADMS was previously certified by the Commission and costs were approved for recovery under the Transmission Cost Recovery (TCR) Rider. The Company proposes to continue recovery of ADMS costs via the TCR Rider. For 2020 and going forward, the Company proposes to recover the costs associated with the Time of Use (TOU) pilot as part of this rate case. I discuss the Business Systems support for these costs below.

Ms. Bloch provides the primary support for the costs and implementation for programs and components where Distribution has primary responsibility, including the GIS data collection effort for ADMS, the AMI meters, and installation of pole-mounted FAN devices, the advanced applications utilizing intelligent field devices (*i.e.*, FLISR and IVVO), and additional elements of the AGIS implementation process.

Q. PLEASE SUMMARIZE THE AGIS COMPONENTS FOR WHICH THE COMPANY IS SEEKING RECOVERY, ALONG WITH THE RESPONSIBLE COMPANY WITNESS.

A. Ms. Bloch and I support the costs of the AGIS components as follows:

Table 24: AGIS Program Witness Support

AGIS Program	Component	Witness
AMI	IT Integration and head end application	Harkness Direct, Section V(E)(3)
	Meters and deployment	Bloch Direct, Section V(D)
FAN	IT Integration and deployment	Harkness Direct, Section V(E)(4)
	Installation of pole-mounted devices	Bloch Direct, Section V(E)
FLISR	System development	Harkness Direct, Section V(E)(5)
	Advanced application and field devices	Bloch Direct, Section V(F)
IVVO	System development	Harkness Direct, Section V(E)(6)
	Advanced application and field devices	Bloch Direct, Section V(G)

Q. HOW ARE AGIS COSTS PRESENTED IN YOUR TESTIMONY?

A. Whereas the costs in Sections I-IV of my Direct Testimony present costs at the NSPM Total Company electric level (as usual for Business Systems costs), the AGIS capital additions presented in my testimony are provided at the Minnesota electric jurisdiction level. AGIS capital expenditures and O&M costs are stated at the NSPM Total Company electric level. The reason for this difference within my testimony is that we wanted to present AGIS costs consistently across the various pieces of AGIS testimony. Additionally, the capital expenditures and O&M costs over the longer term that I present in my

testimony are consistent with the AGIS cost-benefit analysis.[4] For clarity in this section, all cost tables state how the specific costs are being presented.

Q. WHAT TYPES OF IT CAPITAL COSTS IS BUSINESS SYSTEMS INCURRING TO IMPLEMENT THE AGIS PROJECTS?

A. The types of IT capital costs being incurred by Business Systems include project implementation costs related to software licensing, hardware (servers and network), and implementation labor. Labor costs include requirement specification, design, application configuration, screen display development, network security configuration, testing, and implementation.

Q. WHAT ARE THE AGIS-RELATED IT CAPITAL COSTS YOU ARE SUPPORTING IN THIS CASE?

A. The Business Systems AGIS IT capital additions I am supporting for the MYRP are shown in the following table.

Table 25

AGIS Capital Additions – Business Systems- State of MN Electric Jurisdiction (Includes AFUDC) (Dollars in Millions)			
AGIS Program	2020	2021	2022
AMI	$14.2	$5.7	$8.8
FAN	$5.4	$15.9	$42.0
FLISR	$0.3	$0.4	$0.6
IVVO	$0.0	$1.7	$1.9
Total	**$19.9**	**$23.7**	**$53.4**
There may be differences between the sum of the individual AGIS program amounts and total amounts due to rounding.			

[4] As Company witness Mr. Ravikrishna Duggirala explains, the cost-benefit analysis results are stated in 2019 dollars, on a net present value of revenue requirement basis, whereas I speak to Business Systems' underlying budgets. Mr. Duggirala notes that the CBA is consistent with these budgets, but the numbers are stated on different bases.

Total AGIS IT capital additions are also set forth at the NSPM total Company Electric level in Exhibit___(DCH-1), Schedule 2 to my Direct Testimony.[5] I provide additional details and support for the IT capital costs below, organized by AGIS component.

For the years beyond 2020-2022, I discuss at a higher level the anticipated work to be done and the reasonableness or underlying assumptions for Integrated Distribution Plan (IDP) and cost-benefit analysis (CBA) purposes. In this way, I provide support for both the rate case and IDP requirements, as they are heavily interwoven. Exhibit___(DCH-1), Schedules 8, 9, and 10 to my Direct Testimony also includes currently anticipated expenditures in our cost benefit analysis beyond 2022.

Q. WHAT TYPES OF IT O&M COSTS IS BUSINESS SYSTEMS INCURRING TO IMPLEMENT THE AGIS PROJECTS?

A. The types of O&M costs Business Systems is incurring and expects to incur for AGIS include hardware support, data storage, annual software maintenance, labor for software support, and application support, which includes ongoing testing, review of processes, application of security patches to respond to evolving threats.

[5] Schedule 2 shows all AGIS additions, including ADMS, which was previously approved with costs currently being recovered under the TCR Rider.

Q. WHAT ARE THE IT O&M BUSINESS SYSTEMS COSTS FOR AGIS IMPLEMENTATION THAT ARE INCLUDED IN THE COST OF SERVICE IN THIS CASE?

A. The forecasted AGIS O&M expenses for Business Systems are shown in the table below.

Table 26

AGIS O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)			
AGIS Program	2020	2021	2022
AMI	$4.2	$13.1	$9.1
FAN	$0.0	$2.1	$1.1
FLISR	$0.0	$0.0	$0.0
IVVO	$0.0	$0.0	$0.0
Total	**$4.3**	**$15.3**	**$10.2**
There may be differences between the sum of the individual AGIS program amounts and total amounts due to rounding.			

These O&M costs are also set forth in Exhibit___(DCH-1), Schedule 3 to my Direct Testimony,[6] along with currently anticipated costs beyond 2022 for CBA purposes. I provide additional details and support for the IT O&M costs below, organized by AGIS component.

[6] Schedule 2 shows all AGIS additions, including ADMS, which was previously approved with costs currently being recovered under the TCR Rider.

Q. TO WHAT EXTENT ARE THE IT CAPITAL COSTS PRESENTED ABOVE CONSISTENT WITH THE INFORMATION PROVIDED IN THE COMPANY'S TCR RIDER FILINGS AND ITS PRIOR IDP?

A. Project costs in the Company's 2018 IDP Filing were presented at a higher level because the Company was not yet proposing to implement its full AGIS initiative at that time. The TCR filings presented information on only ADMS and the AMI and FAN costs related to the TOU pilot, as those projects were certified to allow the Company to request cost recovery under the TCR. Further, both the TCR filings and the IDP were based on information available at that time, whereas the current rate case and IDP filings present more up-to-date information. Lastly, the Company's plan for components like FLISR incorporated feedback from the Commission, as Ms. Bloch describes in her testimony. This rate case presents the most current information on costs as our planning and data have evolved.

Q. ARE BUSINESS SYSTEMS AGIS CAPITAL AND O&M COSTS INCLUDED IN THE CBA BEYOND THE NEXT SEVERAL YEARS MEANT TO BE "RATE CASE QUALITY" NUMBERS?

A. While these cost assumptions are reasonable and well-supported based on the information available today, they are not intended to reflect more specific budgets as in a standard rate case budget. Rather, they are subject to refinement like all costs that will be incurred several years into the future. This is consistent with my experience, and with most cost projections that represent work to be completed in the longer-term. However, I believe these cost estimates are reasonable, and I explain the support for them in this section of my testimony. I provide the overall capital expenditures and O&M

costs over the AGIS implementation period 2020 through 2029 in Section 6 below.

Q. WHAT SORT OF GOVERNANCE IS IN PLACE TO ENSURE THE AGIS PROJECTS ARE COST EFFECTIVE?

A. Business Systems employs standard processes and procedures for selecting technologies to be deployed in the Company's environment as well as the execution of large capital projects. These include long established processes in the area of competitive vendor sourcing and pricing negotiations as well as technology architectural governance processes, which are discussed earlier in Section III.B of my Direct Testimony. I also discuss sourcing considerations specific to the AGIS initiative below. In addition, the AGIS program has a dedicated Project Management Office to govern all areas within the program. Mr. Gersack discusses overall AGIS governance through the Project Management Office in his testimony. The robust governance processes for the AGIS program and Business Systems ensure fulfillment of requirements and cost effective delivery.

2. Grid Modernization Efforts to Date

Q. PLEASE PROVIDE ADDITIONAL DETAILS REGARDING THE COMMISSION'S PRIOR CERTIFICATION OF GRID MODERNIZATION INVESTMENTS FOR THE COMPANY.

A. Two advanced grid investments have been submitted for certification in biennial grid modernization reports and approved by the Commission. Specifically, in the 2015 Biennial Grid Modernization Report, the Company outlined the ADMS initiative, which was submitted for certification and subsequently approved on June 28, 2016. In the 2017 Biennial Grid Modernization Report, the Company outlined its AMI and Time of Use

(TOU) pilot program and certification was approved in the Commission's August 7, 2018 Order.

a. ADMS

Q. HAS BUSINESS SYSTEMS ALREADY PERFORMED WORK RELATED TO ADMS IMPLEMENTATION?

A. Yes. ADMS was certified by the Commission in 2016, and Distribution Operations and Business Systems have conducted their ADMS implementation activities in partnership with each other. As a utility operating in multiple jurisdictions, our enterprise-wide initiatives – like AGIS – are planned at the overall enterprise level. This allows for efficiencies and provides benefits for all our customers. Enterprise-wide planning and implementation strategies consider different timelines for project rollout in different jurisdictions. For ADMS, Business Systems completed installation of the software for Colorado, including the majority of the legacy integrations. For ADMS deployment in Minnesota, dedicated software will be implemented, design and configuration specific to Minnesota will be performed, and testing of the new NSPM environment will be executed.

Q. WHAT IS THE TIMING FOR IMPLEMENTATION OF ADMS IN MINNESOTA?

A. We expect to implement ADMS in the second quarter of 2020.

Q. IS THE COMPANY SEEKING TO RECOVER ANY COSTS RELATED TO ADMS IN THIS RATE CASE?

A. No. The Company has sought recovery for the costs for ADMS in the TCR Rider and proposes to keep ADMS in the TCR through the multi-year rate plan period.

b. TOU Pilot

Q. WHAT IS THE TOU PILOT?

A. The TOU pilot implements new residential time of use rates for select customers in two areas in the Twin Cities metropolitan area, providing customers with pricing specific to the time of day energy is consumed. This pilot requires installation of AMI meters to measure and record customer usage in detailed, time-based formats and requires installation of FAN communication to transmit this data to the Company and customers.

Q. HOW MANY CUSTOMERS ARE PARTICIPATING IN THE TOU PILOT?

A. As part of this pilot, we will deploy approximately 17,500 advanced meters to residential customers in Eden Prairie and Minneapolis. We will also deploy FAN communications to these areas.

Q. HAS BUSINESS SYSTEMS ALREADY PERFORMED WORK RELATED TO THE TOU PILOT?

A. Yes. In 2019, we began the system integration to support deployment of AMI and FAN for the TOU pilot, and the 2019 costs were certified for recovery under the TCR Rider. A description of overall AMI and FAN integration work is described in more detail in Sections 2 and 3 below.

Q. WHAT IS THE TIMING OF IMPLEMENTATION FOR THE TOU PILOT?

A. The TOU pilot is scheduled to launch, with AMI meters functioning and time of use rates available for participating customers in April 2020.

Q. WHAT ADDITIONAL WORK WILL BE NEEDED FROM BUSINESS SYSTEMS BEFORE LAUNCH OF THE PILOT?

A. The AMI and FAN operations will require a head-end system, which was completed in early 2019. Installation and configuration of both FAN and AMI components in connection with the TOU pilot will be completed in early 2020. This provides foundational two-way communication and control for the advanced meters. Specific system interfaces require significant enhancement to properly communicate, collect, and process the new information to and from these components to support the objectives in the Commission Order approving the pilot. Business Systems will also enable enhanced data availability through the customer portal and provide for enhanced Customer Care and Distribution functionality to fully implement the TOU pilot for participating customers.

Q. IS THE COMPANY SEEKING TO RECOVER ANY COSTS RELATED TO THE TOU PILOT IN THIS RATE CASE?

A. Yes. For 2020 and going forward, the Company proposes to recover the costs associated with the TOU pilot as part of this rate case. The Business Systems costs included in the MYRP period are shown in the table below.

Table 27

Residential TOU Pilot – Business Systems State of MN Electric Jurisdiction (Dollars in Millions)			
TOU Pilot – Business Systems	2020	2021	2022
Capital Additions	$4.1	$0.0	$0.0
O&M Expense	$4.2	$0.7	$0.1

As discussed in the Company's initial petition requesting approval of the TOU pilot,[7] the AMI head end software and associated integrations to support the pilot are enterprise-wide software assets developed initially for AMI implementation in Colorado. Thus for Business Systems, the implementation costs shown above reflect the estimated carrying costs associated with the asset allocated to NSPM, reflecting implementation of the TOU pilot.

I note that the residential TOU pilot costs are part of the Company's overall AGIS initiative (specific to AMI and the FAN). The TOU costs reflect the estimated portion of the total AMI component that are necessary to implement the residential TOU pilot. In her testimony, Ms. Bloch provides the Distribution costs necessary to implement the TOU pilot.

3. AMI

a. AMI Overview

Q. WHAT IS AMI?

A. AMI is a system of advanced meters, communications networks, and data management systems that enable two-way communication between utilities' business and operational data systems and meters, enabling added benefits for customers and the utility. The current metering system uses a one-way communication technology in the collection of meter data and events for subsequent download to the Company's business and customer billing systems (with limited, manual two-way communication capability). AMI meters are able to measure and transmit voltage, current, and power quality data and can act as a "meter as a sensor," providing timely monitoring that has may use

[7] See Docket No. E002/M-17-775.

cases for customers and business operations. AMI is a foundational element of the AGIS initiative because it provides a central source of information that interact with many of the other components of the AGIS initiative. Ms. Bloch provides detailed discussion of AMI and addresses the filing requirements related to AMI in her testimony.

Q. WHY DOES AMI REQUIRE INTEGRATION?

A. Because AMI consists of both software and hardware and works with other Company systems, information technology integration is key to the success of AMI.

Q. HOW WILL BUSINESS SYSTEMS PARTICIPATE IN THE AMI DEPLOYMENT?

A. The advanced meters will be integrated with the Company's IT systems. AMI is data intensive with meter readings, energy usage interval profiles, power outage and restoration events, power quality information and other data transmitted and collected frequently. All data to/from the advanced meters is transmitted to the AMI head-end application and, depending on what the data is, needs to be integrated and made available to the applicable business system in an accurate and timely manner.

The Company has already installed the AMI software head end for use in Colorado and for the Minnesota TOU pilot. This same software will be used and expanded upon in Minnesota for full rollout. Many of the integrations already built will be leveraged in Minnesota, and any newly required interfaces with legacy systems will be identified and developed as required to meet unique state needs.

b. AMI Integration

Q. WHAT SYSTEMS WILL BE INTEGRATED WITH AMI?

A. The major systems to be integrated with AMI are:

- ADMS;
- Customer Resource System (CRS);
- SAP;
- Field Deployment Manager;
- Meter Installation Vendor;
- Network Management System (NMS);
- Distributed Intelligence;
- Meter Asset Lifecycle Management System;
- Meter Data Management (MDM)
- Customer portal and new initiatives; and
- the FAN.

In addition, these applications will share data with other applications, such as the Company's Data Warehouse, as well as any new operational reporting solutions.

I note that the estimated work has been based upon, wherever possible, the integration work that has been completed on an enterprise-wide basis and may have been used previously to incorporate requirements in other jurisdictions. Additionally, we will need to ensure compliance with Minnesota requirements that each integration has appropriate processing capacity to additionally support Minnesota requirements.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH ADMS.

A. As previously noted, ADMS will provide an integrated operating and decision software support system to assist control room, field personnel, and engineers with the monitoring, control and optimization of the electric distribution system. ADMS will use the AMI data to deliver automated grid capabilities, such as FLISR and IVVO. AMI will provide the ADMS with timely real and reactive power measurement data that will be used in load flow and IVVO calculations. AMI meters will also provide voltage measurements at various points on the distribution system to support IVVO calculations. Additionally, advanced meters will report a power-out or "last gasp" event to the AMI head-end application and report a power-on event when power is restored. "Last gasp" is defined as the final message transmitted by the meter upon detection of an outage. This information will flow from the head-end application into ADMS, improving the calculations for the FLISR application. This is an enterprise-wide integration that will used or significantly enhanced, as necessary, to support Minnesota requirements.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH CRS.

A. CRS provides capabilities for customer service, billing, service orders, and payments. CRS is currently integrated with the Meter Asset Lifecycle Management System and Meter Data Management (MDM) System. AMI head-end integration with the CRS will allow the Company to streamline multiple processes. As an example of a process improvement resulting from integrating the AMI head-end with the CRS, we will be able to obtain a meter reading to begin or end a billing cycle when a customer moves into or out of a premise without a visit to the customer's premise. As another example, when a disconnected customer pays their bill, an order generated in the CRS can be

sent to the AMI head-end to automatically (and more quickly) reconnect the service. Disconnect and reconnect processes today are manual processes that require a person to physically visit the customer's site; while we would need to make a filing with the Commission to ensure permissions to utilize disconnect an reconnect (as Company witness Mr. Cardenas notes), these capabilities can be made available. This is an enterprise-wide integration that will be used or significantly enhanced, as necessary, to support Minnesota requirements.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH SAP.

A. SAP manages the general ledger and work and asset management activities across the Xcel Energy enterprise, which were implemented between 2015 and 2017 as part of our Productivity Through Technology (PTT) initiative. SAP is an Xcel Energy-wide platform with financial management and asset management capabilities throughout the enterprise. As a result, two-way integration is required to support business processes for Xcel Energy personnel and customers. Through SAP, customer or field operations work orders initiated from service orders are scheduled, dispatched, and updated. These updates provide information that is synchronized back to the service order/process tracking jobs in CRS so that up-to-date information related to work orders is available to representatives and customers. Grid information will need to be integrated with SAP across the enterprise, to support Minnesota requirements.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH THE FIELD DEPLOYMENT MANAGER.

A. The Field Deployment Manager is a new application that supports the field technicians work and meter communication with the advanced meters. FDM

accepts meter reading requests from a customer system, converts and uses the data to load handhelds with assignments to be processed during this cycle, uploads the handhelds when the meter reader has completed the route, update the route data file, produces reports and performance tracking, and supplies meter reading information to the customer system for billing. As a new application for Xcel Energy, this integration is not currently constructed, and will go through standard software lifecycle steps to be implemented to support Minnesota.

Q. PLEASE DESCRIBE THE INTEGRATION OF THE COMPANY'S SYSTEMS WITH THE AMI METER INSTALLATION VENDOR'S SYSTEMS.

A. This is a new integration that is required to coordinate the logistics with the third-party resource provider that is performing new advanced meter installations. The vendor will be utilizing its proprietary work order management system to manage their activities, and daily synchronization of information with Xcel Energy's systems needs to occur in order to remain track and manage activities supporting Xcel Energy customers throughout the deployment. Information that needs to be synchronized between Xcel Energy and the meter installation vendor includes customer contacts and responses, installation/removal of AMI meters, cancellation/updating of orders, disposed meters, and look ahead data. This integration will keep Xcel Energy systems that support personnel and customers reflective of the work planned and in-process. As a new integration for Xcel Energy, this will require standard software lifecycle maintenance and upgrades to be implemented as needed to support our Minnesota system and customers.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH THE NMS.

A. NMS is the vendor supported application for the Company's Outage Management System (OMS). OMS is the enterprise solution for the electric trouble distribution control centers outage event management. OMS is critical to outage restoration and generally critical to the Company's operations. This would be a new integration for Xcel Energy, requiring standard software lifecycle management. The Company believes that AMI meter events and functionality can be utilized to better identify and manage service outages and restoration activity, and the volume of data available from AMI systems must be pre-processed to produce timely, accurate, consumable, and actionable information for NMS. Such an integration of AMI and NMS would improve customer experiences during service outages by making the associated event details proactively available to personnel managing, communicating and making decisions during service restoration.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH THE DISTRIBUTED INTELLIGENCE PLATFORM.

A. Distributed Intelligence is a processing capability within advanced meters that is controlled by a new meter application environment that is being deployed to support operational and customer application subscriptions. In other words, this Distributed Intelligence capability allows for the installation of applications on the meter – similar to how applications are installed on a smart phone. These applications may be customer-facing, meaning the customer directly interacts with them or grid-facing, meaning Xcel Energy interacts with the applications. As discussed in Mr. Gersack's testimony, the Company anticipates deploying some applications in the near term, but broader deployment will evolve over time.

On an end-to-end basis, the Distributed Intelligence environment consists of application platform, store, gateway, service bus, security manager, hub and analytics components. While the full scope of Distributed Intelligence capabilities goes beyond initial AMI deployment as described by Ms. Bloch, this environment must be at least minimally integrated in so that Xcel Energy meters can be properly and securely registered and grouped to support the deployment, administration, management and utilization of meter-based applications and services, within Company processes that are yet to be defined. The AMI program will test and validate the expected functionality of new advanced meter processing and application environment. Mr. Gersack and Ms. Bloch provide additional Distributed Intelligence details in their testimony.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH THE METER ASSET LIFECYCLE MANAGEMENT SYSTEM.

A. The Meter Asset Lifecycle Management System manages the entire life cycle of serialized metering devices, including purchasing, testing, field installation location, field removal, and retirement of the asset. The Meter Asset Lifecycle Management System is currently integrated with the MDM System and CRS. The integration of the AMI head-end with the Meter Asset Lifecycle Management System will allow it to remain as the Company's primary source of location information and attributes for serialized metering devices. The AMI head-end will receive the meter location and attribute information to enable provisioning of the meter, understand its location, and obtain data from the meter.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH THE METER DATA MANAGEMENT SYSTEM.

A. The Meter Data Management System provides capabilities to validate, edit, and estimate meter readings and manages events from the meter, such as power outages and tampering. The MDM will also assist in facilitating communication to, and receiving data from, the AMI head-end. The MDM is currently integrated with the Meter Asset Lifecycle Management System and CRS. The MDM will serve as the central repository for the reading data. The MDM will also validate the meter data and export it for use in billing, customer viewing, and analytics.

AMI significantly increases the number of meters and amount of data loaded to our MDM. Xcel Energy recently completed an evaluation of the current MDM system application and infrastructure and determined that an entirely new solution is needed to fulfill the requirements for AMI. The current MDM system application is approaching end of life and does not have the capacity and security elements required to support AMI, including the volume and technical capabilities needed for the Company-wide deployment of advanced meters. A new MDM solution will be utilized enterprise-wide across Xcel Energy operating companies and we are in the process of developing the full scope of work, total costs, and determining the operating company allocation. Ultimately, the MDM solution will support the security, functionality, scalability, and performance requirements of AMI meter data management.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH THE CUSTOMER PORTAL AND NEW INITIATIVES.

A. The customer portal (the current version is available on the Xcel Energy website and is known by customers as MyAccount) is used by customers to obtain account information, track energy usage, view billing history, pay bills, and sign up for notifications. AMI data from field devices (i.e., the customer's meter) will move through the AMI head-end, and be integrated with other customer information, to the customer portal, where customers will have the ability to see more granular meter reading data than they see today.

After AMI deployment, we expect to begin rolling out new products and services to customers, some of which may require future filings with the Commission to determine details. These may include high bill alerts, personalized recommendations on energy usage, disaggregation of usage, and the capability to provide data to a customer's Home Area Network (HAN) and through the Company's utilization of Green Button Connect My Data (GB CMD). Ms. Bloch provides an introduction to the HAN capabilities, while Mr. Gersack provides additional information about the customer experience benefits of the advanced meter.

Q. PLEASE DESCRIBE THE INTEGRATION OF AMI WITH THE FAN.

A. The AMI meter's two-way communication module is a component of the mesh network layer of the FAN. The meter's communication module retrieves meter data that is stored within the meter as prescribed by ANSI C12.19 meter table implementation standards. The radio frequency communications modules in the meters may also act as a repeater for other mesh network devices, enabling two-way communication between the meters

and the mesh network. This function has the benefit of increased reliability of communication between the AMI meters and the head-end application. In limited circumstances where deployment of the WiSUN mesh network is not practical (such as remote locations on the edge of the Company's distribution system), meter data may be transmitted over the FAN via public cellular or other wireless technologies.

Q. YOU MENTIONED THAT THE APPLICATIONS DISCUSSED ABOVE WILL SHARE DATA WITH THE COMPANY'S DATA WAREHOUSE AND OPERATIONAL REPORTING SOLUTIONS. PLEASE PROVIDE ADDITIONAL DETAILS.

A. The existing Data Warehouse is used to consolidate data from separate systems of record to facilitate efficient generation of reports and perform analysis of the data. The operational reporting solutions are expected to receive data from the AMI head-end, Meter Data Management System, and the Customer Information System. The Distribution Analytics Software is expected to use the data to perform analytics to identify trends for such items as reverse flow, tampering, load side voltage, and temperature. Once an integration solution is defined, integration details will be defined.

Q. WHAT ARE THE IMPACTS IF THE COMPANY DOES NOT MAKE THE INVESTMENTS NECESSARY TO INTEGRATE AGIS COMPONENTS WITH BACK-OFFICE APPLICATIONS?

A. Without integrating the technical components of the AGIS initiative with other Company applications, the Company and customers will not be able to utilize the benefits and capabilities of the new AGIS components. Each application provides a new capability and benefit to the Company. Without integration, existing applications would not be able to request data from new

field devices, such as AMI meters, and the data provided from these new field devices would not be able to be communicated, stored, or analyzed by our existing applications. In addition, a lack of integration would cause many processes to be manual, and would not allow the ability to make decisions based on recent data collected, all of which will reduce the benefits of these technologies, especially AMI.

Q. OTHER THAN INTEGRATION, WHAT OTHER WORK WILL BUSINESS SYSTEMS PERFORM?

A. Beyond integrating systems, there are additional Business Systems work areas that are included in the scope. Ensuring that the system capacity and resiliency are installed and configured to scale to system levels inclusive of the Minnesota customers is one important work area. In addition, areas of functionality will include software configurations to support Minnesota requirements (*e.g.* rates), and system lifecycle work for meter data management, outage event processing, operational reporting, regional field deployment management, and Customer Care services to support Xcel Energy's Minnesota customers.

Q. WILL THE COMPANY PERFORM THE SYSTEM INTEGRATION WITH EXISTING RESOURCES?

A. Due to the large volume of work expected to occur over the integration period, the Company will need to hire third-party firms to supplement our existing IT resources. Estimates of costs for vendor IT work associated with AMI are part of our AGIS projects in this case, with IT cost estimates described in Section D below.

Q. WHAT WORK IS BUSINESS SYSTEMS UNDERTAKING TO INTEGRATE THE AMI PROJECT?

A. The specific functions Business Systems provides for AMI include:

- Leading the design of the overall system and components.
- Procurement and installation of all hardware components that will run the software.
- Procurement of the software.
- Configuration of the software and hardware.
- Designing, procuring and installation of the necessary additional hardware and software referred to as the "head-end" application that reads the meters and other field devices in the AMI solution and monitors and manages the network and attached devices. System performance and capacity must support the expansion of processing and storage requirements to support Minnesota services. The head-end application is used by the other Xcel Energy operating companies as they deploy advanced meters.
- Enhancement, construction, configuration, and installation of any required interfaces throughout all applications involved in the AMI solution to support Minnesota requirements.
- Designing and integration of security into all aspects of the AMI solution;
- Thorough unit, system, integration, and end-to-end and regression testing of the AMI solution.
- User Acceptance Testing (UAT) with the Distribution, Customer Care and Customer Solutions business resources.

- Establishment of a full ongoing support structure including process and operational requirements.

Q. HAS BUSINESS SYSTEMS ALREADY PERFORMED WORK RELATED TO AMI IMPLEMENTATION?

A. Yes. Starting in 2015, on an enterprise-wide basis, Business Systems and Distribution Operations jointly initiated a systematic approach for selecting vendors for the AMI software and legacy system integrations. Business Systems and Distribution participated in contract awards (resulting from RFP processes) for a vendor to supply the software and network WiSUN solution for AMI. The WiSUN is the mesh network portion of the FAN that will utilize the advanced meters' communications modules.

In addition, Business Systems has already completed limited AMI implementation in connection with the TOU pilot in Minnesota, and has already completed initial work for full AMI rollout in Colorado. For example, in the summer of 2019, the first set-up of legacy interface integrations were successfully implemented to support AMI meter deployments in Colorado. Full AMI implementation in Minnesota will expand on and enhance these capabilities to meet requirements for deployment in Minnesota.

Q. PLEASE DESCRIBE THE WORK BUSINESS SYSTEMS WILL UNDERTAKE IN 2020, 2021, AND 2022 FOR AMI IMPLEMENTATION.

A. As discussed by Ms. Bloch, the Company plans to deploy approximately 1.3 million AMI meters throughout our Minnesota service territory as part of the AGIS initiative starting in the fourth quarter of 2021. This deployment builds off the AMI work already completed. By the end of 2023, we anticipate that

over 90 percent of the meter installations will be complete. The locations and timing of AMI meter deployment will be coordinated with the network communications installations of the FAN components.

During this period, the Business Systems organization will engage in additional interface development, scaling activities, and network communications activities. This will include augmenting legacy integrations with the AMI software based on specific requirements that will be determined once full AMI implementation for our Minnesota customers is approved. This will ensure the functionality and capacity of AMI software and that the integrated legacy systems meet the scalability needs.

c. AMI Costs

Q. WHAT BUSINESS SYSTEM CAPITAL ADDITIONS AND O&M COSTS ARE NECESSARY FOR IT INTEGRATION FOR AMI DURING THE TERM OF THE MYRP IN THIS CASE?

A. The tables below provide the capital additions and O&M costs for AMI IT capacity and integration for 2020 through 2022.

Table 28

AMI Capital Additions – Business Systems State of MN Electric Jurisdiction (Includes AFUDC) (Dollars in Millions)			
AGIS Program	2020	2021	2022
AMI	$14.2	$5.7	$8.8

Table 29

AMI O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)			
AGIS Program	2020	2021	2022
AMI	$4.2	$13.1	$9.1

Q. WAS BUSINESS SYSTEMS PRIMARILY RESPONSIBLE FOR DEVELOPING THE FORECAST FOR AMI?

A. Business Systems is responsible for developing the forecasts for the head-end application, other software and hardware to support AMI data processing, and integrations required by those technologies. Therefore, I describe the forecast development process for these aspects in more detail in my Direct Testimony. Ms. Bloch addresses the forecast for the meters themselves.

Q. PLEASE PROVIDE AN OVERVIEW OF THE PROCESS FOR DEVELOPING THE AMI IT FORECAST.

A. Beginning in 2015, a series of RFPs was conducted to determine the most appropriate AMI solution for the Company on enterprise-wide basis. Business Systems began looking specifically at vendors to provide the WiSUN mesh network solution for AMI, which includes the AMI head-end software. The Company received responses from industry leaders as part of its competitive bidding process. In 2017, as a result of that process, Silver Springs Inc. (which was purchased by Itron shortly after contract signing) was selected to provide the head-end software and WiSUN mesh solution for AMI. (The WiSUN equipment and field deployment are addressed in detail in the following section on the FAN.) This selection was based on optimal pricing, strategic fit, and Silver Springs' (now Itron) industry experience. This

effort was benchmarked and reviewed with other utilities and industry research organizations such as EPRI. I discuss this RFP process further below. Ms. Bloch discusses the Itron selection for AMI meters further in her Direct Testimony.

In addition, beginning in 2017 and as AGIS details were developed, Business Systems worked to leverage established relationships with our existing vendors to obtain optimal pricing for the legacy integration pieces for AGIS implementation.

An additional competitive bid process was completed in 2018 to select a vendor partner for all AGIS program testing on an enterprise-wide basis. Accenture was selected for this work, which is described further below. I note that while I include discussion of this competitive bid and vendor section process here, these testing costs are not all included in the AMI budget but instead are allocated across the individual AGIS component budgets.

In 2019, we conducted an RFI process to select a vendor to provide meter data management software. Cost estimates for this component in our AGIS budget forecast are based on a detailed market analysis, and costs will be finalized once contract negotiations with the vendor are concluded. Also in progress is vendor selection for an operational reporting solution for AMI.

A detailed project estimate for the AMI head-end, mesh network solution, and IT integration was created from the pricing and contract information discussed above, as well as the incremental hardware and labor necessary to support overall AMI implementation. I discuss the RFP and vendor selection

processes in further detail below. For some of the cost estimates, while specific Minnesota requirements are yet to be determined, the work performed in Colorado provides a reasonable point of reference for labor estimates for most general functional and non-functional work areas supporting Minnesota. We incorporated our previous experience into the development of cost estimates for AMI implementation in Minnesota.

(1) AMI Capital Forecast

Q. WHAT ARE THE PRIMARY COMPONENTS OF THE AMI IT CAPITAL FORECAST?

A. The AMI IT forecast has three key components: (1) hardware, (2) software, and (3) labor.

Q. WHAT HARDWARE IS NEEDED FOR AMI IMPLEMENTATION FOR BUSINESS SYSTEMS?

A. The additional hardware necessary for AMI implementation consists of computing components used for data processing and storage to support AMI services, across all environments that are used in the software lifecycle of a particular service. Examples of environments that may be applicable to a service are production, disaster recovery, development, testing, and quality assurance. The functions that were analyzed within the hardware estimates are to support outage event processing, security, the head-end application, meter data management software, Customer Care support, reporting, database and operational storage, middleware, and field deployment. In other words, due to the increased volume of data and processes necessary to use that data in a meaningful way for our customers and the Company, additional servers with computing and storage capabilities will be needed.

Q. HOW DID THE COMPANY DERIVE THE HARDWARE PORTION OF THE AMI IT FORECAST?

A. Xcel Energy has standards for all hardware that is deployed in our data centers. These standards define hardware for which the Company has industry benchmarked, negotiated pricing. Based on these standards, the hardware estimates were derived utilizing the hardware requirements of the applications(s) and applying standard pricing. Hardware estimates to support the head-end capacity, security services, outage processing, meter data management software, data storage capacity, and interfaces were all developed.

Q. HOW DID THE COMPANY DERIVE THE SOFTWARE PORTION OF THE AMI IT FORECAST?

A. Pricing for the AMI head-end software and mesh solution is provided in the contract with Itron, selected through the RFP process noted above. Software forecasts also include costs based on the other RFPs discussed above that have been completed or are in progress, as well as the vendor selections completed using our standard process. Pricing is consistent with industry benchmarks and our review with other utilities and industry research organizations such as EPRI. These benchmarks drove the negotiations with the selected vendors.

Q. DESCRIBE THE PROCESS USED TO SELECT THE VENDOR FOR THE WISUN MESH SOLUTION FOR THE AMI HEAD-END SOFTWARE.

A. Xcel Energy issued an RFP in 2015 to select a vendor to provide the WiSUN mesh solution for the AMI head-end software. Responses were received from three different companies. Xcel Energy evaluated these vendors and responses on a number of factors including:

- Technical performance;
- Operational performance;
- System long-term survivability;
- Adequacy of security capabilities;
- Warranty and support;
- Manageability with operational model;
- Ability to design mesh systems;
- Ability to implement;
- Ability to meeting scope and schedule;
- Acceptability of business terms and conditions;
- Industry experience;
- Adequacy of support systems; and
- Pricing.

In 2016, Xcel Energy selected Silver Springs (now Itron) and began contract negotiations. Contract negotiations were finalized in late 2016. The details of the contract awarded to Silver Springs (now Itron) included: detailed product (hardware and software) pricing; licensing pricing based on end device counts for many of the software specific applications; optional pricing for a number of potential software solutions; services pricing; and other related parts and services for future potential deployments.

Q. WHY DID XCEL ENERGY SELECT ITRON AS THE VENDOR FOR THE AMI HEAD-END AND MESH SOLUTION?

A. The primary factors in the decision were:

- Favorable pricing;

- Industry experience and track record with other utilities the Company benchmarked against;
- Performance in on-site testing of products against the Company requirements in the RFP;
- Breadth of solution; and
- Interoperability capabilities.

A summary of the RFP selection process and results are provided as Trade Secret Exhibit___(DCH-1), Schedule 11.[8]

Q. CAN YOU PROVIDE ADDITIONAL DETAIL ON HOW BUSINESS SYSTEMS WORKED WITH EXISTING VENDORS ON LEGACY INTEGRATION PIECES FOR AGIS IMPLEMENTATION?

A. Yes. Existing systems such as the Customer Resource System (CRS), Monitoring Device Management System (MDMS), Meter Reading and Acquisition System (MRAS) and Enterprise Service Bus (ESB) have existing support teams that consist of Xcel Energy personnel that are teams of employees and professional service vendors. In the case of the systems I listed, which are strictly representative, there are personnel from Xcel Energy, IBM, Accenture and product vendors that support the IT components of those systems. Integrations with those systems are key to coordinate the processing to/from new AMI systems to keep data and business processes timely, accurate and consistent. The existing support teams were engaged in the AMI delivery because they possess the knowledge of the operational environments to engage in system enhancement planning, design,

[8] The Company's RFPs related to the AGIS projects are provided on the AGIS supporting files compact disk provided with Vol. 2B.

construction, testing and deployment to efficiently meet the requirements of AMI system integration, and ensure that existing operational requirements for those systems remain reliable.

Q. DESCRIBE THE PROCESS USED TO SELECT THE VENDOR FOR OVERALL TESTING OF THE AGIS PROGRAM.

A. Xcel Energy issued an RFP in February 2018 to select a vendor to provide overall testing for the AGIS program on an enterprise-wide basis. The RFP sought a vendor to provide planning and execution of all AGIS testing phases including system acceptance, integration acceptance, performance acceptance, end-to-end and user acceptance testing. Responses were received from three different companies. Xcel Energy evaluated these responses on a number of factors including:

- Approach or methods recommended for testing;
- Environment and release management;
- Resource plan efficiency and effectiveness;
- Situational problem solving; and
- Pricing.

In April 2018, Xcel Energy selected Accenture and began contract negotiations, which were finalized in June 2018.

Q. WHY DID XCEL ENERGY SELECT ACCENTURE AS THE VENDOR FOR OVERALL AGIS PROGRAM TESTING?

A. The primary factors in the decision were:

- Experience delivering similar testing for other utility customers;

- Experience and strength of team members who have previously done this work;
- Strong methodology; and
- Favorable pricing.

Q. PLEASE DESCRIBE THE RFI PROCESS THAT IS CURRENTLY UNDERWAY TO SELECT A VENDOR FOR THE METER DATA MANAGEMENT SOFTWARE.

A. In 2019, we initiated an RFI process to select a vendor to provide meter data management (MDM) software. We evaluated MDM options from three vendors. We selected a vendor based on: simplicity of technical architecture; strong availability commitment; and favorable pricing. Once the vendor was selected, we evaluated three different technology options, and have made a final technology selection. This RFI process was conducted based on our standard processes. We are currently in negotiations with the vendor and expect to complete contract negotiations in 2019.

Q. HOW WERE THE MDM SOFTWARE COST FORECASTS DEVELOPED BASED ON THE RFI PROCESS?

A. Cost estimates for this component in our AGIS budget forecast are based on the vendor quotes received during the RFI process. Costs will be finalized once the vendor negotiations are concluded. While vendor negotiations and deployment methodology are still in process, vendor pricing and product deployment sizings have been provided to allow software, hardware, and labor estimates to be built to support Minnesota.

Q. PLEASE DESCRIBE THE OPERATIONAL REPORTING SOLUTION FOR AMI.

A. The AMI operational reporting solution will support several business use cases to deliver efficient, quality service to customers. Some example areas of operational reporting will include analysis of meter events, data quality, provisioning workflows, diagnostics, service quality and usage, and time-based data correlation and analysis using patterns and types of network and meter attributes. We are currently evaluating options for a reporting solution.

Q. HOW WERE THE REPORTING SOLUTION COSTS FORECASTS DEVELOPED?

A. Cost estimates for this component in AGIS budget forecast are based on vendor quotes we have previously received and will be finalized once vendor contract negotiations are concluded.

Q. HOW DID THE COMPANY DERIVE THE LABOR PORTION OF THE AMI IT FORECAST?

A. Our labor estimates are based on our experience and work that has already been completed for AMI implementation. Business Systems has leveraged spend information to date, for both AMI rollout in Colorado and the limited deployment of AMI in Minnesota to support the TOU pilot, to estimate the future costs associated with full deployment in Minnesota. In addition, we plan to leverage the same expertise and knowledgeable vendor partners to deliver additional capabilities for Minnesota, which will provide cost efficiencies. While specific Minnesota requirements are yet to be determined, the work performed in Colorado provides a reasonable point of reference for labor estimates for most general functional and non-functional work areas supporting Minnesota.

Q. ARE THERE OTHER COSTS INCLUDED IN THE BUSINESS SYSTEMS CAPITAL FORECAST FOR AMI?

A. Yes. Like any other project of this size and scope, there are additional project management costs that are include in the AMI capital forecast. For the Business Systems portion of the AMI budget, these include labor costs for: (1) delivery and execution leadership; (2) testing environment/release management; and (3) security.

Q. HOW DID THE COMPANY DEVELOP THESE PROJECT MANAGEMENT COST FORECASTS?

A. These capital costs were developed using labor estimates for the work necessary to support AMI integration efforts. These costs were derived based on evaluation of prior work performed in Colorado, which provides a reasonable point of reference for labor estimates for most general functional areas supporting Minnesota.

(2) AMI O&M Forecast

Q. WHAT ARE THE PRIMARY COMPONENTS OF BUSINESS SYSTEMS' AMI O&M FORECAST?

A. The primary components of Business Systems AMI O&M costs include: (1) planning phase activities, including scope definition and solution selection; and (2) support activities that will occur after AMI is implemented, including contractor labor, maintenance, and warranty. In other words, these cost forecasts encompass the incremental work that will be necessary related to hardware and software maintenance, licensing, and the other work described above that will be necessary to support the increased data storage and processing related to AMI implementation.

Q. HOW DID BUSINESS SYSTEMS DERIVE THE FORECAST FOR AMI O&M?

A. The AMI O&M forecast was developed based on vendor quotes, existing internal support team estimates of the work required, and industry benchmarking information. Each AGIS component has an internal IT team responsible for project delivery. Our forecasts for labor costs related to AMI are based on estimates from these team members, who have previous experience with similar systems implementations and support models, including AMI implementation in Colorado. I note that there could be future sourcing decisions for different AGIS components as additional requirements are identified. The Company would use its existing sourcing processes to manage additional O&M requirements in a cost-effective manner.

(3) AMI Contingency

Q. DO THE BUSINESS SYSTEMS AMI FORECASTS INCLUDE CONTINGENCY AMOUNTS?

A. Yes. Using contingencies is consistent with project planning practices, especially for large projects that implement new technologies and require major changes to enterprise IT systems. We believe it is appropriate to include a contingency amount at this stage given that the project will be implemented over multiple years (2021-2024), as well as the complexity, size, and integrated nature of the project – with integration required for both new and legacy systems. Mr. Gersack discusses the overall AGIS project contingencies in his testimony.

Q. WHAT ARE THE BUSINESS SYSTEMS CONTINGENCIES FOR AMI?

A. The Business Systems AMI budget forecast for the period 2020-2025 includes capital contingency amounts of approximately 37 percent.

Q. CAN YOU PROVIDE MORE INFORMATION ABOUT THE BUSINESS SYSTEMS CONTINGENCY ASSOCIATED WITH AMI?

A. Yes. Due to the integrated nature of deployment and implementation of AMI and the FAN, several reasons for including contingency amounts in the AMI budget are applicable to the FAN as well. While the FAN budget is discussed separately in the following section, I address the budget contingencies overall here to avoid duplication.

First, budget contingency amounts are appropriate due to the scale of the deployment and the volume of data that will be handled as a result of AMI implementation. As discussed above, the volume of data provided by AMI metering is orders of magnitude larger than our current metering system provides. While our project plans are appropriate with respect to the IT architecture, software, hardware, and integrations necessary to manage and use this data, additional work may be required as we cannot replicate in a test environment what will actually occur during full roll out.

Further, as we begin AMI deployment and throughout the installation phase, we will be running two metering systems simultaneously. We have planned for this, as AMI meters will not be installed for all customers until 2024. However, some level of contingency is needed to ensure that we can address any issues that arise as AMI implementation begins, so that our basic systems and provision of service to our customers remains the same for both AMI and non-AMI metered customers.

In addition, geography is important in the deployment and functioning of the AMI meters and FAN network devices. Similarly, weather may have an

impact. Business Systems has conducted field coverage studies to ensure the FAN will provide adequate coverage for both deployment of meters and other devices, and our deployment plans are specific to the Minnesota geography and weather. However, we cannot duplicate some of the realities of field deployment in a test environment, so some level of contingency is appropriate.

The multi-year implementation schedule is also a reason using contingencies is appropriate. Part of IT planning requires that we will be able to address new security threats that may evolve over the implementation timeline. While the Company budgets for these eventualities at some level, contingency amounts are included because we must ensure that we are able implement security controls as new cyber threats arise.

Q. DOES THE COMPANY BELIEVE THE CONTINGENCY AMOUNTS WILL BE USED?

A. Yes; while the Company does not necessarily anticipate using all of the contingencies, we believe that some amount of contingency will be used based on experience with prior projects. Contingency amounts are included to avoid the need for tradeoffs in schedule and/or scope and functionality. In this way, we can ensure implementation of the project will help maximize benefits for our customers. As Mr. Gersack discusses, there are strict controls on how the contingency amounts may be used. The overall AGIS governance structure provides for review and approval of any project changes that will affect the scope, costs, or benefits of implementation. Any changes from budgeted amounts and any specific use of budget contingencies will need approval according to the established AGIS governance processes.

Q. FROM A PROJECT DETAIL PERSPECTIVE, ARE THERE OTHER SPECIFIC REASONS FOR INCLUDING CONTINGENCY AMOUNTS IN THE AMI BUDGET?

A. Yes. While we have based our budget estimates on all known design and installation details, there remain uncertainties with respect to specific Minnesota requirements that will not be known until after Commission approval of the projects, and unknowns that may develop through the installation phase. The level of contingency recognizes the following specifications that will be determined as we progress toward and during project implementation:

- Legacy interfaces – For AMI, we have a reasonable estimates of the type of interface work that will be necessary for Minnesota based on our previous experience with implementation in Colorado. However, the Minnesota-specific functionality will be dependent on final Minnesota requirements once approved.
- Capacity scaling – We have estimated the cost of scaling activities, but the full costs will be determined as all design and solution specifications finalized.
- MDM and operational reporting solution vendor selections are not yet finalized. Our budget estimates are based on market analysis and vendor quotes, but costs will not be finalized until we complete the selection processes and negotiate and execute contracts.
- Security – Security solutions will be dependent on final Minnesota requirements once approved.

(4) AMI Expenditures 2020-2029

Q. WHAT ARE THE BUSINESS SYSTEMS CAPITAL EXPENDITURE AND O&M FORECASTS FOR AMI FOR 2020 THROUGH 2029?

A. The tables below provide the Business Systems AMI capital expenditure and O&M forecasts for 2020 through 2029.

Table 30

AMI Capital Expenditures – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
AMI	$11.4	$6.5	$10.0	$5.7	$0.9
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

Table 31

AMI O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
AMI	$4.2	$13.1	$9.1	$15.2	$51.5
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

(5) AMI Cost Summary

Q. WHY IS BUSINESS SYSTEMS' AMI FORECAST REASONABLE FOR CUSTOMERS TO SUPPORT?

A. AMI is a foundational component of AGIS, which is a long-term strategic initiative to transform our electrical distribution system to enhance security, efficiency, and reliability, to safely integrate more DERs, including those that are customer owned, and to enable improved customer products and services.

The volume and scope of data processing is several orders of magnitude greater than the legacy metering infrastructure. This allows many business processes and services supporting Xcel Energy customers to be more timely, accurate and consistent. AMI will support business operations efficiencies, and a better customer experience to empower informed energy decisions. The IT components described above are necessary to implement AMI, and the AMI IT forecast is reasonable in enabling technologies that improve customer products and services.

Further, the Company employs standard processes and procedures for selecting technologies to be deployed in the Company's environment, as well as for the execution of large capital projects. Our planning for AGIS implementation is done on an enterprise-wide basis, which allows for efficiencies and provides benefits for all our customers. Consistency across the enterprise simplifies deployment across different jurisdictions in a cost-effective manner.

The processes and procedures for selecting AMI technologies include:

- *Product Selection*:
  - Head-End. The Company used multiple RFP processes to select the optimal vendor partners for various aspects of the AMI delivery. A competitive bid was completed at the end of 2017 resulting in the selection of Itron for the AMI head-end software solution.
  - Testing. An additional competitive bid process was completed in 2018 to select a vendor partner for all program testing.
  - Meter Data Management and Operational Reporting Solution. Additional processes were implemented in 2019 to select vendors

for the meter data management software and operational reporting solutions.

- System Integration. Negotiated individual statements of work were developed with existing vendors that own and support each of the interfacing applications. We leveraged our long-standing partnerships with these vendor in an effort to obtain optimal costs for the integration effort.

- *Project and Initiative Governance*: As described further by Mr. Gersack, the AGIS initiative's formal project governance processes are incorporated into the AMI project.

4. The FAN

a. FAN Overview

Q. WHAT IS THE FAN?

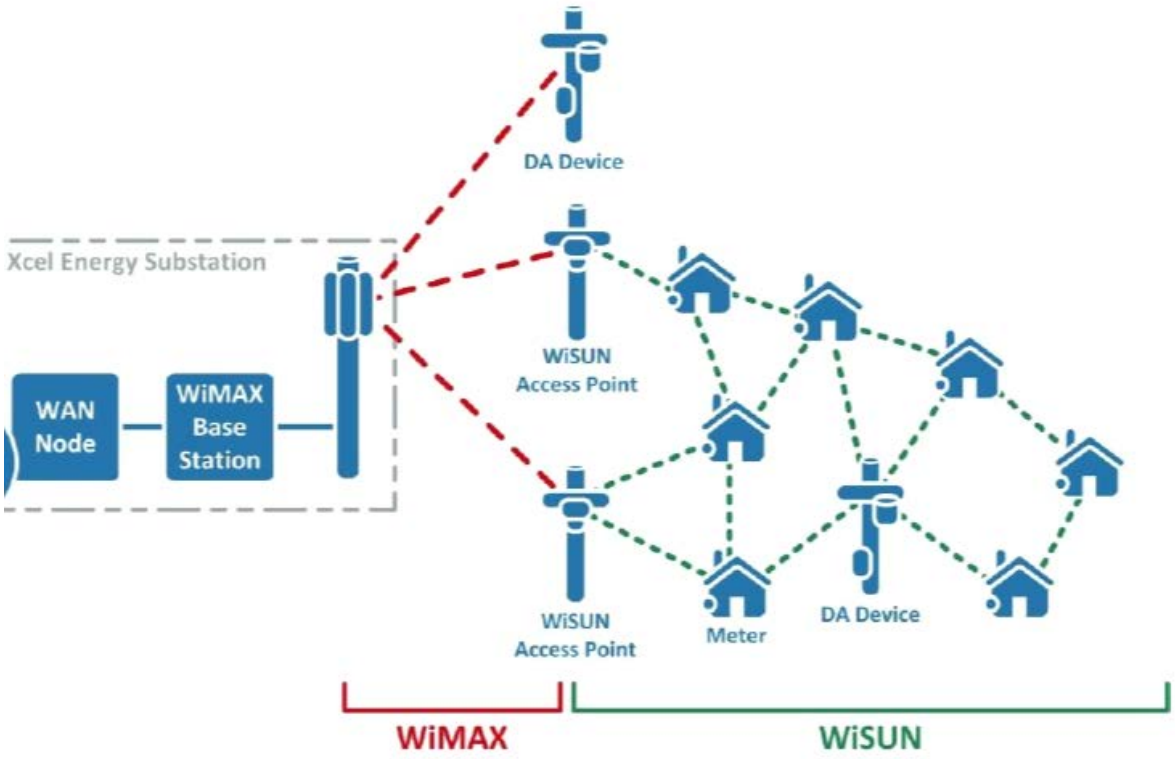
A. The FAN is a private, Company-owned wireless communications network that will leverage our existing Wide Area Network (WAN) and substation infrastructure to securely and reliably address the need for increased communication capacity that arise from the new advanced grid devices, including AMI, FLISR, and IVVO. The primary function of FAN is to enable secure and efficient two-way communication of information and data between our existing substation infrastructure and new or planned intelligent field devices – up to and including meters at customers' homes and businesses. The FAN will provide benefits to all AGIS programs but is designed and built according to the needs of various components, and each has different communication network requirements.

Q. WHAT ARE THE PRINCIPAL TECHNOLOGIES THAT WILL BE USED BY THE FAN?

A. To provide communication between the substation and field devices, the FAN will use two wireless technologies: (1) Wireless Smart Utility Network (WiSUN) mesh network; and (2) a Worldwide Interoperability for Microwave Access (WiMAX) network. These two networks are depicted in Figure 6 below.

Figure 6

WiSUN and WiMAX Networks



Q. DESCRIBE THE COMPANY'S CURRENT COMMUNICATION NETWORK.

A. Xcel Energy's current communication network is the WAN. The WAN provides high-speed, two-way communications capabilities and connectivity in a secure and reliable manner between Xcel Energy's core data centers and its

service centers, generating stations, and substations. The Company's current WAN communications network primarily composed of private optical ground wire fiber and a collection of routers, switches, and private microwave communications that are supplemented by leased circuits from a variety of carriers as well as satellite backup facilities.

Q. HOW WILL THE FAN INTERACT WITH THE WAN?

A. The WAN, which resides upstream of the FAN, will continue to be Xcel Energy's primary means of communicating data between the Company's data centers that house data and AGIS applications, such as ADMS, and facilities such as generating plants and service centers as well as the FAN. The FAN, in turn, will provide the connectivity to intelligent devices installed across the distribution system.

Q. DESCRIBE THE COMPONENTS OF THE WISUN NETWORK.

A. The WiSUN mesh network is the key network structure that will communicate directly with the AMI infrastructure and most Distribution Automation (DA) field devices. The core infrastructure for WiSUN will consists of two main devices: (1) access points and (2) repeaters. Both of these devices will be principally located on distribution poles and other similar structures.

An access point is a device that will link the Company's endpoint devices that are enabled with wireless communication modules with the rest of the Company's communication network. The access points will wirelessly connect directly to backhaul (which is an intermediate link in the communications network – WiMAX, in this case) to pass data between the mesh network and the WAN.

Repeaters are range extenders that are used to fill in coverage gaps where devices would be otherwise unable to communicate. The mesh network design of WiSUN means that additional nodes on the network provide devices more options to communicate with their access point.

Q. DESCRIBE THE COMPONENTS OF THE WIMAX NETWORK.

A. The WiMAX network will consist of two main components: (1) base stations, and (2) customer premise equipment (CPE). I note that "customer" here refers to the Company rather than our electric utility customers. The Company is the "customer" purchasing the WiMAX equipment in this case.

Base stations will serve as the key communication points between the substation WAN and the WiSUN mesh network. At substations there will be a base station with up to three radios that will communicate with the WAN and multi-directionally with CPEs out in the field of operations. Where possible, the base stations at the substations will be mounted on existing poles or structures.

The CPEs will further enable the back office applications to communicate wirelessly with any device accessible to that access point's connections to the mesh network. CPEs will be mounted on distribution poles in the field of operation.

Q. HOW WILL THE WIMAX NETWORKS BE CONNECTED TO AND INTERFACE THE COMPANY'S EXISTING WAN NETWORK?

A. The WiMAX base stations will be connected to the pre-existing WAN connections at the substation, which, in turn, will enable connectivity back to

the data center locations. This connection at the substation will be via private fiber or alternate cabling within the substation from the WiMAX base station radios to the routers at the substations which are connected to the WAN. There may be rare instances in which WiSUN devices will be connected directly to the WAN, when WiMAX is not needed.

b. Interrelation of FAN with other AGIS Components

Q. HOW WILL THE COMPONENTS OF THE FAN INTERACT WITH THE OTHER AGIS COMPONENTS?

A. The FAN is the primary communication network for many of the AGIS components to communicate with each other as well as Company's back-office systems.

Q. HOW WILL THE FAN INTERACT WITH THE AMI METERS?

A. The AMI meters will have embedded communication modules that will allow the devices to communicate with the WiSUN network. This will allow data to be transferred between the meters and the AMI head-end application, including interval reads, register reads, voltage information, and power quality data. The FAN will also allow AMI meters to send and receive of commands like power outage notifications. Once fully deployed, we estimate that the AMI meters will make up over 90 percent of the devices that will communicate as part of the mesh network.

Q. HOW WILL THE FAN INTERACT WITH FLISR?

A. The FLISR distribution equipment (*i.e.,* feeder-level devices) will have communication modules that will communicate with access points in the mesh network or directly to WiMAX CPEs.

Q. HOW WILL THE FAN INTERACT WITH THE COMPONENTS OF IVVO?

A. Most devices that control or inform IVVO (such as capacitors, SVCs and power line sensors) will have communication modules that will allow them to communicate as part of the WiSUN mesh network or directly on WiMAX. Through this network, the FAN will allow data to be transferred between the IVVO devices in the field and the ADMS. This will enable the field devices to report their current operating conditions and allow the ADMS to send commands to the devices, thereby enabling the entire system to dynamically react to changing load conditions and voltage levels.

Q. HOW WILL THE FAN INTERACT WITH ADMS?

A. The FAN enables data and information from field devices to be communicated to ADMS, and also enables commands to be transmitted to the field devices from ADMS.

Q. PLEASE DESCRIBE IN MORE DETAIL HOW THESE SYSTEMS WILL BE INTEGRATED WITH THE FAN.

A. The following applications will be integrated with the FAN:

- *AMI*: The WiSUN mesh network, including the meters' communication nodes that will communicate as part of the network, will support AMI through the meters' communication function. The FAN will provide the transport for data transfer between the meters and the AMI head-end application, including interval reads, register reads, voltage information, and power quality data. It will also provide the sending and receiving of commands like power outage notifications and remote connect/disconnect commands.

- *ADMS*: The FAN infrastructure will provide data from field devices to the WAN, which will then deliver data to ADMS. The FAN enables data and information from field devices to be communicated to ADMS, and also enables commands to be transmitted to the field devices from ADMS. The FAN infrastructure will provide data from endpoint devices, such as meters and field devices, to a common ESB via the WAN, which will then deliver data to ADMS. The ESB will also receive commands from ADMS that will be delivered to the devices connected to the FAN via the WAN. The FAN enables data and information from field devices to be communicated to ADMS, and also enables commands to be transmitted to the field devices from ADMS.

c. FAN Benefits

Q. WILL CUSTOMERS DIRECTLY BENEFIT FROM THE DEPLOYMENT OF FAN ALONE?

A. The FAN, in and of itself, does not provide direct benefits to customers or the Company. Benefits to customers and the distribution system will be realized through FAN's support of, and interaction with, other programs and technologies. The FAN strategy proposed is tightly coupled with the proposed AMI implementation and similarly enables other technologies that transform the customer experience and create customer value. The reliable, private, secure network capabilities provided by the FAN also enable the end-to-end transport of interval meter data to provide the customer and grid benefits enabled by AMI. FAN also enables the communication for FLISR and thus contributes to the outage restoration capabilities.

Q. HOW DOES THE MESH NETWORK DESIGN OF FAN PROVIDE BENEFITS FOR THE OTHER AGIS COMPONENTS?

A. The mesh network design of FAN provides redundancy and will ensure the overall dependability of communications of the AGIS components. For example, if a device falls on the WiSUN network and can no longer communicate, the mesh configuration of the system will allow that node to be bypassed so other nodes will be unaffected and network communications will continue. Every device on the mesh network will maintain a primary and secondary access point, so that in the case of an access point failure the nodes will automatically route communications to a secondary access point. If the access point outage persists, the entire network will reconstruct itself so that every device will have a primary and secondary access point. The design also calls for access points to be served by multiple WiMAX base stations, so that in the event of a WiMAX base station goes off-line the mesh nodes will still be able to route communications through a different access point and WiMAX base station. In sum, the redundancy of the mesh network design of the FAN will enable endpoint devices to continuously communicate both with each other and with head-end systems.

Q. HOW DOES THE FAN ASSIST THE OTHER AGIS COMPONENTS IN MANAGING OUTAGES?

A. The core infrastructure of both WiMAX and WiSUN will have battery backup as will other devices that are critical for outage operations. This means that the Distribution Control Center will still have visibility into the current status of the grid and remote control capabilities for devices like reclosers. Although AMI meters will not have battery backup, they will have energy storage adequate send "last gasp" messages (that is, a final message transmitted by the

meter upon detection of an outage) over the FAN to let the head-end system know that particular customers do not have power service. Once those customers have been reenergized, those meters will once again be able to communicate on the FAN and the head-end system will be able to remotely verify that customers have been reconnected. The additional visibility will also aid with the restoration of nested outages[9] by showing that certain customers remain without power even when the surrounding issue was resolved. This will help the control center identify those situations and reduce restoration times.

Q. WHY IS IT IMPORTANT TO IMPLEMENT THE FAN NOW?

A. The FAN communication network is required to support the deployment of AMI meters and will facilitate the operation of FLISR and IVVO. Deploying AMI meters without the FAN would be considerably more expensive to install and operate because the Company would need to find other ways read data from the meter such as driving by or physically reading the meter, both of which would require truck rolls and added labor costs. The primary advantage the FAN provides in terms of efficiency of meter operations is enabling the operate to send remote commands to the meter (such as connect/disconnect), as well as read data as often as required without dispatching a truck and personnel to do so.

Further, without the FAN, the Company would not be able to gain full value from the capabilities of AMI, FLISR, or IVVO. This is because FAN will support the interconnection and communication of the field device

[9] Storms often result in multiple failures. When we repair and reenergize a section, but a subset remains out due to a second fault, that outage is referred to as a "nested" outage.

components of these technologies. In addition to supporting the AGIS infrastructure, the FAN will support the ability to deploy computing capability closer to the field devices (for example, in substations) that will allow for quicker identification of potential issues and immediate resolution. This deployment will enable Xcel Energy to monitor and manage impacts of distributed energy resources (for example, solar resources) and other events occurring on the grid in a more timely manner.

d. FAN Implementation

Q. WHAT WORK IS NECESSARY TO IMPLEMENT THE FAN?

A. FAN implementation requires installation of WiMAX and WiSUN equipment in the field as well as implementation of the necessary software components and IT integration with the Company's other systems.

Q. WHAT WORK IS BUSINESS SYSTEMS UNDERTAKING TO IMPLEMENT THE FAN PROJECT?

A. The specific functions Business Systems provides for FAN implementation include:

- Leading the design of the network systems (WiMAX and WiSUN);
- Procurement and installation of all hardware components that will operate the network. This task is a joint effort between Business Systems and Distribution in the procurement and deployment of the hardware components. For WiMAX, Business Systems is primary responsible for the installation of WiMAX base stations at the substations, and Distribution Operations is responsible for the installation of the CPE devices that are located on Distribution poles. Distribution is responsible for installation of the WiSUN devices (APs

and repeaters), which will be located on Distribution poles. The Business Systems and Distribution budgets reflect this division of responsibility for hardware and installation. Company witness Ms. Bloch discusses the costs associated with the Distribution Operations' participation in the procurement and installation of pole-mounted FAN devices;

- Configuration of the software and hardware;
- Designing and integrating security into all aspects of the FAN solution;
- Thorough unit, system and end-to-end testing of the FAN solution;
- User Acceptance Testing (UAT) with the Distribution, Customer Care and Customer Solutions business resources; and
- Establishment of a full ongoing support structure including process and operational requirements.

Q. HOW WILL THE WIMAX INFRASTRUCTURE BE INSTALLED?

A. WiMAX base stations will be primarily installed at substations, with Business Systems responsible for installation using the deployment services provider selected in the RFP process described below, as well as the Company's transmission personnel as needed for work at the substations. Antennas will need to be installed at appropriate heights to provide optimal coverage of the WiMAX signal. Installation can be on existing transmission towers where possible and allowable under safety guidelines. Where there are no suitable transmission structures, a monopole will be erected on which to mount the antennas. The radio equipment will be mounted at ground level at the base of the structure and will connect to the substation's Electronic Equipment Enclosure (EEE) via trenched cabling. The equipment will connect to the WAN in the substation's EEE.

Distribution Operations is responsible for the installation of the CPEs on distribution poles. Ms. Bloch discusses this further in her testimony.

Q. HOW WILL THE WISUN INFRASTRUCTURE BE INSTALLED?

A. WiSUN equipment consists of access points and repeaters. Distribution Operations is responsible for installation of these devices, which will be mounted primarily on distribution poles. Ms. Bloch provides additional installation details in her testimony.

Q. HAS BUSINESS SYSTEMS ALREADY PERFORMED WORK TO SUPPORT THE FAN IMPLEMENTATION?

A. Yes. To support our TOU pilot, Business Systems and Distribution Operations have begun deploying a limited amount of FAN infrastructure in the same geographic area as the AMI meter deployment (Eden Prairie and Minneapolis). Business Systems has begun to deploy WiMAX base stations in three substations, and Distribution has begun to deploy of access points (APs) and repeaters that will be connected to those base stations. Business Systems has conducted field coverage studies to ensure the FAN will provide adequate coverage for both the TOU as well as full deployment of meters and other devices in those areas.

Q. WHAT IS THE FAN IMPLEMENTATION AND IT INTEGRATION SCHEDULE TO SUPPORT FULL AMI DEPLOYMENT?

A. For any given geography, FAN availability will precede AMI meter deployment by approximately three to six months, to ensure meters will have a fully operational network to use when they are installed. To support this the FAN installation will begin approximately 12-18 months ahead of AMI meter

deployment to allow adequate time for permitting, material sourcing, and construction. Based on the current schedule for AMI meter deployment, we anticipate FAN deployment will begin in mid-2020 to ensure network readiness when AMI meters and other devices are deployed in mid-2021. Business Systems has already completed limited FAN implementation in connection with the TOU pilot. In addition, Business Systems has already completed initial work for full FAN rollout in Colorado. Full FAN implementation in Minnesota will expand on and enhance these capabilities to meet requirements for deployment in Minnesota.

Q. WILL THE WISUN AND WIMAX NETWORKS BE DEPLOYED THROUGHOUT THE COMPANY'S ENTIRE SERVICE TERRITORY IN MINNESOTA?

A. WiSUN will be deployed throughout the entire network where we are connecting to field devices such as AMI meters. WiMAX is the current primary means of connecting WiSUN to the main WAN backhaul systems, but it is not the only solution that will be deployed. As the Company performs field coverage studies it may deploy other solutions, such as fiber or private LTE, to provide that connectivity.

e. FAN Costs

Q. PLEASE DESCRIBE THE SPECIFIC WORK BUSINESS SYSTEMS WILL UNDERTAKE TO SUPPORT IMPLEMENTATION OF THE FAN IN 2020, 2021, AND 2022.

A. The efforts will include field studies for network coverage in areas that will require FAN implementation to ensure the number, location, and configuration of network devices will adequately cover the full deployment. This will ensure the appropriate design for the network to support all devices being deployed that will require connectivity thru the FAN. This also provide

the necessary information and data to file for permitting through the FCC for frequency and location of wireless devices. The effort will also include the planning and organizing of all labor required to build out and install the network devices throughout the geography of the implementation.

Q. WHAT BUSINESS SYSTEMS CAPITAL AND O&M COSTS ARE NECESSARY FOR FAN IMPLEMENTATION DURING THE TERM OF THE MYRP IN THIS CASE?

A. The table below provides the Business Systems capital additions and O&M costs for FAN implementation for 2020 through 2022.

Table 32

FAN Capital Additions – Business Systems State of MN Electric Jurisdiction (Includes AFUDC)(Dollars in Millions)			
AGIS Program	2020	2021	2022
FAN	$5.4	$15.9	$42.0

Table 33

FAN O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)			
AGIS Program	2020	2021	2022
FAN	$0.0	$2.1	$1.1

Q. WAS BUSINESS SYSTEMS PRIMARILY RESPONSIBLE FOR DEVELOPING THE FORECAST FOR THE FAN?

A. Yes. Business Systems was responsible for developing the forecast for both the WiSUN and WiMAX components of the FAN. Therefore, I describe the forecast development process for these aspects in more detail below. Ms.

Bloch discusses the costs associated with Distribution's participation in the procurement and installation of pole-mounted FAN devices.

Q. PLEASE PROVIDE AN OVERVIEW OF THE PROCESS FOR DEVELOPING THE WISUN FORECAST.

A. As previously noted, Business Systems employs standard processes and procedures for selecting technologies to be deployed in the Company's environment, as well as the execution of large capital projects. These standard processes are being utilized for deployment of the FAN, as follows:

- *Product Selection*: The Company awarded a contract for the WiSUN mesh network in 2017 to Itron after an extensive and thorough competitive RFP process. In addition to the RFP process mentioned, the Company also provided the platform and facilities for each RFP responding company to demonstrate their claims in the RFP in a test environment. The RFP responses and the test results were primary input the RFP award.
- *Project and Initiative Governance*: The AGIS initiative's formal project governance processes are incorporated into the FAN project.

Q. PLEASE PROVIDE AN OVERVIEW OF THE PROCESS FOR DEVELOPING THE WIMAX FORECAST.

A. The Company's standard forecast development processes were followed, as set forth below:

- *Product Selection*: An RFP was issued and awarded for the WiMAX primary vendor in 2015. That portion of the project is in the deployment process. The Company awarded a contract for this part of the AGIS solution in 2017. In conjunction with the RFP for the AMI

Software selection, Itron was also selected in 2017 for the WiSUN mesh aspects of the FAN. This process ensured the most optimal solution for the Company's needs was selected and the Company negotiated a contract with reasonable costs.

- *Project and Initiative Governance*: The AGIS initiative's formal project governance processes are incorporated into the FAN project.

(1) FAN Capital Forecast

Q. WHAT ARE THE PRIMARY COMPONENTS OF THE FAN CAPITAL FORECAST?

A. The FAN forecast has two key components: (1) labor; and (2) hardware. Ms. Bloch discusses the costs associated with Distribution's participation in the procurement and installation of pole-mounted FAN devices.

Q. HOW DID THE COMPANY DERIVE THE LABOR PORTION OF THE FAN FORECAST?

A. The labor costs were derived utilizing pricing gained from industry benchmarks and reviewed with other utilities and industry research organizations such as EPRI. In addition, our labor estimates are based on our experience and work that has already been completed for FAN implementation. Business Systems has leveraged spend information to date, for both FAN rollout in Colorado and the limited deployment of FAN in Minnesota to support the TOU pilot, to estimate the future costs associated with full deployment in Minnesota. While specific Minnesota requirements are yet to be determined, the work performed in Colorado provides a reasonable point of reference for labor estimates for most general functional and non-functional work areas supporting Minnesota. As each stage of the FAN deployment is conducted, the labor costs and estimates are reviewed on

a per-site basis and forward-looking estimates are refined. These costs will be reviewed and refined throughout the lifecycle of the project. Labor cost types include installation labor, RF design, configuration and testing, planning engineering, program management, and network services.

Q. HOW DID THE COMPANY DERIVE THE HARDWARE PORTION OF THE FAN FORECAST?

A. The hardware portion of our FAN budget was derived from prices included in contracts resulting from RFP processes. Xcel Energy has standards for all hardware that is deployed in the field. These standards define hardware for which the Company has industry benchmarked, negotiated pricing. On an enterprise-wide basis, Xcel Energy issued four RFPs for FAN hardware and deployment services. For this project, the Company issued separate equipment and installation RFPs, so there were two RFPs for WiMAX and two for WiSUN.

Q. HOW DID THE COMPANY SELECT THE VENDORS FOR THE FAN TECHNOLOGY?

A. The Company conducted four RFPs related to the FAN technology. The following vendors were selected:

- WiMAX technology – Airspan was awarded the technology contract and Council Rock was awarded the reseller contract.
- WiMAX deployment service provider – Council Rock was awarded the deployment service contract.
- WiSUN Mesh technology – Silver Spring Networks (now Itron) was award the equipment contract which includes associated software.
- WiSUN deployment service provider – Silver Springs (now Itron) was awarded the deployment services contract.

Although these were four separate RFPs, a combined summary of the selection processes and results are provided as Trade Secret Exhibit___(DCH-1), Schedule 12.

Q. DESCRIBE THE PROCESS USED TO SELECT THE VENDOR FOR THE WIMAX TECHNOLOGY.

A. Xcel Energy issued an RFP in 2015 to select a vendor to provide the WiMAX technology and equipment. Responses were received from three different companies. Xcel Energy evaluated these vendors and responses on a number of factors including:

- Technical performance;
- Operational performance;
- System long-term survivability;
- Adequacy of security capabilities;
- Warranty and support;
- Manageability with operational model;
- Ability to design mesh systems;
- Ability to implement;
- Ability to meeting scope and schedule;
- Acceptability of business terms and conditions;
- Industry experience;
- Adequacy of support system; and
- Pricing.

In 2016 Xcel Energy selected Airspan and began contract negotiations, which were finalized in 2016. Since Airspan does not sell direct to customers,

Council Rock was selected as the company that would sell Airspan technology solutions to the Company. Contract details include product pricing for base station radios, CPEs, antennas, and all associated hardware required for installation.

Q. WHY DID XCEL ENERGY SELECT AIRSPAN AS THE VENDOR FOR THE WIMAX TECHNOLOGY?

A. The primary factors in the decision were:

- Favorable pricing;
- Ability to meet technical requirements; and
- Industry experience with other utilities and similar type communication systems.

Q. DESCRIBE THE PROCESS USED TO SELECT THE VENDOR FOR THE WIMAX DEPLOYMENT SERVICES.

A. Xcel Energy issued an RFP in 2015 to select a vendor to provide implementation services for the WiMAX solution. Key requirements included ability to provide adequate resources for deployment plans, experience deploying similar technology, familiarity with solution provider and other project management related experience. Responses were received from two different companies. Xcel Energy evaluated these vendors and responses on a number of factors including those listed above, as well as references from other utilities.

In 2016 Xcel Energy selected Council Rock and began contract negotiations, which were finalized in 2016. Contract details include product pricing for installation of base station radios, CPEs, antennas, and all associated hardware.

Q. WHY DID XCEL ENERGY SELECT COUNCIL ROCK AS THE VENDOR FOR THE WIMAX DEPLOYMENT SERVICES?

A. The primary factors in the decision were:

- Council Rock's experience with implementing similar solutions for other utilities;
- Council Rock's demonstrated expertise in the technology and what the Company is deploying; and
- Council Rock's relationship with Airspan in procurement and installation.

Q. DESCRIBE THE PROCESS USED TO SELECT THE VENDOR FOR THE WISUN TECHNOLOGY.

A. Xcel Energy issued an RFP in 2015 to select a vendor to provide the WiSUN technology and equipment. Responses were received from three different companies. Xcel Energy evaluated these vendors and responses on a number of factors including those listed above. Xcel Energy also allowed each vendor to come to Xcel facilities in the summer of 2016 to deploy their technology with their own resources and demonstrate their product's performance against specific requirements in the RFP. Those tests were conducted by the vendors with Xcel Energy's assistance. Results for each vendors test were provided to them but not shared with other vendors. The results were also used for internal scoring in determining the vendor awarded the technology/product contract.

In 2016 Xcel Energy selected Silver Springs (now Itron) and began contract negotiations. Contract negotiations were finalized at the end of 2016. The contract includes detailed product pricing, licensing pricing based on end

device counts for many of the software specific applications, optional pricing for a number of potential software solutions, services pricing and other related parts and services for future potential deployments.

Q. WHY DID XCEL ENERGY SELECT SILVER SPRINGS (NOW ITRON) AS THE VENDOR FOR THE WISUN TECHNOLOGY?

A. The primary factors in the decision were:

- Leadership in the marketplace for requirements similar to Xcel Energy's in the RFP;
- Performance in the testing against Xcel Energy requirements (met all of the testing requirements); and
- References from other utilities that implemented the same technology.

Q. DESCRIBE THE PROCESS USED TO SELECT THE VENDOR FOR THE WISUN DEPLOYMENT SERVICES.

A. Xcel Energy issued an RFP in 2016 to select a vendor to provide installation services including planning, coverage mapping, network performance planning, device installation layout, device installation planning and support service requirements. Responses were received from two different companies. Xcel Energy evaluated these responses on a number of factors including: experience, price, ability to deliver, and industry references

In 2016 Xcel Energy selected Silver Springs (now Itron) and began contract negotiations. Contract negotiations were finalized in late 2016 and included in the overall Silver Springs (now Itron) contract.

Q. WHY DID XCEL ENERGY SELECT ITRON AS THE VENDOR FOR THE WISUN DEPLOYMENT SERVICES?

A. The primary factors in the decision were:

- Experience with the technology and requirements defined in the RFP;
- References from other utilities;
- Input from EPRI and other industry groups involved in technology deployment; and
- Favorable pricing.

(2) FAN O&M Forecast

Q. WHAT ARE THE PRIMARY COMPONENTS OF BUSINESS SYSTEMS' FAN O&M FORECAST?

A. The primary components of Business Systems' FAN O&M forecast include the work necessary for FAN implementation as well as ongoing field support for devices deployed, hardware maintenance (patches and firmware upgrades), technical support for the network, and Network Operations Center (NOC) support for monitoring the network. In other words, these cost forecasts encompass the incremental work that will be necessary to support FAN implementation and ongoing maintenance and support.

Q. HOW DID BUSINESS SYSTEMS DERIVE THE FORECAST FOR FAN O&M?

A. The FAN O&M forecast was developed based on FAN vendor contracts, existing internal support team estimates of the work required, and industry benchmarking information gathered from other utilities and industry organization such as EPRI. Each AGIS component has an internal IT team responsible for project delivery. Our forecasts for labor costs related to AMI are based on estimates from these team members, who have previous

experience with similar systems implementations and support models, including FAN implementation in Colorado. I note that there could be future sourcing decisions for different AGIS components as additional requirements are identified. The Company would use its existing sourcing processes to manage additional O&M requirements in a cost-effective manner.

(3) FAN Contingency

Q. DO THE BUSINESS SYSTEMS FAN FORECASTS INCLUDE CONTINGENCY AMOUNTS?

A. Yes. The Business Systems FAN budget forecast for the period 2020-2025 includes capital contingency amounts of approximately 45 percent. Using contingencies is consistent with project planning practices, especially for large projects that implement new technologies and require major changes to enterprise IT systems. Mr. Gersack discusses the overall AGIS project contingencies in his testimony. In the AMI section above, I discuss the reasons for including contingency amounts in the AMI budget that are applicable to the FAN as well. This is due to the integrated nature of deployment and implementation of these technologies.

Q. GIVEN THE EARLIER CONTINGENCY DISCUSSION, CAN YOU HIGHLIGHT THE PRIMARY REASONS FOR INCLUDING CONTINGENCY AMOUNTS WITH RESPECT TO THE FAN?

A. Yes. While we have based our budget estimates on all known design and installation details, there remain uncertainties with respect to specific deployment of the FAN devices and unknowns that may develop through the installation phase. For the FAN, the primary for contingency is to recognize there may be situations where the primary solution being deployed may not

work, for example in remote areas at edge of grid. Further, there may be a change in deployment counts of sites or devices or other situations that could not be anticipated in the initial plan. Contingencies also recognize that there may be a sudden change in viable technology or identification of a security risk or vulnerability that we would not be able to anticipate at this time.

(4) FAN Expenditures 2020-2029

Q. WHAT ARE THE BUSINESS SYSTEMS CAPITAL EXPENDITURE AND O&M FORECASTS FOR THE FAN FOR 2020 THROUGH 2029?

A. The tables below provide the Business Systems capital expenditure and O&M forecasts for the FAN for 2020 through 2029.

Table 34

FAN Capital Expenditures – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
FAN	$11.5	$31.1	$36.8	$3.8	$0.0
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

Table 35

FAN O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
FAN	$0.0	$2.1	$1.1	$0.2	$8.2
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

(5) FAN Cost Summary

Q. WHY IS BUSINESS SYSTEMS' FAN FORECAST REASONABLE FOR CUSTOMERS TO SUPPORT?

A. The FAN is a foundational component of AGIS, which is a long-term strategic initiative to transform our electrical distribution system to enhance security, efficiency, and reliability, to safely integrate more DERs, including those that are customer owned, and to enable improved customer products and services. The FAN will provide communications between the advanced grid devices, including the AMI meters, enabling business operations efficiencies, and a better customer experience to empower informed energy decisions. The IT components described above are necessary to implement AMI, and the AMI IT forecast is reasonable in enabling technologies that improve customer products and services.

f. Minimization of Risk of Obsolescence for FAN

Q. HOW WILL THE FAN TECHNOLOGIES SELECTED BY THE COMPANY PROTECT AGAINST OBSOLESCENCE?

A. The WiSUN mesh technology is constantly being validated, refreshed, updated, and enhanced by industry organizations (WiSUN alliance and IEEE standards bodies) to ensure it is staying abreast of technology changes and requirements. The Company participates in the WiSUN alliance and ensures it technology partners are involved and leading efforts in both the Wi-SUN alliance and the IEEE standards bodies with other technology vendors and manufacturers. The Wi-SUN alliance continues to drive the incorporation of additional communications and security standards into the certification process. Currently, a number of AMI vendors have received WiSUN PHY certification. In 2019, a number of AMI vendors will receive WiSUN FAN

1.0 certification. Next will be Border Router certification and hopefully in 2022, Wi-SUN FAN 2.0 certifications are targeted. Company strategy is to continue to drive the AMI vendor community toward WiSUN certifications as they progress in the industry. Company strategy is to deploy WiSUN capable networks with continued industry standards based technological extensions which meet Company's robust security and performance objectives. In other words, as vendors update technologies, we are working with them to increase interoperability.

g. Alternatives to FAN

Q. WHAT ALTERNATIVES TO FAN DID THE COMPANY EVALUATE?

A. The FAN RFP processes and vendor selections described above were the result of an enterprise-wide effort that began in 2010 to identify an appropriate communications solution to support advanced grid capabilities. The principal alternative to the FAN for supporting AMI is the use of cellular carrier solutions. Another alternative would be to develop a dedicated AMI communications network, meaning a specific network for the singular purpose of supporting only meters and AMI. In this case devices that would make up the network would be dedicated only to AMI and be proprietary in their design and operations. However, these alternatives would not match the features and capabilities of the FAN network. Below I discuss the efforts we have undertaken since 2010 to inform our decisions on the FAN strategy, and provide the background for our assessment of the FAN compared to the alternatives.

Q. PLEASE OUTLINE THE COMPANY'S EFFORTS TO DEVELOP A COMMUNICATIONS SOLUTION FOR THE ADVANCED GRID.

A. The Company began engaging with vendors such as IBM and Accenture in 2010 to provide guidance and input on critical business applications that would or could impact the operations of the Company, and what network requirements could be defined to support those applications. Based on that work, a detailed study of potential network efforts to support operations for the Company was developed and reviewed with business units based on projected timelines and volumes for applications and associated network requirements. This was primarily focused on connectivity to devices in the field that would need to communicate with the applications identified. It also identified key requirements for reliability, security, and the need for two-way communications (*i.e.*, not just monitoring systems but also providing commands to those devices). This strategy was refined over a two-year period and involved direct input and collaboration with key engineers from all business units, including Finance, Capital Asset Accounting, and Security.

The Company then began developing initial plans for the FAN in 2012-2013 through an organized effort with external vendors comparing currently deployed network solutions and comparing that to what will be needed for communications with emerging technologies such as ADMS, AMI, FLISR, and IVVO and other grid management and customer support solutions. At that time virtually all network solutions were proprietary solutions based on the devices or applications being deployed.

Q. HOW DID THE WORK YOU DESCRIBE ABOVE INFORM THE DEVELOPMENT OF THE COMPANY'S FAN STRATEGY?

A. In 2013, based on the preliminary work described above, the Company formalized the FAN strategy into a program. Key guidelines for the RFP/RFI processes included the following:

- Leverage Xcel Energy owned assets such as Wide Area Network connectivity to substations as well as network components in data centers and communication hubs;
- Design to capitalize equipment for full control;
- Unify equipment and services across all operating companies;
- Follow and embrace industry standards for all tiers of networks;
- Carefully integrate and coordinate network control and monitoring systems; and
- Plan and build without compromise for security controls.

The FAN team also recommended the following technical requirements:

- Point-to-Point microwave and fiber for connectivity to FAN;
- WiMAX technology for wide area broadband services;
- Mesh networking for AMI and deep access to electric, gas, and street-lighting controls;
- Rigorous attention to standards and interoperability; and
- Continued review of technology on an annual basis to ensure future proofing.

In 2013-2015 the Company prepared and executed detailed RFIs and RFPs for the network solutions to support the business applications as discussed above.

The Company's proposed the FAN, composed of WiMAX and WiSUN components, is also consistent with developments within the electric utility industry, and current industry standards that have been adopted by vendors, organizations, and other electric utility companies. The Company actively participated with industry standards organizations and alliances – such as EPRI and IEEE – to ensure that our requirements and assumptions are aligned with the standards and products being deployed throughout the industry. In choosing FAN technology, we have relied on information from industry experts and systems integrators on actual installations of the FAN technology, public records on other utility implementations, and information through participation in industry research programs such as EPRI. The WiSUN and WiMAX networks are standards based network solutions that conform to IEEE standards.

Q. PLEASE DISCUSS THE COMPANY'S FAN PROPOSAL COMPARED TO USE OF A CELLULAR CARRIER SOLUTION FOR ADVANCED GRID COMMUNICATIONS.

A. The principal alternative to the FAN for supporting AMI is the use of cellular carrier solutions. If this was used for replacing the RF Mesh, this would require the Company to deploy a cellular modem in every meter and pay monthly fees for usage and for the private internet protocol service for every device. This alternative would cause the Company to incur substantial monthly and annual expenses.

In particular, when comparing cellular carrier solutions and the FAN, the Company determined that device costs were fairly similar but monthly and annual expenses were considerably higher with the use of public cellular network. Other key decision criteria such as security, reliability, and support costs all weighed into the decision to choose the FAN. Also factoring into our decision is consideration of latency requirements. By latency, we refer to the time it takes for data to pass from the devices through the cellular network to our applications at our data centers, and then back out to the devices. This creates an extended period of time (latency) that does not meet the Company requirements for some applications.

Cellular backhaul also would not fully support the Company's requirements for peer-to-peer requirements in all cases. Peer-to-peer requirements are associated with devices in a local setting being able to talk to each other to provide situational awareness to what is happening on the feeder or grid, and help make decisions near instantaneously without needing to communicate with applications at a data center or central office. If cellular was used to replace WiMAX (*i.e.*, Cellular backhaul from APs top data center) the same concern would apply as well as reducing the advantages of planned distributed computing at the substations to manage data traffic and provide local computing capabilities.

Q. WHAT ARE THE SECURITY ADVANTAGES ASSOCIATED WITH THE PRIVATE FAN NETWORK AS COMPARED TO A PUBLIC CELLULAR NETWORK?

A. A private network allows the Company to better control the integrity of the devices on its network and the data exchanged with those devices. Through the exchange of digital certificates, as well as other controls, Company

determines and authorizes each device before allowing it to use the FAN. As does any utility, Company utilizes many public communications circuits for the backhaul of voice and data communications. Security threats, however, are more prevalent in networks with a higher number of points of entry. The Company's FAN network will carry communications traffic for literally millions of end-devices, span its entire service territory and experience constant device moves/adds/changes and upgrades. Company strategy to reduce cyber threat vulnerability footprint is to manage its own FAN.

Q. PLEASE DISCUSS THE COMPANY'S FAN PROPOSAL COMPARED TO AN ALTERNATIVE DEDICATED AMI NETWORK SOLUTION FOR ADVANCED GRID COMMUNICATIONS.

A. By definition, and AMI-dedicated network solution would only allow connectivity between AMI devices. When comparing this option to the FAN, the Company determined that it will be more functional and is preferable to have a FAN network that allows for connectivity of diverse devices (meters, capacitor banks, sensors, etc.). Allowing devices to connect both to each other and to back office applications not only increases the ability to conduct peer-to-peer communications on a local feeder but also reduces overhead associated with managing, supporting, and monitoring multiple networks of diverse manufacturers and network management tools.

Q. WHAT DID THE COMPANY CONCLUDE AFTER EVALUATING DIFFERENT COMMUNICATIONS NETWORK SOLUTIONS?

A. The Company concluded that virtually none of the communication network alternatives could match the features and capabilities of the FAN network. A

summary comparison of the FAN capabilities to the alternative options is provided in Table 36 below.

Table 36
Comparison of Network Communications Solutions

Feature/ Requirement	FAN Mesh	Cellular	Dedicated AMI Network	Comments
Two-way Communications	●	●	●	All can do two-way communications.
Peer-to-Peer	●	◔	◕	Less clear how this would be accomplished with cellular.
Multi-purpose	●	◕	◔	Only FAN Mesh can support all potential use cases at Xcel Energy.
Latency Requirements	●	●	◕	If set up correctly each could meet requirements known today for latency.
Security	●	◑	●	Dedicated networks provide more secure traffic not travelling over public networks.
Dedicated Traffic	●	◔	◕	The network would be fully dedicated to Xcel Energy traffic.
Priority Traffic	●	◔	●	Dedicated networks allow for priority traffic routing with Xcel Energy traffic being the top priority.
O&M Costs Impact (run state)	●	◔	◑	Higher monthly costs for data traffic using cellular and higher support costs per device for dedicated AMI network.
Resiliency	●	◑	◑	Fewer unplanned outages with mesh network as it heals itself. The more devices on the mesh the more resilient.

Legend				
Full	Most	Partial	Minimal	None
●	◕	◑	◔	○

5. FLISR

a. FLISR Overview

Q. WHY IS IT INTEGRATION IMPORTANT FOR IMPLEMENTATION OF FLISR?

A. The advanced application FLISR will rely on accurate power flow calculations to determine the power flow at points on the grid where sensor information does not exist. As such, they require integration with the core ADMS systems. FLISR must be integrated with the ADMS core applications and other critical systems to provide its intended benefits to the Company's customers.

Q. WHAT WORK IS BUSINESS SYSTEMS UNDERTAKING WITH RESPECT TO FLISR?

A. The work Business Systems will undertake with respect to FLISR is as follows:

- Leading the design of the system components;
- Configuration of the required software and hardware;
- Building and installation of any required interfaces;
- Designing and integrating security into all aspects of FLISR;
- Thorough unit, system, and end-to-end testing; and|
- User Acceptance Testing (UAT) with the Distribution business resources.

Q. HAS BUSINESS SYSTEMS ALREADY PERFORMED WORK TO SUPPORT FLISR IMPLEMENTATION?

A. Yes. FLISR implementation has been planned on an enterprise-wide basis, and work to test functionality was completed for Colorado in 2019. In Minnesota, Business Systems will support testing of FLISR on the feeders selected by the Distribution organization. As discussed in Ms. Bloch's testimony, as part of the installation of ADMS, FLISR will be deployed to a

small two-feeder area in South Minneapolis in 2020 to validate the ADMS capabilities. Business Systems has engaged in work to support this FLISR testing, which will be conducted in the second quarter of 2020. I note that this limited testing of FLISR is included in the costs for ADMS, which the Company proposes to continue recovering through the TCR Rider. FLISR implementation costs for 2020 and beyond are proposed for inclusion in base rates.

Q. PLEASE DESCRIBE THE WORK BUSINESS SYSTEMS WILL UNDERTAKE TO SUPPORT IMPLEMENTATION OF FLISR IN 2020, 2021, AND 2022.

A. As discussed in Ms. Bloch's testimony, the Company proposes to implement FLISR on 206 additional feeders between 2021 and 2028, and Distribution will install the FLISR equipment. Business Systems will support this FLISR implementation by adding and conditioning field devices to support FLISR functionality. Business Systems will also perform testing to support this implementation.

b. FLISR Costs

Q. WHAT BUSINESS SYSTEM CAPITAL ADDITIONS AND O&M COSTS ARE NECESSARY FOR IT INTEGRATION FOR FLISR DURING THE TERM OF THE MYRP IN THIS CASE?

A. Table 37 below provides the capital additions for IT integration for FLISR for 2020 through 2022. Table 38 shows that there are no IT O&M costs for FLISR integration during the term of the MYRP.

Table 37

FLISR Capital Additions – Business Systems State of MN Electric Jurisdiction (Includes AFUDC)(Dollars in Millions)			
AGIS Program	2020	2021	2022
FLISR	$0.3	$0.4	$0.6

Table 38

FLISR O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)			
AGIS Program	2020	2021	2022
FLISR	$0.0	$0.0	$0.0

Q. WAS BUSINESS SYSTEMS PRIMARILY RESPONSIBLE FOR DEVELOPING THE FORECASTS FOR FLISR?

A. No. However, Business Systems is responsible for the integration of the Sensor Management System (SMS) for Aclara sensors into ADMS, and for managing the integration of the FLISR sub-application with ADMS. Although Ms. Bloch provides a discussion of the forecast process with respect to the FLISR advanced application and its related field devices in her Direct Testimony, I discuss the Aclara SMS below.

Q. WHAT IS THE ACLARA SMS FOR FLISR?

A. The Aclara SMS is software which provides control and reporting on sensors across the Company's distribution system. It also acts as a virtual RTU, providing the ability to integrate the sensor data with the SCADA system. The sensors and SMS will be used in conjunction with each other to support FLISR. FLISR requires that the substation relay provide certain signals in

order to communicate to the ADMS to begin automatic locating of the fault and subsequent restoration. The Company's current substation standard requires a specific make and model of relay which many of the Company's substations do not have, so these sensors provide a low cost alternative that can provide that telemetry. Because the Aclara SMS software is currently used for other purposes across the Company's distribution system, no new software is needed to implement FLISR.

Q. WHAT ARE THE PRIMARY COMPONENTS OF THE IT CAPITAL FORECAST TO IMPLEMENT FLISR?

A. The FLISR IT capital forecast is primarily composed of labor costs for the work described above.

Q. HOW DID THE COMPANY DEVELOP THESE COST ESTIMATES?

A. The Company developed labor estimates primarily using actual labor costs for the design and implementation of the FLISR functionality testing described above as part of ADMS implementation.

Q. PLEASE DESCRIBE THE FLISR CONTINGENCY AMOUNTS INCLUDED IN THE FORECAST.

A. The Business Systems FLISR budget forecast for the period 2020-2025 includes capital contingency amounts of approximately 24 percent. A significant portion of the FLISR IT work and cost is to develop templates which provide the computer screen interface for managing field devices used for FLISR functions. Each device requires a corresponding template. Base Templates are created as generic templates across a product family. These are used as the starting point to create Subtype Templates, which include the

attribute variations needed by each device subtype in the product family. Significant work is required for each Subtype Template build.

The amount of re-use of the Base Template to create the Subtype Templates is estimated, but not precisely known until the detailed build work begins. We have included a contingency for FLISR implementation due to this unknown.

c. FLISR Expenditures 2020-2029

Q. WHAT ARE THE BUSINESS SYSTEMS CAPITAL EXPENDITURE AND O&M FORECASTS FOR FLISR FOR 2020 THROUGH 2029?

A. The tables below provide the Business Systems capital expenditure and O&M forecasts for FLISR for 2020 through 2029.

Table 39

FLISR Capital Expenditures – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
FLISR	$0.4	$0.5	$0.7	$2.9	$3.4
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

Table 40

FLISR O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
FLISR	$0.0	$0.0	$0.0	$0.1	$0.1
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

Q. WHY IS BUSINESS SYSTEMS' FLISR FORECAST REASONABLE FOR CUSTOMERS TO SUPPORT?

A. FLISR is an advanced grid component that will enable significant reliability improvements for our customers, and operational efficiencies for the Company. Overall, implementing FLISR allows the Company to more efficiently restore power with the use of fewer resources and will improve the customer reliability experience. The Business Systems work will provide for the implementation of FLISR and integration with the advanced grid technologies, enabling these benefits for our customers and the Company. The Business Systems FLISR forecast is reasonable based on the details provided above.

6. IVVO

a. IVVO Overview

Q. WHY IS IT INTEGRATION IMPORTANT FOR IMPLEMENTATION OF IVVO?

A. The advanced application IVVO will rely on accurate power flow calculations to determine the power flow at points on the grid where sensor information does not exist. As such, they require integration with the core ADMS systems. IVVO must be integrated with the ADMS core applications and other critical systems to provide its intended benefits to the Company's customers.

Q. WHAT WORK IS BUSINESS SYSTEMS UNDERTAKING WITH RESPECT TO THE IVVO?

A. The work Business Systems will undertake with respect to IVVO is as follows:

- Leading the design of the system components;
- Configuration of the required software and hardware;
- Building and installation of any required interfaces;

- Designing and integrating security into all aspects of IVVO;
- Thorough unit, system, and end-to-end testing;
- User Acceptance Testing (UAT) with the Distribution business resources.

Q. HAS BUSINESS SYSTEMS ALREADY PERFORMED WORK TO SUPPORT THE IVVO IMPLEMENTATION?

A. Yes. IVVO implementation has been planned on an enterprise-wide basis, and work to test functionality was completed for Colorado in 2019. In Minnesota, Business Systems will support testing and implementation of the IVVO on the feeders selected by the Distribution organization. As discussed in Ms. Bloch's testimony, as part of the installation of ADMS, the Company will implement IVVO on the seven feeders at one substation in Southeast Minneapolis. Business Systems has engaged in work to support this IVVO testing, which will be conducted in the second quarter of 2020. I note that this limited testing of IVVO is included in the costs for ADMS, which the Company' proposes to continue recovering through the TCR Rider. The implementation costs for wider IVVO deployment are proposed for inclusion in base rates.

Q. PLEASE DESCRIBE THE WORK BUSINESS SYSTEMS WILL UNDERTAKE TO SUPPORT IMPLEMENTATION OF IVVO IN 2020, 2021, AND 2022.

A. As discussed in Ms. Bloch's testimony, the Company proposes to implement IVVO at 13 substations between 2021 and 2024. Distribution will install the IVVO equipment, the Company will capture data and configure equipment, and then tune ADMS models. Business Systems will support this IVVO implementation by adding and conditioning field devices to support IVVO

functionality and will perform testing to support this expansion. Business Systems will also implement the Grid Edge Management System (GEMS) software for the secondary static VAr compensator (SVC) devices that are part of the IVVO implementation, and will complete IT integration of the IVVO advanced sub-application with ADMS.

b. IVVO Costs

Q. WHAT BUSINESS SYSTEM CAPITAL ADDITIONS AND O&M COSTS ARE NECESSARY FOR IT INTEGRATION FOR IVVO DURING THE TERM OF THE MYRP IN THIS CASE?

A. Table 41 below provides the capital additions for IT integration for IVVO for 2020 through 2022. Table 42 shows that there are no IT O&M costs for IVVO integration during the term of the MYRP.

Table 41

IVVO Capital Additions – Business Systems State of MN Electric Jurisdiction (Includes AFUDC)(Dollars in Millions)			
AGIS Program	2020	2021	2022
IVVO	$0.0	$1.7	$1.9

Table 42

IVVO O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)			
AGIS Program	2020	2021	2022
IVVO	$0.0	$0.0	$0.0

Q. WAS BUSINESS SYSTEMS PRIMARILY RESPONSIBLE FOR DEVELOPING THE FORECASTS FOR IVVO?

A. No. However, Business Systems was responsible for developing the forecast for the GEMS software and for managing the integration of the IVVO advanced sub-application with ADMS. Although Ms. Bloch provides a discussion of the forecast process with respect to the IVVO advanced application and its related field devices, I discuss GEMS below.

Q. PLEASE DESCRIBE THE GEMS SOFTWARE THE COMPANY HAS SELECTED TO SUPPORT THE IVVO FIELD DEVICES.

A. The GEMS software was included in the package from the vendor supplying the SVC devices. As discussed in Ms. Bloch's testimony, the Company began an RFP process to select an SVC vendor in the second quarter of 2018. As a result of the RFP, the Company selected Varentec's Edge of Network Grid Optimization (ENGO) unit as the winning bidder for the SVC devices. The GEMS software to manage and control the SVC devices was included in the package. Business Systems will deploy the GEMS software for management and control of the ENGO SVC devices. The Company will host the server in-house for IVVO deployment.

Q. WHAT ARE THE PRIMARY COMPONENTS OF THE IVVO IT CAPITAL FORECAST TO IMPLEMENT THIS SOFTWARE?

A. The IVVO IT capital forecast has three key components: hardware, software, and labor.

Q. WHAT HARDWARE IS NEEDED FOR IVVO IMPLEMENTATION FOR BUSINESS SYSTEMS?

A. The additional hardware necessary for AMI implementation consists of computing components used for data processing and storage to support IVVO services. Additional servers are needed due to the increased volume of data and processes necessary to implement IVVO capabilities.

Q. HOW DID THE COMPANY DERIVE THE HARDWARE PORTION OF THE AMI IT FORECAST?

A. Xcel Energy has standards for all hardware that is deployed in our data centers. These standards define hardware for which the Company has industry benchmarked, negotiated pricing. Based on these standards, the hardware estimates were derived utilizing the hardware requirements of the applications and applying standard pricing.

Q. HOW DID THE COMPANY DEVELOP THE COST FORECAST FOR IVVO SOFTWARE COSTS?

A. Pricing for the IVVO software is provided in the contract with Varentec, selected through the RFP process noted above. Pricing is consistent with industry benchmarks and our review with other utilities and industry research organizations such as EPRI. These benchmarks drove the negotiations with the selected vendor. Varentec provided budgetary quotes for their ENGO device licensing based on a cloud-based approach and an in-house server based approach. The in-house approach, described above for the AMI forecast, was used to develop cost estimates, consistent with the Company's security requirements.

Q. HOW DID THE COMPANY DEVELOP THE FORECAST FOR THE CAPITAL LABOR COSTS?

A. Our forecast includes both internal and external labor. External labor costs are based on the contract pricing described above. The internal labor forecast is based on our experience and work that has already been completed for IVVO implementation. Business Systems has leveraged spend information to date, for both IVVO rollout in Colorado and the limited deployment in Minnesota for testing purposes, to estimate the future costs associated with full deployment in Minnesota.

Q. ARE THERE OTHER COSTS INCLUDED IN THE BUSINESS SYSTEMS CAPITAL FORECAST FOR IVVO?

A. Yes. There are additional project management costs that are include in the IVVO capital forecast. For Business Systems, these include labor costs for delivery and execution leadership and security.

Q. HOW DID THE COMPANY DEVELOP THESE PROJECT MANAGEMENT COST FORECASTS?

A. These capital costs were developed using contract pricing for the external project management work, and labor estimates for the work necessary to support IVVO integration efforts described above. These costs were derived based on evaluation of prior work performed in Colorado, which provides a reasonable point of reference for labor estimates for most general functional areas supporting Minnesota.

Q. WHAT ARE THE PRIMARY COMPONENTS OF BUSINESS SYSTEMS IVVO O&M COSTS?

A. The primary components of Business Systems IVVO O&M costs include ongoing hardware support, data storage, annual software maintenance, application support, and labor for software support.

Q. HOW DID BUSINESS SYSTEMS DERIVE THE IVVO O&M FORECAST?

A. The IVVO O&M forecast was developed based on vendor quotes, existing internal support team estimates of the work required, and industry benchmarking information. Each AGIS component has an internal IT team responsible for project delivery. Our forecasts for labor costs related to AMI are based on estimates from these team members, who have previous experience with similar systems implementations and support models.

Q. PLEASE DESCRIBE THE IVVO CONTINGENCY AMOUNTS INCLUDED IN THE FORECAST.

A. The Business Systems IVVO budget forecast for the period 2020-2025 includes capital contingency amounts of approximately 10 percent. A significant portion of the IVVO IT work and cost is to develop templates which provide the computer screen interface for managing field devices used for IVVO functions. Each device requires a corresponding template. Base Templates are created as generic templates across a product family. These are used as the starting point to create Subtype Templates, which include the attribute variations needed by each device subtype in the product family. Significant work is required for each Subtype Template build.

The amount of re-use of the Base Template to create the Subtype Templates is estimated, but not precisely known until the detailed build work begins. We have included a contingency for IVVO implementation due to this unknown.

c. IVVO Expenditures 2020-2029

Q. WHAT ARE THE BUSINESS SYSTEMS CAPITAL EXPENDITURE AND O&M FORECASTS FOR IVVO FOR 2020 THROUGH 2029?

A. The tables below provide the Business Systems capital expenditure and O&M forecasts for IVVO for 2020 through 2029.

Table 43

IVVO Capital Expenditures – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
IVVO	$0.0	$1.9	$2.2	$4.3	$0.0
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

Table 44

IVVO O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
IVVO	$0.0	$0.0	$0.0	$0.1	$0.0
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

Q. WHY IS BUSINESS SYSTEMS' IVVO FORECAST REASONABLE FOR CUSTOMERS TO SUPPORT?

A. IVVO will enable automated capabilities to optimize the operation of the distribution voltage regulating and VAr control devices to reduce electrical losses, electrical demand, and energy consumption, and provides increased distribution system capacity to host DER. The Business Systems work will provide for the implementation of IVVO and integration with the advanced grid technologies, enabling these benefits for our customers and the system. The Business Systems IVVO forecast is reasonable based on the details provided above.

7. AGIS IT Overall Costs and Implementation

Q. OVER WHAT TIME PERIOD WILL THE FOUNDATIONAL COMPONENTS OF AGIS BE IMPLEMENTED?

A. The Company began implementation of the foundational components of AGIS in 2019, and implementation of AMI, the FAN and IVVO will be substantially completed in 2024. FLISR implementation will be accomplished over a longer time period, through 2028.

Q. WHAT ARE THE TOTAL IT INTEGRATION COSTS FOR THE AGIS COMPONENTS?

A. The tables below show the total capital expenditure and O&M IT integration costs, by component, for 2020-2029.

Table 45

AGIS Capital Expenditures – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
AMI	$11.4	$6.5	$10.0	$5.7	$0.9
FAN	$11.5	$31.1	$36.8	$3.8	$0.0
FLISR	$0.4	$0.5	$0.7	$2.9	$3.4
IVVO	$0.0	$1.9	$2.2	$4.3	$0.0
Total	$23.3	$40.0	$49.7	$16.7	$4.3
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

Table 46

AGIS O&M – Business Systems NSPM – Total Company Electric (Dollars in Millions)					
AGIS Program	2020	2021	2022	2023-2024	2025-2029*
AMI	$4.2	$13.1	$9.1	$15.2	$51.5
FAN	$0.0	$2.1	$1.1	$0.2	$8.2
FLISR	$0.0	$0.0	$0.0	$0.1	$0.1
IVVO	$0.0	$0.0	$0.0	$0.1	$0.0
Total	$4.3	$15.3	$10.2	$15.5	$59.8
Period may include additional assumptions, including inflation and labor cost increases, that are not part of the capital budget in periods 2020-2024.					

Q. WHAT IS YOUR RECOMMENDATION FOR THE COMMISSION WITH RESPECT TO THE BUSINESS SYSTEMS COMPONENTS OF THE AGIS INITIATIVE?

A. I recommend that the Commission approve our request to recover the Business Systems costs of the capital investments and O&M expense for the foundational components of AGIS that we propose to implement during the 2020-2022 term of the MYRP. Our proposal includes full AMI implementation, IVVO and FLISR as part of our broader grid resiliency

efforts, and the FAN components necessary to support AMI and the advanced grid applications. We also recommend that the Commission certify these projects to provide the opportunity for the Company to request recovery of costs for 2023 and later in subsequent rider filings. Approval of the costs necessary to implement the AGIS initiative will advance the Company's electric distribution system, provide customers with more choices, and enhance the way the Company serves its customers.

VI. CONCLUSION

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. I recommend that the Commission approve the Business Systems capital and O&M budget presented in this rate case. Our planned capital investments are managed appropriately and established to address aging technology, cyber security, customer experience, enhanced capabilities, and emerging demand for the Company. Certain major projects, such as our investment in the AGIS initiative, will bring the distribution grid and the Company into the future. The budgets we propose are a reasonable representation of the activities we will undertake on behalf of the Company and ultimately our service to customers through 2022 and beyond.

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes, it does.

DAVID C. HARKNESS

Chief Information Officer • Senior IT Executive • Chief Technology Officer • Senior Vice President IT

PROFILE

Talented and accomplished senior IT executive and corporate officer with consistent record of success in promoting corporate growth through effective management of technology operations. Special expertise in change management, turnaround leadership, digital transformation, multi-sourcing, technology development. Proven ability to lead Customer Marketing, Product Development, Sales, Brand activities. Familiar with supporting M&A activities. Adept at building relationships with business stakeholders.

IT Governance • Strategic Planning • Enterprise Business Transformation • Turnaround Operations
Service Delivery • Project/Program Management • Relationship Management • Cost/Budget Control
Technology Development • Succession Planning • Enterprise Infrastructures/Architectures
Six Sigma/Lean/ITIL • Compliance • Outsourcing • SAP/ERP Deployment • Shared Services

PROFESSIONAL EXPERIENCE

XCEL ENERGY, Minneapolis, MN 2009 - Present

Senior Vice President Customer Solutions (2019 – Present)
Lead the Customer Solutions organization for the Commercial & Industrial, Residential and Small Business–focused customer segments. C&I portfolio currently represents 500,000 customers and 60 percent of Xcel Energy revenue, while the Residential and Small Business segment represents roughly 3.5 million customers and 40 percent of Xcel Energy revenue. This includes HomeSmart, Xcel Energy's national non-regulated home warranty business, Economic Development, Transportation and EVs, Digital Channel Management, Product Development, DSM Product Management and Regulatory & Strategy, Renewable Product Management. By combining his business and technology leadership experiences, Dave helps create and drive a transformed digital customer experience. Utilizing strategic partnerships, he leads Xcel Energy toward a product and services portfolio helping develop connected communities, advanced home and business energy solutions, and further enable the electrification of the Transportation industry.

Senior Vice President; Chief Information Officer (2009 – 2019)
Responsible for all information technology development, operations and governance, cyber security functions, and Xcel Energy's overall business continuity program. Drives innovation and transformation by leveraging technology to create business value for $11B Gas and Electric energy company operating in 8 states. Administer $500M combined budget and supervise 900 direct and indirect reports, including senior IT leadership team. Manage strategy development

and ensure alignment with corporate goals. Build and maintain strategic partner relationships, primarily IBM, Accenture, Dell, Motorola, PWC. Direct infrastructure operations, including data / voice communications, service levels, and security.

- Drove $400M SAP Deployment (Productivity Through Technology program) across enterprise including all 4 subsidiaries.
- Increased deployment capacity 300% through Digital Transformation program.
- Restructured primary sourcing contract spend by $25M annually; representing a 25% reduction.
- Developed 10-yr IT strategic Roadmap including Business Unit plans, Platform Risk Assessment, Cyber Security Requirements and Enterprise Architecture principles and reference architectures.

PNM RESOURCES, Albuquerque, NM 2003 - 2009

Vice President; Chief Information Officer (2006-2009)

Oversee all technology management and development for $2.6B energy company with 4 subsidiaries in Southwest. Administer $70M combined budget and supervise 260 direct and indirect reports, including executive management team. Manage strategy development and ensure alignment with corporate goals. Identify needs and implement improvements. Evaluate new technologies and determine ROI for purchase vs. build strategies. Build and maintain partner and vendor relationships. Direct infrastructure operations, including data / voice communications, service levels, and security.

- Reduced spending 20% and headcount 40% over 18-month period.
- Increased deployment capacity 400% and internal client satisfaction 30% by implementing new portfolio management process.

Executive Director, Business Transformation (2006)

Managed organizational development, corporate training, Six Sigma Black Belt and Lean process improvement, and M&A operations. Supervised staff of 25.

- Implemented enterprise-wide competency model that included performance management, leadership development, and roundtable review. Launched online / classroom training program.

Executive Director, Business Process Outsourcing, First Choice Power (2005-06)

Directed major outsourcing project for $600M subsidiary. Project encompassed call center, field offices, bill printing, remittance processing, and various system conversions. Managed provider relationship. Created program plan and operating model. Supervised staff of 20.

- Brought call center and bill printing online in 2 months and remittance processing in 3 months.
- Facilitated >$4M in annualized savings through successful completion of initiative.

Executive Aide to CEO, President, & Chairman (2004-05)

Completed 6-month program of corporate officer mentorship. Attended board meetings, long-range strategic planning sessions, investor/regulator meetings and more. Actively involved in corporate governance and ethics review and planning sessions.

MCLEODUSA, Cedar Rapids, IA 1996 - 2003

Director, Enterprise Applications Development

Supervised application development, business analysis for $1B telecom company. Supervised staff of more than 120 developers. Administered $20M budget.

MCI COMMUNICATIONS, Cedar Rapids, IA 1991 - 1996

Manager, Business Analysis

Developed and led software projects for 800 Card marketing group and Intelligent Services Platform. Supervised 8 senior-level analysts and administered $8M+ budget.

CAREER NOTES: Previously held position of **Software Engineer** at ROCKWELL INTERNATIONAL (1985-1991). Wrote patented algorithm for robot manufacturing equipment.

ADDITIONAL EXPERIENCE

STATE OF NEW MEXICO, Santa Fe, NM 2005 - 2009

State Commissioner, Information Technology Commission

Appointed by governor to commission responsible for state information architecture and strategic information technology plan.

EDUCATION

BS in Computer Science/ BA in Applied Mathematics, The University of Iowa, Iowa City, IA

TRAINING & DEVELOPMENT

Utility Executive Course, The University of Idaho
Merger Week, Kellogg School of Business, Northwestern University

CURRENT & PAST AFFILIATIONS

Chair, Board of Directors, BestPrep, an organization driven to improve business and financial literacy of MN youth

Board of Directors, Minnesota High Tech Association, organization of Minnesota based businesses driving to improve the technology literacy and maturity in the state of Minnesota

Chair, EEI (Edison Electric Institute) Technology Advisory Council; Group of EEI and AGA (American Gas Association) CIOs designated to collaborate on key technical and business challenges facing utility Industry.

Member of EEI Executive Advisory Committee CIO group; consult on technology policy; advises Energy CEOs

Advisory Board University of Idaho Utility Executive Course – Premier Utility industry executive development program since 1952

CIO Advisory Board for IBM's Global Infrastructure

Volunteer for EarthDay; Feed my Starving Children; Holidazzle Parade; Big Brothers/Big Sisters

Chair, College Success Network Board of Directors 2006-2010
Vice Chair, PNM Resources Foundation Board of Trustees 2008-2009
PNM Resources Speakers Bureau and Community Crew 2004-2009

FOR PROFIT BOARD SERVICE

Director, PayGo Board of Directors
Director, First Choice Power Board of Directors

AWARDS / PUBLICATIONS / SPEAKING ENGAGEMENTS

Orbie Twin Cities CIO of the Year 2018
ComputerWorld Magazine's 100 Premier IT Leaders 2008
Author/Contributor - Managing Your IT Department as a Business: Leading CTOs and CIOs on Assessing Client Needs, Driving IT Costs Down, and Measuring Performance; Aspatore, September, 2009
Radio Interview – CIOTalkRadio
CIO Magazine / Martha Heller CIO Paradox
Multiple Interviews/Publications for EnergyCentral, EnergyBiz, Intelligent Utility, Five Point Partners, Utility CIO Knowledge Conference, CIO Global Forum

Capital Investment Additions
NSPM

Category	Project Name	WBS Level 2 #	Classification	Addition Amount 2020	2021	2022	Date
Enhance Capabilities	ITC- BUS SYS WIND Blazing Star2 MN	A.0001702.009	Electric General Plant	(247,338)			12/31/2020
Enhance Capabilities	ITC- BUS SYS WIND Freeborn MN	A.0001704.008	Electric General Plant	(371,540)			12/15/2020
Enhance Capabilities	ITC-BUS SYS Dakota Range WIND SD	A.0001707.008	Electric General Plant		(346,394)		12/31/2021
AGIS	ADMS SW MN	D.0001723.004	Electric General Plant	(43,165,009)			4/30/2020
Enhance Capabilities	Sub Asset Mgmt SW MN	D.0001728.004	Electric Intangible Plant			(5,583,004)	12/31/2022
Aging Technology	Emptoris SW MN-10708	D.0001732.011	Common Intangible Plant				12/31/2023
Cyber Security	NSPM C Corp Sec Furn	D.0001781.001	Common General Plant	(232)	(0)		1/1/2025
Cyber Security	NSPM E Corp Sec Ntwk	D.0001781.010	Electric General Plant	(21)			1/1/2025
Cyber Security	Security Projects - Electric -	D.0001781.035	Electric General Plant	(119,405)	(5,852)	(287)	1/1/2025
Cyber Security	Security Projects - Common - MN	D.0001781.036	Common General Plant	(282)	(14)	(1)	1/1/2025
Aging Technology	Peoplesoft Upgrade SW MN	D.0001792.040	Common Intangible Plant			(28,635,543)	12/31/2022
Aging Technology	Purch Sub Frame Relay Equip ND	D.0001797.007	Electric General Plant	3,591			12/31/2020
Emergent Demand	BS-Fcst-BD-SW-CM-M	D.0001804.085	Common Intangible Plant	(9,067,834)	(14,745,822)	(12,216,205)	12/31/2024
Cyber Security	Security Tech Refresh SW MN	D.0001807.001	Common Intangible Plant	(5,334,002)	(11,636,100)	(8,265,066)	12/31/2023
Aging Technology	2018 EMS Infra Refresh MN	D.0001821.304	Electric General Plant		(247,000)		12/31/2021
Aging Technology	2020 Planned MDT Refresh MN	D.0001821.413	Common General Plant		(2,434,870)		12/31/2021
Aging Technology	Real Property Asset Mgmt Upgra	D.0001826.005	Common Intangible Plant				12/31/2023
Enhance Capabilities	Purch Synchrophasor Net HW MN	D.0001826.370	Electric General Plant	(980,891)			4/30/2020
Aging Technology	Purch CRS Tech Stack HW MN	D.0001839.400	Common General Plant	(250,000)			12/31/2020
Aging Technology	Purch VOIP MN	D.0001840.021	Common General Plant	(399,996)			12/31/2020
AGIS	PURCH FAN HW CM COMM MN	D.0001900.049	Common General Plant	(6,813,182)	(19,966,725)	(24,796,788)	12/31/2024
AGIS	AGIS Advanced Metering SW MN	D.0001901.004	Electric Intangible Plant	(3,798,298)			12/31/2020
AGIS	AGIS Meter Data Mgmt (MDMS) SW MN	D.0001901.008	Electric Intangible Plant	(8,249,299)			12/31/2020
AGIS	AMI-BS-NSPM-MN Full AMI	D.0001901.040	Electric Intangible Plant	(3,312,399)	(6,581,018)	(4,698,678)	1/1/2025
AGIS	AMI-BS-NSPM-MN-TOU-CRS-Billing Modu	D.0001901.054	Electric Intangible Plant	(924,511)			12/31/2020
AGIS	Purch AGIS FLISR El Comm MN	D.0001902.029	Electric General Plant	(363,194)	(466,905)	(466,919)	1/1/2025
AGIS	AGIS Integrated Volt Var (IVVO) SW	D.0001904.004	Electric Intangible Plant		(1,896,843)	(1,917,915)	12/31/2024
AGIS	AGIS-BS-Capital-Comm-Contingency-NS	D.0001908.018	Common General Plant			(27,925,189)	12/31/2022
AGIS	AGIS-BS-Capital-E-Comm-Contingency-	D.0001908.025	Electric General Plant			(274,223)	12/31/2024
AGIS	AGIS-BS-Cap-SW-Cont-AMI-NSPM	D.0001908.053	Electric Intangible Plant			(5,460,955)	1/1/2025
AGIS	AGIS-BS-Cap-SCom-Cont-IVVO-NSPM	D.0001908.061	Electric General Plant			(255,715)	1/1/2025
Aging Technology	2020 Oracle SW MN	D.0002003.015	Common Intangible Plant		(1,656,526)		12/31/2020
Aging Technology	2021 Oracle SW MN	D.0002003.019	Common Intangible Plant		(1,656,526)		12/31/2021
Aging Technology	2022 Oracle SW MN	D.0002003.023	Common Intangible Plant			(1,170,900)	12/31/2022
Cyber Security	Ent DataBase Security Ph4 SW MN-107	D.0002008.015	Common Intangible Plant	(375,927)			3/20/2020
Aging Technology	Purch WAN HW MN-BSPRJ0001167	D.0002011.001	Common General Plant	(8,251,371)	(15,823,270)	(10,792,247)	12/31/2023
Aging Technology	Purch Facility IT Investments HW MN	D.0002021.001	Common General Plant		(2,771,384)		12/31/2021
Aging Technology	TAMS Replacement SW MN	D.0002025.001	Electric Intangible Plant			(1,576,550)	12/31/2022
Customer	Customer Identity Access SW MN-1068	D.0002028.004	Common Intangible Plant	(1,509,750)			4/20/2020
Enhance Capabilities	BUD-Application Virtualization HW M	D.0002029.005	Common General Plant			(2,500,002)	12/31/2022
Aging Technology	Cash Management System SW MN	D.0002032.001	Common Intangible Plant		(599,666)		12/31/2021
Enhance Capabilities	Customer Engagement Platform SW MN	D.0002036.001	Common Intangible Plant			(353,400)	12/31/2022
Customer	CEC-Cust Service Console SW MN-1070	D.0002037.001	Common Intangible Plant		(9,524,378)		12/20/2021
Customer	CEC-Homesmart Ph2 SW MN-10722	D.0002037.011	Common Intangible Plant	(372,984)			12/18/2020
Customer	CEC-Builders Call SW MN-10723	D.0002037.016	Common Intangible Plant	(633,950)			12/31/2020
Aging Technology	DEMS Ph4 HW MN-10756	D.0002038.004	Electric General Plant	(12,380,272)			12/31/2020
Aging Technology	ITC-Purch DEMS HW MN	D.0002038.010	Electric General Plant	(3,391,272)			12/31/2020
Aging Technology	eGRC Phase IV SOx Corp Com SW MN-10	D.0002041.001	Common Intangible Plant	(594,172)			12/20/2020
Aging Technology	eGRC FERC Compliance SW MN	D.0002041.005	Common Intangible Plant			(371,208)	12/31/2022
Aging Technology	eGRC Ph IV SOX SW MN-10764	D.0002041.013	Common Intangible Plant	(227,201)			12/20/2020
Enhance Capabilities	BUD-Enterprise Operational HW MN	D.0002045.005	Common General Plant		(1,333,332)		12/31/2021
Emergent Demand	BUD-IT Blanket Core Tech HW MN	D.0002060.001	Common General Plant		(254,000)	(558,764)	12/31/2024
Aging Technology	Meridium Upgrade SW MN	D.0002063.001	Common Intangible Plant	(1,913,002)			12/31/2020
Enhance Capabilities	Remote Branch Office SW MN	D.0002071.001	Common Intangible Plant	(827,642)			12/31/2020
Enhance Capabilities	Safety Observation SW MN	D.0002073.001	Electric Intangible Plant		(286,026)		12/31/2021
Enhance Capabilities	BUD-BSPRJ1134 SAP Data Gov SW MN	D.0002074.001	Common Intangible Plant				12/31/2023
Aging Technology	TWR SW MN-10713	D.0002078.004	Electric Intangible Plant	(1,583,980)			4/30/2020
Enhance Capabilities	Video Conf SW MN	D.0002082.001	Common Intangible Plant			(2,619,555)	12/31/2022
Aging Technology	BUD-Windows OS Upgrade SW MN	D.0002083.001	Common Intangible Plant			(2,163,726)	12/31/2022
Enhance Capabilities	Software Asset Mgmt SW MN-10729	D.0002084.008	Common Intangible Plant	(1,017,437)			12/31/2020
Enhance Capabilities	Tririga Mobile SW MN-10730	D.0002084.017	Common Intangible Plant	(504,448)			12/31/2020
Aging Technology	2022 Remittance SW MN	D.0002086.001	Common Intangible Plant			(200,608)	12/31/2022
Enhance Capabilities	Data Analytics SW MN	D.0002091.001	Common Intangible Plant			(4,428,288)	12/31/2024
Aging Technology	Product Office Enable SW MN	D.0002103.001	Common Intangible Plant				12/31/2023
Aging Technology	ITSM Modernization SW MN	D.0002104.001	Common Intangible Plant			(3,113,151)	12/31/2022
Enhance Capabilities	ITAM Mod SW MN	D.0002105.001	Common Intangible Plant				12/31/2023
Aging Technology	Purch VOIP Refresh HW MN	D.0002106.001	Common General Plant	(223,105)	(452,885)	(376,078)	12/31/2023
Aging Technology	NMS 2x SW MN	D.0002107.001	Electric Intangible Plant			(6,364,439)	12/31/2022
Aging Technology	Purch Rugged Tablet HW MN	D.0002109.001	Common General Plant	(357,508)	(642,492)		12/31/2021
Aging Technology	Commodity Mgmt Sys SW MN	D.0002110.001	Common Intangible Plant			(1,463,026)	12/31/2022
Aging Technology	SubTran Portal SW MN	D.0002111.001	Electric Intangible Plant		(639,916)		12/31/2021
Enhance Capabilities	Purchase Power SW MN	D.0002113.001	Electric Intangible Plant	(1,306,773)			12/31/2020
Aging Technology	Trans Change Asset SW MN	D.0002119.001	Electric Intangible Plant			(1,036,460)	12/31/2022
Aging Technology	Site Scope SW MN	D.0002126.001	Common Intangible Plant	(240,648)			12/31/2020
Aging Technology	2022 Planned Printer HW MN	D.0002127.001	Common General Plant			(250,000)	12/31/2022
Aging Technology	Bus Obj SW MN	D.0002133.001	Common Intangible Plant		(455,045)		6/30/2021
Enhance Capabilities	Mobile App Mod SW MN	D.0002136.001	Common Intangible Plant	(363,624)			12/31/2020
Aging Technology	Workforce One 2020 Lic MN	D.0002138.005	Common Intangible Plant	(88,510)			12/31/2020
Aging Technology	2023 Planned Printer HW MN	D.0002144.001	Common General Plant				12/31/2023
Aging Technology	2021 Planned Printer HW MN	D.0002145.001	Common General Plant		(125,000)		12/31/2021
Cyber Security	Purch SPAM Filter HW MN	D.0002146.005	Common General Plant		(200,000)		12/31/2021
Enhance Capabilities	Micro Monitor SW MN	D.0002147.001	Common Intangible Plant	(84,030)			12/31/2020
Aging Technology	DRMS PH 2 SW MN	D.0002149.001	Common Intangible Plant		(2,339,677)		12/31/2021
Aging Technology	Tech Lic 2020 SW- MN	D.0002150.001	Common Intangible Plant	(509,232)			12/31/2020
Aging Technology	Tec Lic 2021 SW-MN	D.0002151.001	Common Intangible Plant		(503,072)		12/31/2021
Aging Technology	Tec Lic 2022 SW-MN	D.0002152.001	Common Intangible Plant			(503,345)	12/31/2022
Aging Technology	Tec Lic 2023 SW-MN	D.0002153.001	Common Intangible Plant				12/31/2023
Cyber Security	Purch 2020 Sec Cam HW MN	D.0002154.001	Common General Plant	(175,000)			12/31/2020
Cyber Security	Purch 2022 Sec Cam HW MN	D.0002156.001	Common General Plant			(575,000)	12/31/2022
Aging Technology	Purch 2021 Net Ref HW MN	D.0002157.001	Common General Plant		(1,000,000)		12/31/2021

Aging Technology	Purch 2022 Net Ref HW MN	D.0002158.001	Common General Plant			(1,625,000)	12/31/2022
Aging Technology	Purch 2023 Net Ref HW MN	D.0002159.001	Common General Plant				12/31/2023
Aging Technology	2023 Oracle SW MN	D.0002160.001	Common Intangible Plant				5/1/2023
Aging Technology	OSI Soft PI Ent Agree SW MN	D.0002161.001	Common Intangible Plant				8/31/2023
Enhance Capabilities	Diagnostic Center 5 SW MN-10725	D.0002163.003	Electric Intangible Plant			(603,508)	12/31/2022
Aging Technology	Sharepoint Nuclear EL SW MN only	D.0002164.002	Electric Intangible Plant	(1,236,689)			12/31/2020
Aging Technology	Purch Teradata Hadoop HW MN	D.0002169.001	Common General Plant		(785,228)		12/31/2021
Cyber Security	Security Svc 2022 SW MN	D.0002171.001	Common Intangible Plant			(124,213)	12/31/2022
Aging Technology	2021 EMS Refresh HW MN	D.0002172.001	Electric General Plant		(202,313)		12/31/2021
Aging Technology	2022 EMS Refresh HW MN	D.0002173.001	Electric General Plant			(250,000)	12/31/2022
Aging Technology	BUD-Purch MT Security Servers Nuc M	D.0002174.001	Electric General Plant		(3,286,580)		12/31/2021
Aging Technology	SAP Purge Archive SW MN	D.0002176.001	Common Intangible Plant		(1,346,202)		12/31/2021
Aging Technology	IIB Lic ESB SW MN-10742	D.0002184.002	Electric Intangible Plant	(1,511,097)			12/31/2020
Aging Technology	ITC-Purch IIB ESB EL HW MN	D.0002184.006	Electric General Plant	(36,896)			12/31/2020
Enhance Capabilities	CRS Voice Agent SW MN-10753	D.0002199.003	Common Intangible Plant	(351,006)			12/31/2020
Aging Technology	BUD-ITC-Purch 2020 EMS Infra HW MN	D.0002208.001	Electric General Plant		(127,328)		12/31/2021
Aging Technology	BUD-ITC-Purch 2020 Handheld Mobile	D.0002209.001	Common General Plant		(62,140)		6/30/2021
Aging Technology	BUD-ITC-Purch 2020 IT INFS Ref HW M	D.0002210.001	Common General Plant	(1,893,750)			12/31/2020
Aging Technology	BUD-ITC-Purch 2020 Planned PC HW MN	D.0002211.001	Common General Plant	(2,069,650)			12/31/2020
Aging Technology	BUD-ITC-Purch 2020 Plan Server HW M	D.0002212.001	Common General Plant	(750,000)			12/31/2020
Aging Technology	BUD-ITC-Purch 2020 Storage HW MN	D.0002213.001	Common General Plant	(1,700,000)			12/31/2020
Aging Technology	BUD-ITC-Purch 2020 UnPlan PC HW MN	D.0002215.001	Common General Plant	(600,000)			12/31/2020
Aging Technology	BUD-ITC-Purch 2020 Unplan Server HW	D.0002216.001	Common General Plant	(250,000)			12/31/2020
Aging Technology	BUD-ITC-Purch 2021 Unplan PC HW MN	D.0002217.001	Common General Plant		(600,000)		12/31/2021
Aging Technology	BUD-ITC-Purch 2022 Unplan PC HW MN	D.0002218.001	Common General Plant			(750,000)	12/31/2022
Aging Technology	BUD-ITC-Purch 2023 Plan PC HW MN	D.0002219.001	Common General Plant				12/31/2023
Aging Technology	BUD-ITC-Purch 2023 Unplan PC HW MN	D.0002220.001	Common General Plant				12/31/2023
Aging Technology	BUD-ITC Active Directory 2020 SW MN	D.0002221.002	Common Intangible Plant	(396,684)			12/31/2020
Aging Technology	BUD-ITC-Cust Care IVR SW MN	D.0002223.002	Common Intangible Plant		(1,913,772)		12/31/2021
Enhance Capabilities	BUD-ITC Cust Care Stop Start SW MN	D.0002224.002	Common Intangible Plant			(748,196)	12/31/2022
Aging Technology	BUD-ITC-Purch Data Center HW MN	D.0002225.005	Common General Plant				3/31/2023
Aging Technology	BUD-ITC-DMZ SW MN	D.0002226.002	Common Intangible Plant			(1,748,318)	12/31/2022
Aging Technology	BUD-ITC-GIS SW MN	D.0002227.002	Common Intangible Plant				12/31/2023
Aging Technology	BUD-ITC Integrated Energy Mgmt SW M	D.0002228.002	Electric Intangible Plant				12/31/2023
Aging Technology	BUD-ITC-Internet Explorer SW MN	D.0002229.002	Common Intangible Plant			(1,692,602)	12/31/2022
Aging Technology	BUD-ITC-Purch 2021 Plan Converged H	D.0002230.001	Common General Plant		(2,462,500)		12/31/2021
Aging Technology	BUD-ITC-Purch 2022 Plan Converged H	D.0002231.001	Common General Plant			(2,337,500)	12/31/2022
Aging Technology	BUD-ITC-Purch 2023 Plan Converged H	D.0002232.001	Common General Plant				12/31/2023
Aging Technology	BUD-ITC-Purch 2021 Plan PC HW MN	D.0002233.001	Common General Plant		(2,187,494)		12/31/2021
Aging Technology	BUD-ITC-Purch 2022 Plan PC HW MN	D.0002234.001	Common General Plant			(2,450,007)	12/31/2022
Aging Technology	BUD-ITC-SCCM 2021 SW MN	D.0002235.001	Common Intangible Plant		(522,287)		12/31/2021
Aging Technology	BUD-ITC-Software Defined Data SW MN	D.0002236.002	Common Intangible Plant		(8,439,181)		12/31/2021
Enhance Capabilities	BUD-ITC-TRIRIGA Construction SW MN	D.0002238.002	Common Intangible Plant			(682,376)	12/31/2022
Aging Technology	BUD-ITC-VDI 2020 SW MN	D.0002239.001	Common Intangible Plant	(1,307,332)			12/31/2020
Enhance Capabilities	BUD-ITC-Integrated Financial SW MN	D.0002242.002	Common Intangible Plant				12/31/2023
Customer	BUD-CXT NSPMN	D.0002246.001	Common Intangible Plant	(13,064,636)	(13,588,109)	(12,096,288)	12/31/2022
Enhance Capabilities	BUS SYS Purch Net Equip Crown Wind	A.0001705.006	Electric General Plant	(326,893.46)			7/1/2020
Enhance Capabilities	ITC Purch BUS SYS Net Eq Jeffers WI	A.0001721.002	Electric General Plant	(255,846.65)			11/30/2020
Enhance Capabilities	ITC-Purch BUS SYS Net Eq Comm WIND	A.0001722.002	Electric General Plant	(254,442.97)			11/30/2020

O&M Costs by Cost Element Account
NSPM Electric

Posting Accou	Description	2016 Actuals	2017 Actuals	2018 Actuals	2019 July Forecast	2020 Forecast	2021 Forecast	2022 Forecast
5540001	Productive Labor	9,445,867.32	11,489,995.52	14,392,160.77	20,013,380.25	26,618,582.03	27,438,069.42	28,245,647.27
5540180	Premium Time Labor	3,664.02	4,407.80	3,534.97	2,321.89			
5540185	Other Compensation Accruals	101,105.02	1,077.65					
5540220	Labor Overtime	156,096.03	180,120.97	231,961.35	82,998.61			
5540260	Other Compensation	16,479.69	13,086.27	28,707.15	16,721.42			
5540270	Welfare Fund				1,150.63			
5600001	Contract Labor	5,702,636.57	7,369,602.20	6,604,799.37	7,647,724.41	7,779,023.98	17,405,908.89	12,932,487.81
5600006	Consulting Professional Services Other	3,812,047.49	1,879,969.09	2,160,301.27	1,563,284.01	1,414,567.55	1,396,813.96	1,403,070.47
5600016	Consulting Professional Eng and Design			3,699.90				
5600021	Consulting Professional Services Legal	2,348.69	11,138.18	96,418.71	80,059.43			
5600031	Consulting Legal Regulatory	(6.45)						
5600041	Outside Vendor Contract	33,000.79	109,172.39	216,815.85	215,683.14	84,985.51	84,985.52	84,985.47
5600051	Outside Services Customer Care	924.77	236.89	1,729.25	198.20			
5600066	Materials	225,406.40	175,940.20	153,838.55	102,931.94	66,971.51	67,119.25	67,268.09
5600069	Service Consumption			2,298.41	2,889.04			
5600070	Material - Direct Purchase			21.61				
5600073	Material Small Cap Purchases	15.90						
5600091	Print and Copy Cost - Other	4,358.66	7,065.35	10,794.62	5,520.10	4,294.61	4,294.61	4,294.61
5600106	Equipment Maintenance	898,701.26	858,020.06	466,173.02	649,508.39	1,109,648.23	1,138,725.21	1,168,610.64
5600116	IT Hardware Maintenance	1,327,486.65	1,367,195.26	2,449,287.07	3,207,812.24	4,415,084.19	6,014,404.92	5,540,848.42
5600121	IT Hardware Purchases	283,075.98	255,842.36	388,866.39	219,516.48	229,586.25	237,827.35	246,269.20
5600126	Software License Purchase - Perpetual	395,562.71	388,398.81	766,721.33	402,055.31	515,519.51	535,916.07	557,128.41
5600131	Software License Purchase - Term	1,838,213.72	2,697,602.55	3,103,080.36	3,832,168.82	4,418,479.60	4,941,501.30	5,382,050.63
5600136	Software Maintenance	16,742,281.24	18,319,353.96	19,912,536.46	20,808,379.47	27,047,680.10	28,289,357.96	28,878,350.24
5600141	Network Services	424,470.01	305,101.08	710,233.46	270,114.88	406,460.31	406,456.33	406,288.96
5600146	Network Voice	3,455,268.09	3,710,632.45	3,501,184.26	3,157,451.10	2,416,631.87	2,426,543.25	2,389,662.89
5600151	Network Data	4,973,833.21	4,486,014.98	5,996,223.92	11,108,871.60	12,356,769.47	12,355,940.41	12,315,150.01
5600156	Network Telecommunication	8,507,920.09	8,623,754.37	6,232,358.54	1,175,169.01	181,761.22	181,991.50	180,531.24
5600161	Network Radio	1,593,947.30	814,638.80	1,680,717.57	1,698,628.97	539,918.98	539,918.85	539,918.97
5600166	Mainframe Services	753,878.57	760,457.86	1,071,116.24	1,262,353.05	1,614,724.91	1,477,614.80	1,477,614.80
5600171	Distributed Systems Services	9,377,993.58	3,718,164.42	2,943,690.32	2,318,769.18	2,107,676.24	2,180,520.86	2,254,847.55
5600176	Application Development and Maintenance	9,740,307.36	8,560,964.78	7,751,183.49	9,806,799.24	9,252,251.15	9,279,977.26	8,990,494.18
5600186	Software - ASP	1,404,737.15	1,101,757.07	733,196.26	1,195,689.89	1,716,581.41	1,757,717.85	1,815,822.59
5600191	Employee Expenses Airfare	107,549.38	110,909.06	156,094.23	191,583.06	180,136.03	183,308.00	186,710.63
5600196	Employee Expenses Car Rental	11,128.32	10,012.97	12,080.71	13,394.85	18,969.96	19,333.29	19,712.81
5600201	Employee Expenses Taxi and Bus	9,845.45	11,867.22	15,570.00	16,413.71	18,204.17	18,510.44	18,819.54
5600206	Employee Expenses Mileage	26,536.61	24,175.29	19,246.46	19,361.76	16,302.29	16,642.41	16,987.00
5600211	Employee Expenses Conf Seminar Trng	85,239.68	136,435.39	75,503.50	85,748.55	110,574.35	113,705.09	115,745.30
5600216	Employee Expenses Hotel	131,614.53	160,492.84	197,294.94	169,974.81	159,597.04	162,233.88	164,975.40
5600221	Employee Expenses Meals	70,528.41	54,983.52	77,853.59	56,239.38	61,651.10	62,586.78	63,546.39
5600226	Employee Expenses Meals Non-Employee	13,209.46	18,986.68	17,492.32	10,540.43	1,992.90	2,021.37	2,049.60

5600231	Employee Expenses Parking	34,515.04	23,213.79	44,353.20	55,468.73	73,027.39	73,237.04	73,454.51
5600236	Employee Expenses Per Diem	645.33	6,405.12	(113.40)	18.00			
5600241	Employee Expenses Safety Equipment	18,740.05	9,900.05	3,390.25	2,986.35	8,844.08	8,851.56	8,851.56
5600246	Employee Expenses Other	(276,570.85)	72,057.96	58,502.73	61,313.38	42,881.83	42,992.50	43,828.86
5600251	Employee Expense Personal Communication	482,044.55	559,814.79	640,067.13	201,994.58	372,445.66	373,482.95	374,748.26
5600256	Office Supplies	47,921.19	24,466.16	37,807.19	54,440.03	71,887.37	71,969.31	72,052.03
5600261	Workforce Administration Expense	49.69	278.14	35.99				
5600271	Safety Recognition	33,895.88						
5600276	Life Events	2,743.48	2,315.96	3,758.57	2,256.04	942.47	942.47	948.18
5600291	Transportation Fleet Cost	77,020.77	39,452.41	485.00	77,613.19	170,972.06	170,972.06	170,972.06
5600296	Janitorial - Routine				2,951.81	5,903.63	5,903.63	5,903.63
5600306	Fire Life Safety Maintenance		1,467.80	4,218.62	792.92			
5600311	General Interior Exterior Maintenance	50.00	290.33	2,035.83	3,991.68			
5600316	Use Costs	5.37		1,828.06	855.29			
5600336	Trash Removal Costs		50.00					
5600341	Water Use Costs			358.08	204.92			
5600351	Moves Adds Changes	12,112.08	13,929.48	91.17	34,382.58	6,411.88	6,488.33	6,564.78
5600381	Rent - Space	786.50	192.83	169.46	3,541.06	7,082.13	7,082.14	7,082.13
5600382	Rent - Equipment	4,041.48	255.71	1,868.22	1,118.97	1,888.57	1,888.57	1,888.57
5600436	Postage	32,677.84	35,926.93	32,882.30	30,222.07	32,001.75	32,619.19	33,253.76
5600516	Advertising - General			55.48				
5600546	Customer Program - Advertising		58.86					
5600566	Customer Program - Non-Recoverable		99.00					
5600591	Dues - Professional Association	130,296.10	19,037.47	34,348.43	50,129.84	54,320.93	54,575.77	54,830.83
5600596	Dues - Utility Association Other	(1,096.99)	1,500.00	1,000.00	3,000.00			
5600601	Dues - Utility Association		11,650.16		6,556.49			
5600721	Environmental Permits and Fees			198.86				
5600726	License Fees and Permits	4,731.54	56,567.77	12,385.72	5,819.45			
5600778	Removal Salvage	(2,337.25)		(2,079.93)				
5600781	O and M Credits - Other	(5,687.62)						
5600861	Shared Asset Costs	19,965,797.23	24,528,479.80	23,814,823.56	29,537,058.80	38,418,314.92	37,610,104.49	45,733,295.76
5600866	Shared Assets - Owning Co Credit	(27,026,164.78)	(33,166,416.75)	(25,379,661.93)	(27,799,858.36)	(33,870,939.56)	(33,671,599.04)	(34,453,235.86)
5600871	Other	182,335.74	3,539.58	90,363.58	(5,190,565.89)			
5600896	Online Information Services	602,382.50	525,656.25	784,942.39	1,242,211.92	1,045,419.90	1,082,030.27	1,126,956.64
5600951	Purchasing Overhead Expense		(88.48)					
5610000	External Settlement Labor	(89.90)	1,315.47	25,125.59	6,066.44			
5610003	External Settlement Contract Labor	(901.52)	13,296.17	114,072.13	3,425.57			
5610004	External Settlement Consulting	(447.59)	18,629.74	15,116.62	2,897.13			
5610005	External Settlement Contract Outside Ven		303.36	(120.31)	94.04			
5610006	External Settlement Materials	(0.46)	(2.53)	1,370.43	0.77			
5610007	External Settlement Employee Expense	(0.01)	66.70	58.89	1,141.37			
5610008	External Settlement Transportation		(3,852.02)					
5610009	External Settlement Miscellaneous	1,798.10	1,771.50	19,190.96	704.57			
5610011	External Settlement Overhead	37,044.97	191,440.32	5,296.24	(2,160.92)			
8000000	Prod Labor Bargaining Benefit Group 1	(30,410.83)	131,312.69	7,842.24	1,421.76			
8000005	Prod Labor Bargaining Benefit Group 6		(7,966.15)		7.98			
8000020	Prod Labor Non-Bargaining Benefit Grp 1	166,680.99	535,547.20	54,773.61	(61,054.94)			

8000022	Prod Labor Non-Bargaining Benefit Grp 3	25.75						
8000023	Prod Labor Non-Bargaining Benefit Grp 4	2,071.44	4,798.93	13,175.62	(122.62)			
8000025	Prod Labor Non-Bargaining Benefit Grp 6	(258.84)						
8000037	Productive Labor Non-Barg No Load	(7,126.07)	(1,803.92)	(43.26)	60.58			
8000100	Premium		(9.10)					
8000105	Overtime	1,585.43	21,751.87	488.80	563.39			
8000110	Other Compensation		3,454.18					
8000115	Other Compensation Craft Welfare Fund		(4,331.86)		5.83			
8100000	Non-Prod Labor Bargaining Benefit Grp 1	185,797.37	256,895.24	256,040.07	111,249.95			
8100020	Non-Prod Labor Non-Bargaining Ben Grp 1	1,495,538.35	1,873,789.34	2,213,205.59	1,229,449.62			
8100022	Non-Prod Labor Non-Bargaining Ben Grp 3	1,345.59						
8100023	Non-Prod Labor Non-Bargaining Ben Grp 4	4,984.56	13,068.50	16,920.25	10,439.69			
8100205	AG Overhead	0.59						
8100260	Purchasing - Overhead	140,326.78		213,145.45	153,896.17			
8100315	Warehouse - Overhead	0.03						
8100500	NonProd Bargaining Labor G1_OH Alloc	3,696.27	4,867.22	943.32				
8100502	NonProd NonBarg Labor G1_OH Alloc	31,105.09	4,074.66	21,998.53				
8100530	Purchasing_OH Allocation	(45,631.62)		262,424.10	81,958.48			
8100532	Fleet_OH Allocation	(7,458.89)						
8100533	Warehouse Energy Supply_OH Allocation	199.72						
8100534	Purchasing Nuclear_OH Allocation	(0.08)						
8100540	NonProd NonBarg Labor G3_OH Alloc	(409.32)						
8100541	NonProd NonBarg Labor G4_OH Alloc	676.63	(372.78)	(41.25)				
8100550	Fleet-Base Rates		39,359.37	76,148.08	38,513.55			
	Total	77,978,351.02	73,605,079.47	85,690,032.49	91,378,469.54	111,306,031.47	124,611,488.08	128,731,284.83

Xcel Energy®

Customer Experience Satisfaction

Performance Trends

September 2019

CX MEASUREMENT AT XCEL ENERGY

Channels

- Contact Center Phone Agent & IVR
- Website & My Account
- Mobile App
- Notifications
- Email Correspondence
- Customer Connection

Key Moments

- Start/Stop/Transfer service
- Billing & Paying
- Outage Reporting & Notifications
- Finding Solutions
- New Construction

Xcel Energy®

OVERVIEW OF CUSTOMER EXPERIENCE SURVEYS

Capturing feedback from over 370,000 customer responses since launching our new surveys starting in 2016 or later

Channel	Description	Customer Responses since Launch	Launch Date
Website	Online pop up survey offered to 100% of customers visiting XE.com and My Account	79,489	2016
Mobile App	Measures satisfaction and ease of use within the mobile app	3,293	2018
Contact Center Agent (Experience survey)	Phone survey to customers completing a transaction with an Xcel phone agent	34,626	2016
Contact Center Agent (Post Call survey)	Brief automated IVR survey to customers completing a transaction with an Xcel agent	164,523	2016
Contact Center IVR	Brief automated IVR survey to customers completing transaction through the IVR	36,338	2016
Email Correspondence	Online survey to customers corresponding via e-mail with an Xcel contact center agents	6,639	2018
Outage Notifications	Online survey that measures satisfaction, ERT accuracy & timeliness (text/email)	45,611	2017
Customer Connection	Measures satisfaction with all phases of installing and connecting new electric and/or natural gas service process	2,167	2017

Xcel Energy

Key Takeaways & Recommendations

As more customers move toward completing transactions in our **digital channels**; satisfaction has been worsening. Scores have significantly declined in 2019 in our Website and Mobile App, while our non-digital channels (Agent, E-mail) continue to significantly outperform.

Currently planned initiatives in 2019/20 to improve digital tools must proceed as scoped to pick up digital satisfaction

Billing and Payment and **Outage** satisfaction continue to trend significantly lower for the website channel compared to non-digital channels.

Maritz CX Xcel Energy

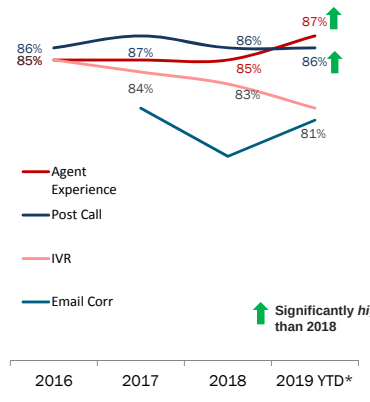
Overall Digital & Non Digital Trend

Maritz CX Xcel Energy

Large Satisfaction Gap Exists Between Digital and Non-Digital

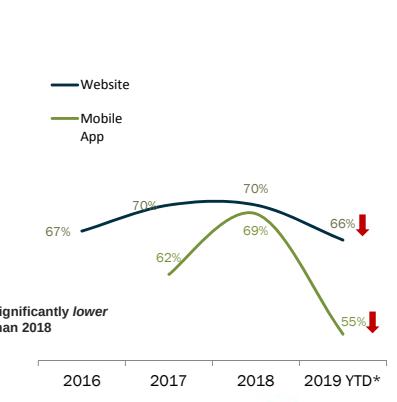
Digital channels are scoring significantly lower than last year, and continue to score significantly below non-digital channels

Non-Digital Yearly Trend - OSAT



*1/1/19 – 9/22/19

Digital Yearly Trend - OSAT

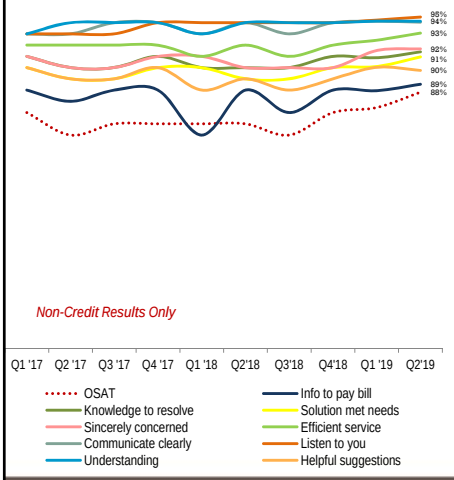


Maritz CX Xcel Energy

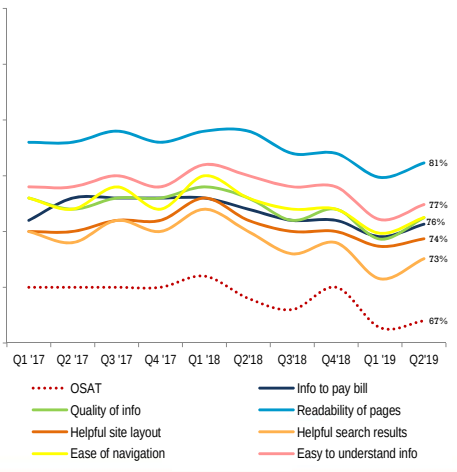
Large Digital Gap Also Exists for Key Attributes

Key attributes from the survey that provide insights to satisfaction performance show that web satisfaction is low across all attributes with the exception of readability.

Agent Experience OSAT & Attributes (Top 3 Box)

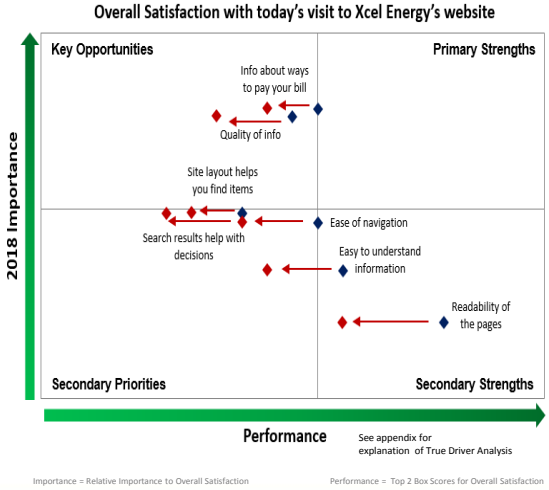


Website OSAT & Attributes (Top 3 Box)



Digital True Driver Analysis: *Website – Total*

Takeaway: As of mid-year 2019, all diagnostics fell below 2018 YE levels for the website. Through late Sept 2019, all attribute scores have significantly declined compared to last year.



2018 Performance

2019 Q1/Q2 Performance (no arrows = no change)

Performance (% Top 2 Box)	2018	YTD 2019*
Quality of info	66	62 ↓
Readability of the pages	72	68 ↓
Site layout helps you find items	64	61 ↓
Search results help with decisions	64	59 ↓
Ease of navigation	67	63 ↓
Easy to understand information	68	64 ↓
Info about ways to pay your bill	67	64 ↓

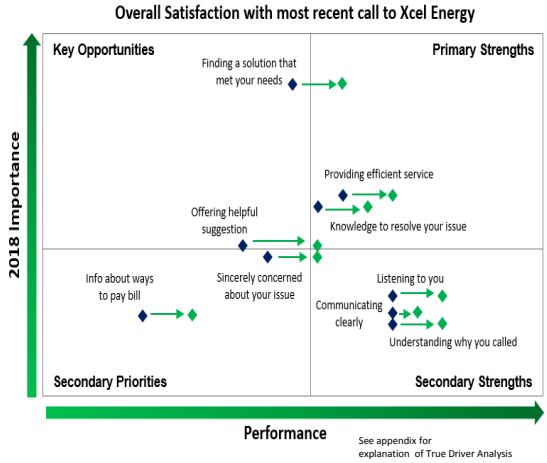
*YTD = 1/1/19 – 9/22/19

↓ **Significantly *lower* than 2018**

Maritz CX Xcel Energy

Non-Digital True Driver Analysis: *Agent Experience – Total*

Takeaway: The Phone/Agent channel continues to perform strongly for the tested diagnostics; as of Q2 2019 there were four primary strengths for this channel.



2018 Performance

2019 Q1/Q2 Performance (no arrows = no change)

Performance (% Top 2 Box)	2018	YTD 2019*
Knowledge to resolve your issue	84	86 ↑
Finding a solution that met your needs	83	85 ↑
Sincerely concerned about your issue	82	84 ↑
Providing efficient service	85	87 ↑
Communicating clearly	87	88 ↑
Listening to you	87	89 ↑
Understanding why you called	87	89 ↑
Offering helpful suggestion	81	83 ↑
Info about ways to pay bill	77	79 ↑

↑ Significantly *higher* than 2018

*YTD 2019 = 1/1/19 – 9/22/19

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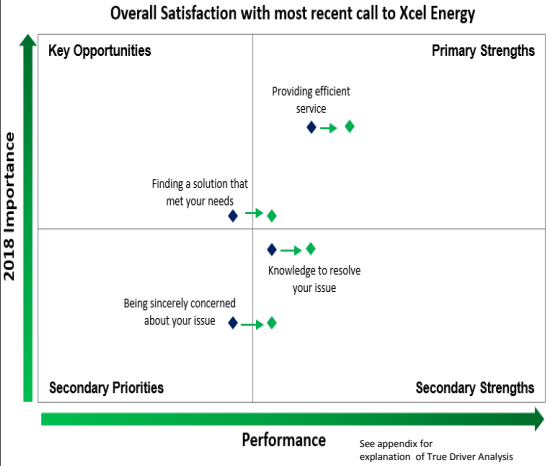
Non-Digital True Driver Analysis: *Agent Post Call – Total*

Takeaway: We have also seen significant improvements in the Agent Post Call Study for all attributes except for Finding Solutions



2018 Performance

2019 Q1/Q2 Performance (no arrows = no change)

Performance (% Top Box)	2018	YTD 2019*
Knowledge to resolve your issue	77	78 ↑
Being sincerely concerned about your issue	76	77 ↑
Finding a solution that met your needs	77	77
Providing efficient service	78	79 ↑

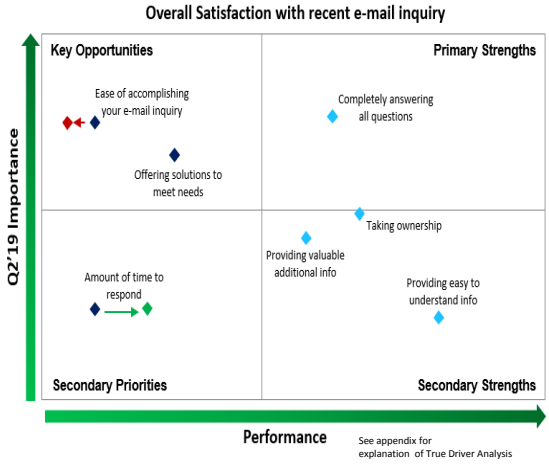
↑ Significantly *higher* than 2018

*YTD 2019 = 1/1/19 – 9/22/19

Maritz CX Xcel Energy

Non-Digital True Driver Analysis: *Email Correspondence – Total*

Takeaway: Timeliness has significantly improved compared to last year.



2018 Performance
2019 Q1/Q2 Performance (no arrows = no change)
New questions added in Q2 2019

Performance (% Top 2 Box)	2018	YTD 2019*
Amount of time to respond	71	74 ↑
Ease of accomplishing task	71	71
Completely answering all questions*		80
Providing valuable additional info*		77
Taking ownership*		79
Providing easy to understand info*		82
Offered solutions to meet needs	74	75

*YTD 2019 = 1/1/19 – 9/22/19
* New survey question added in Q2'19

↑ Significantly *higher* than 2018

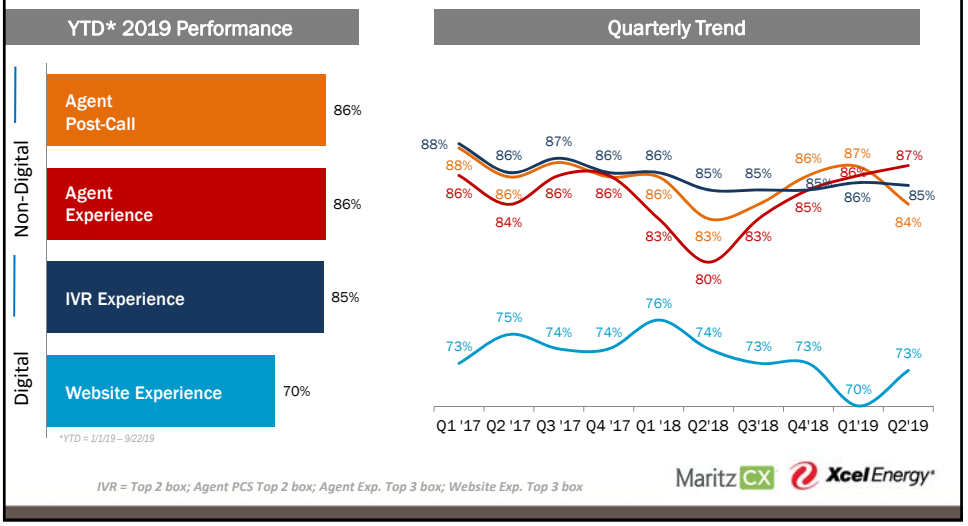
Maritz CX Xcel Energy

Billing & Payment & Outage: CX Satisfaction

Maritz CX Xcel Energy

Billing and Payment: Overall Satisfaction

Among billing and payment customers the Website is significantly below Non-Digital channels, with Q1 2019 being the lowest point over the last two years.

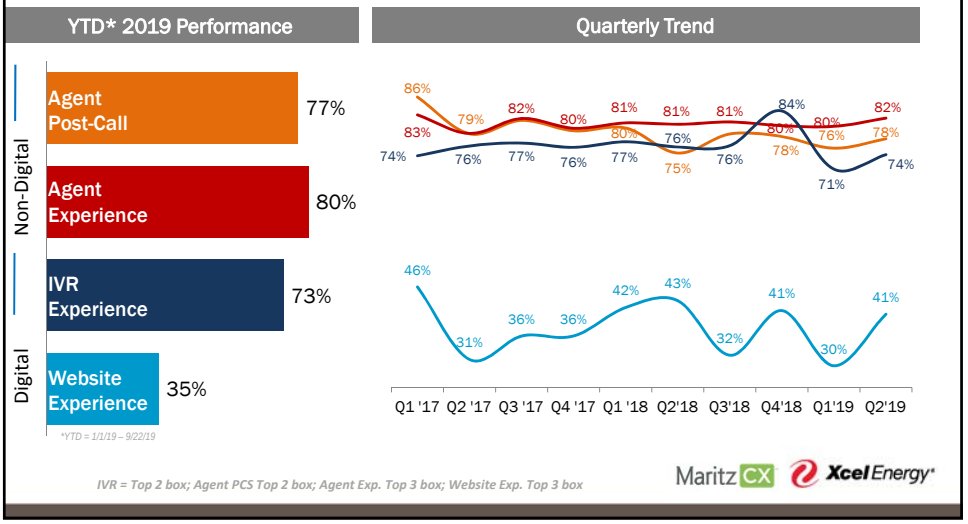


IVR = Top 2 box; Agent PCS Top 2 box; Agent Exp. Top 3 box; Website Exp. Top 3 box

Maritz CX Xcel Energy

Outage: Overall Satisfaction

Customers that visited the website due to an outage are significantly less satisfied than customers that utilized non-digital channels



IVR = Top 2 box; Agent PCS Top 2 box; Agent Exp. Top 3 box; Website Exp. Top 3 box

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Customer Connection

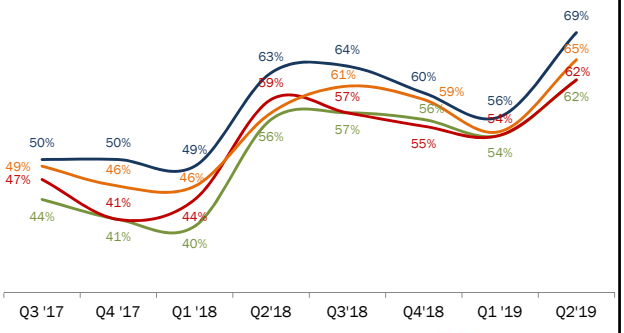
Maritz CX Xcel Energy

Customer Connection Satisfaction

While scores continue to improve due to efforts by Distribution to identify and correct problems, satisfaction is still relatively low compared to all other channels

YTD* 2019 Performance

Quarterly Trend – Top 3 Box



Maritz CX Xcel Energy

Recap prioritization criteria

We heard what you said - ranked priorities

1

Customer satisfaction

Increase in customer satisfaction scores from Xcel Energy customers

2

Employee satisfaction

Increased satisfaction of Xcel Energy employees in delivering top customer experiences

3

Efficient operations

Use of tools and processes that improve outcomes and experiences at a low cost

4

Earnings per share

Increased earnings across Xcel Energy key products and services

Prioritization scoring definitions

Assess each experience across two dimensions

Value

1 **Strategic alignment**

- Enablement of high-priority capabilities
- Importance for achieving long-term objectives
- New strategy/process set-up

2 **Financial impact**

- Direct and/or indirect value creation (ROI)
- Sustained positive impact on incremental revenue or cost structure
- Ability to recover investment

3 **Customer value**

- Direct improvement to customer experience, satisfaction, and trust
- Ability to strengthen customer relationships over time
- New experience implementation

Complexity

1 **Cost**

- Upfront development cost
- Run costs for ongoing maintenance

2 **Capability requirement**

- People, processes, or platforms to unlock capabilities
- Cultural and organizational shifts to foster outcomes
- User adoption of new experiences
- Brand reputation and strategic fit

3 **Risk & dependency**

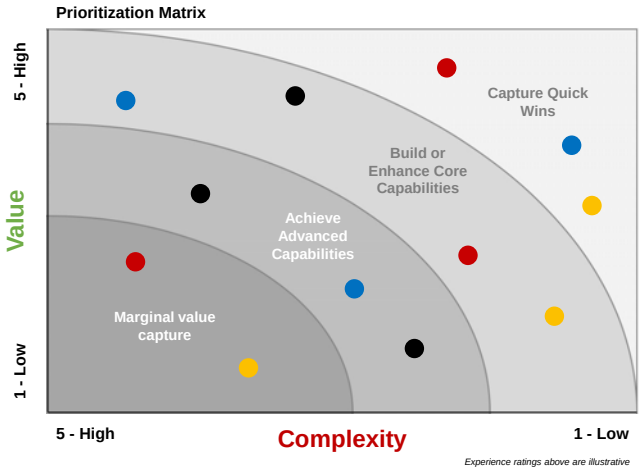
- Level of risk, complexity, and uncertainty
- Longer timeframes
- Dependency on outcomes of other initiatives
- Dependency on 3rd parties
- Regulatory or Labor Union constraints

Experiences driven by outcomes

Customer satisfaction. Employee engagement. Efficient operations. Earnings per share.

We will help you prioritize the right activities by aligning with your objectives

- **Customer satisfaction** - Increase in customer satisfaction scores from Xcel Energy customers
- **Employee engagement** - Increased satisfaction of Xcel Energy employees in delivering top customer experiences
- **Efficient operations** - Use of tools and processes that improve outcomes and experiences at a low cost
- **Earnings per share -** Increased earnings across Xcel Energy key products and services

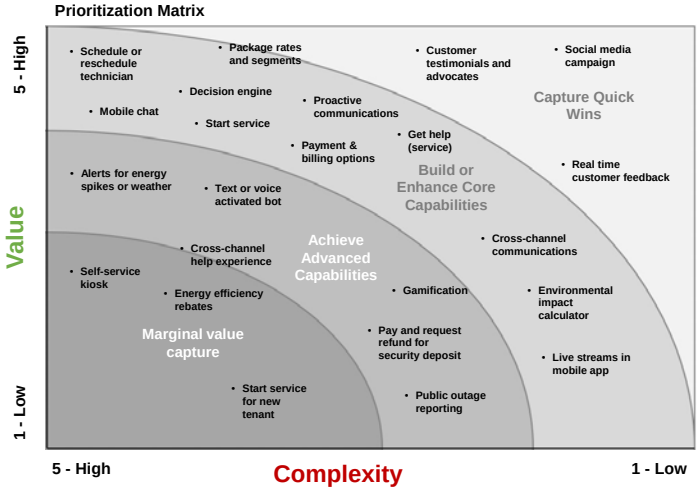


Experience ratings above are illustrative

Outcome - customer satisfaction ●

Increase in customer satisfaction scores from Xcel Energy customers

31+ initial experiences identified

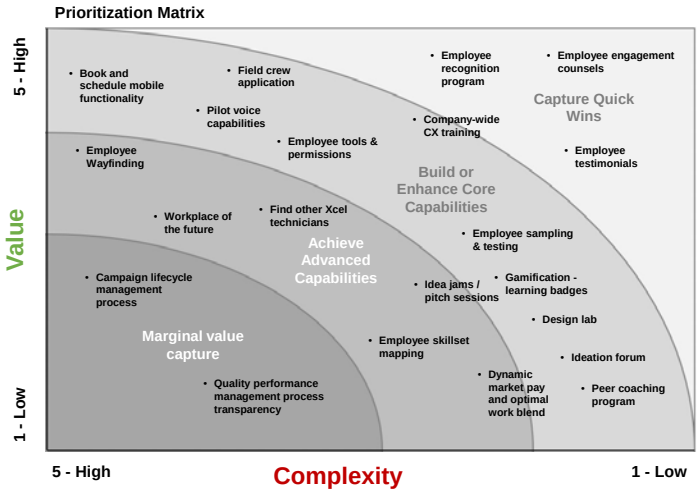


This is an initial experience analysis whose complexity and value ratings may change over time.

Outcome - employee satisfaction

Increased satisfaction of Xcel Energy employees in delivering top customer experiences

21+ initial experiences identified

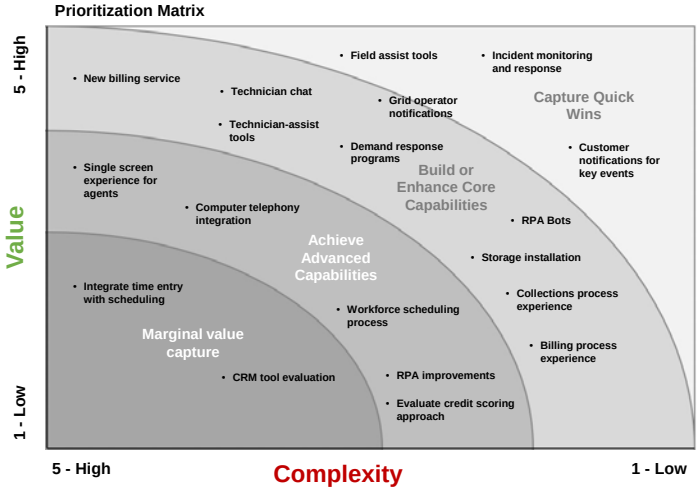


This is an initial experience analysis whose complexity and value ratings may change over time.

Outcome - efficient operations

Use of tools and processes that generate the highest results at the lowest costs

24+ initial experiences identified

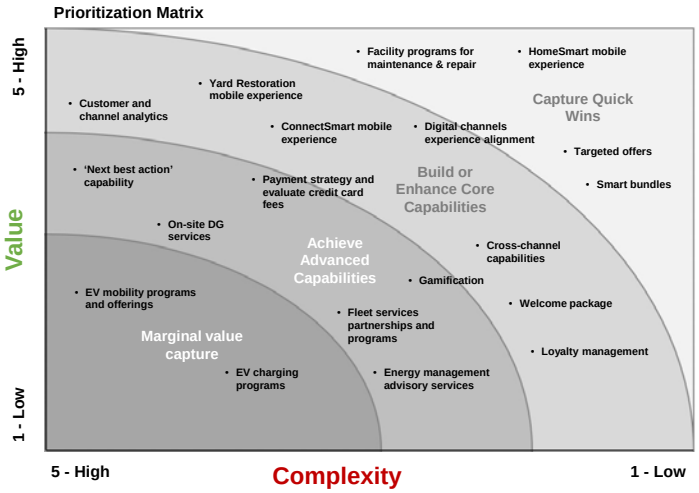


This is an initial experience analysis whose complexity and value ratings may change over time.

Outcome - earnings per share

Increased earnings across Xcel Energy key products and services

20+ initial experiences identified



This is an initial experience analysis whose complexity and value ratings may change over time.

Recap prioritized experiences

Customer satisfaction ● Efficient operations ●
Employee satisfaction ● Earnings per share ●

We heard what you said - priority experiences

Customer experience

- Get help (service) ● ● ●
- Proactive communications ● ● ●
- Start service ● ● ●
- Electric vehicles ● ● ●
- Payment options ● ●
- Billing options ● ●
- Customer testimonials, feedback, and advocates ● ●
- Cross-channel communications ●
- Social media campaign ●

Employee experience

- Employee tools & permissions (to support Get Help) ● ● ●
- Field crew application ● ● ●
- Pilot voice capabilities (Field or CSR Voice of Customer) ● ●
- Employee testimonials ● ●
- Company-wide CX training ● ●
- Employee sampling & testing ●
- Employee recognition ●
- Badges ●

Recap selected experiences

We heard what you said - selected experiences

Inflight experiences

1. HomeSmart

Initial experiences → **Horizon experiences**

2. Electric vehicles
3. Get help
4. Start service

5. Payment options
6. Billing options
7. Proactive communications

Note: experience sequence is subject to change

NSPM Customer Experience Transformation Capital Additions by Project ($'s in millions)				
Project	**Program**	**2020 Forecast**	**2021 Forecast**	**2022 Forecast**
Digital Channel Platforms	New Customer Connection	1.0	1.0	0.9
	Mobile App Re-Platform	0.6	0.6	0.6
	XE.com Re-Platform	2.0	2.1	1.8
	MyAccount Re-Platform	0.6	0.6	0.6
	Contact Center	0.6	0.6	0.6
	Single Screen	2.1	0.6	0.6
Customer Relationship Management	Customer Identity Access Management	1.5	11.0	1.3
Platform Infrastructure and Technology Maintenance	Customer API Platform	1.7	1.8	1.6
Data Analytics and Automation	Customer Data Platform	3.9	4.0	3.6
	Analytics, AI and NLU	0.6	0.6	0.6
	Other	1.0	-	-
Total		**15.6**	**23.1**	**12.1**

PUBLIC DOCUMENT – NOT PUBLIC DATA HAS BEEN EXCISED
Schedule 7 – CRM Platform RFP Results

Trade Secret Justification

Schedule 7 is an internal assessment summary that the Company has designated as Trade Secret information in its entirety as defined by Minn. Stat. § 13.37, subd. 1(b). The analysis and information contained therein has not been publicly released. This summary was prepared by Customer and Sourcing employees and their representatives in 2019, in conjunction with the Company's review of its Customer Relationship Management (CRM) system. This Schedule contains information regarding bidder responses to requests for proposal (RFPs) issued by the Company, including sensitive pricing and other bid data; the Company's proprietary analysis of selected bids; market intelligence; and potential comparative bidder cost and negotiation planning information. Because this overall analysis derives independent economic value from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use, Xcel Energy maintains this information as a trade secret pursuant to Minn. Rule 7829.0500, subp 3.

Northern States Power Company
AGIS: AMI and FAN Expenditures

XCEL ENERGY

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	TOTAL	NPV
Total Meters Deployed	*10,131*	*7,368*	*121,800*	*630,000*	*590,000*	*40,700*	*13,755*	*13,890*	*14,027*	*14,164*	*14,304*	*14,444*	*14,586*	*14,729*	*14,874*	*15,020*	*15,168*	***1,558,960***	
CAPITAL COSTS																		***TOTAL DISCOUNTED***	***NSPM-NPV***
Communications Network																			
FAN Bus Sys Costs	1,709	51,120	88,387	59,329	56,142	15,200	0	0	0	0	0	0	0	0	0	0	0	**271,887**	**217,842**
FAN Bus Sys WiMAX Cost	334,633	10,011,076	17,309,267	11,618,600	10,994,506	2,976,466	0	0	0	0	0	0	0	0	0	0	0	**53,244,549**	**42,660,847**
FAN Bus Sys Contingency	73,854	1,267,037	2,253,221	1,166,606	1,103,942	298,863	0	0	0	0	0	0	0	0	0	0	0	**6,163,522**	**4,979,818**
TOTAL - Communications	***410,196***	***11,329,233***	***19,650,875***	***12,844,535***	***12,154,590***	***3,290,528***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***59,679,958***	***47,858,507***
IT Systems and Integration																			
IT Hardware	1,504,080	2,537,978	2,141,049	545,521	556,814	568,340	580,104	0	0	0	0	0	0	0	0	0	0	**8,433,885**	**7,028,256**
IT Software	1,064,115	1,552,117	5,536,877	4,669,670	323,141	0	0	0	0	0	0	0	0	0	0	0	0	**13,145,919**	**10,838,063**
IT Labor + Project Management	1,725,374	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1,725,374**	**1,621,097**
IT Contingency	0	0	0	11,176,589	605,252	548,564	174,031	0	0	0	0	0	0	0	0	0	0	**12,504,436**	**9,642,915**
TOTAL - IT Systems and Integration	***4,293,568***	***4,090,095***	***7,677,926***	***16,391,780***	***1,485,207***	***1,116,904***	***754,136***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***35,809,615***	***29,130,330***
TOTAL CAPITAL	**4,703,764**	**15,419,328**	**27,328,801**	**29,236,315**	**13,639,797**	**4,407,432**	**754,136**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**95,489,573**	**76,988,837**
O&M ITEMS																			
Communications Network																			
FAN Network Business Systems	0	0	335,766	3,171,422	2,673,589	1,491,278	499,575	671,918	685,827	700,023	714,514	729,304	744,401	759,810	775,538	791,592	807,978	**15,552,536**	**9,460,970**
FAN WiMAX Cost	233,600	357,245	427,150	434,290	562,241	1,048,049	653,607	0	0	0	0	0	0	0	0	0	0	**3,716,182**	**2,782,723**
NOC Opco Allocation	200,000	408,280	625,097	638,037	651,244	664,725	678,485	692,529	706,864	721,497	736,432	751,676	767,235	783,117	799,328	815,874	832,762	**11,473,181**	**6,445,717**
FAN Network Bus Sys Contingency	0	0	301,130	686,305	623,871	517,616	243,271	124,153	0	0	0	0	0	0	0	0	0	**2,496,348**	**1,830,131**
TOTAL - Communications	***433,600***	***765,525***	***1,689,144***	***4,930,054***	***4,510,945***	***3,721,669***	***2,074,937***	***1,488,601***	***1,392,691***	***1,421,520***	***1,450,946***	***1,480,980***	***1,511,636***	***1,542,927***	***1,574,866***	***1,607,466***	***1,640,740***	***33,238,246***	***20,519,541***
IT Systems and Integration																			
IT Hardware	42,114	1,654,282	1,678,585	1,705,324	1,740,624	1,776,655	1,813,432	1,850,970	1,889,285	1,928,393	1,968,311	2,009,055	2,050,642	2,093,091	2,136,418	2,180,642	2,225,781	**30,743,604**	**17,268,781**
IT Software	27,285	85,988	983,487	1,845,314	2,011,390	2,053,026	2,095,523	2,138,900	2,183,176	2,228,367	2,274,495	2,321,577	2,369,633	2,418,685	2,468,752	2,519,855	2,572,016	**32,597,467**	**17,432,600**
IT Labor	0	2,056,405	1,553,273	1,750,246	1,680,090	1,717,226	1,721,011	1,789,073	1,859,799	1,933,290	2,009,656	2,089,007	2,171,461	2,257,136	2,346,156	2,438,653	2,534,759	**31,907,241**	**17,784,018**
Common Corporate Business System development-Allocation	646,904	4,270,861	5,304,505	11,866,886	12,378,199	10,847,247	10,347,121	0	0	0	0	0	0	0	0	0	0	**55,661,724**	**41,239,207**
IT Contingency	0	997,287	9,826,939	4,112,864	2,099,639	2,145,629	2,192,624	2,240,646	2,289,716	2,339,857	2,391,093	2,443,448	2,496,946	2,551,611	2,607,470	2,664,547	2,722,871	**46,123,186**	**28,075,602**
TOTAL - IT Systems and Integration	***716,303***	***9,064,823***	***19,346,789***	***21,280,633***	***19,909,942***	***18,539,783***	***18,169,711***	***8,019,589***	***8,221,975***	***8,429,907***	***8,643,555***	***8,863,087***	***9,088,683***	***9,320,523***	***9,558,795***	***9,803,697***	***10,055,427***	***197,033,221***	***121,800,207***
TOTAL O&M	**1,149,903**	**9,830,348**	**21,035,932**	**26,210,687**	**24,420,887**	**22,261,452**	**20,244,648**	**9,508,190**	**9,614,666**	**9,851,427**	**10,094,500**	**10,344,068**	**10,600,319**	**10,863,450**	**11,133,661**	**11,411,162**	**11,696,167**	**230,271,467**	**142,319,748**
GRAND TOTAL CAPITAL & O&M	**5,853,667**	**25,249,675**	**48,364,733**	**55,447,002**	**38,060,684**	**26,668,884**	**20,998,783**	**9,508,190**	**9,614,666**	**9,851,427**	**10,094,500**	**10,344,068**	**10,600,319**	**10,863,450**	**11,133,661**	**11,411,162**	**11,696,167**	**325,761,039**	**219,308,585**

Northern States Power Company
AGIS: FLISR and FAN Expenditures

XCEL ENERGY

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL	NPV	Cost Category
CAPITAL ITEMS - SUMMARY																							
Communications Network																							
FAN Bus Sys Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**Direct and Tangible**
FAN Bus Sys WiMAX Cost	62,744	1,877,077	3,245,488	2,178,488	2,061,470	558,087	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9,983,353**	**7,998,909**	**Direct and Tangible**
FAN Bus Sys Contingency	48,467	831,493	1,478,676	765,585	724,462	196,129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**4,044,811**	**3,268,006**	**Direct and Tangible**
TOTAL - Communications	**111,210**	**2,708,569**	**4,724,164**	**2,944,073**	**2,785,932**	**754,216**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**14,028,164**	**11,266,914**	
IT Systems and Integration																							
ADMS FLISR Integration	0	372,780	503,962	521,853	1,023,270	1,059,597	807,499	836,165	865,849	896,587	0	0	0	0	0	0	0	0	0	0	**6,887,562**	**4,636,414**	**Direct and Tangible**
IT Contingency	0	0	0	299,788	632,358	654,807	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1,586,953**	**1,147,107**	**Direct and Tangible**
TOTAL - IT Systems and Integration	***0***	***372,780***	***503,962***	***821,641***	***1,655,629***	***1,714,403***	***807,499***	***836,165***	***865,849***	***896,587***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***8,474,515***	***5,783,521***	
TOTAL CAPITAL	**111,210**	**6,214,857**	**13,637,130**	**10,048,307**	**13,491,578**	**10,910,457**	**7,146,728**	**7,325,662**	**7,509,401**	**7,698,082**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**84,093,414**	**59,596,959**	
O&M ITEMS - SUMMARY																							
Communications Network																							
FAN Network Business Systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**Direct and Tangible**
FAN WiMAX Cost	43,800	66,983	80,091	81,429	105,420	196,509	122,551	0	0	0	0	0	0	0	0	0	0	0	0	0	**696,784**	**521,761**	**Direct and Tangible**
NOC Opco Allocation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**Indirect and Tangible**
FAN Network Bus Sys Contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**Direct and Tangible**
TOTAL - Communications	43,800	66,983	80,091	81,429	105,420	196,509	122,551	0	0	0	0	0	0	0	0	0	0	0	0	0	**696,784**	**521,761**	
TOTAL O&M	**43,800**	**66,983**	**80,091**	**81,429**	**105,420**	**196,509**	**122,551**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**696,784**	**521,761**	
GRAND TOTAL CAPITAL & O&M	**155,010**	**6,281,841**	**13,717,220**	**10,129,736**	**13,596,999**	**11,106,966**	**7,269,279**	**7,325,662**	**7,509,401**	**7,698,082**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**84,790,198**	**60,118,719**	

SumFLISRCOSTS

Northern States Power Company
AGIS: IVVO and FAN Expenditures

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL	NPV	Cost Categories
Feeders enabled with IVVO	0	0	26	43	61	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	189		
CAPITAL COSTS																							
Communications Network																							
Communications Operations-IVVO Budget	0	0	61,332	115,547	110,814	104,193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	391,886	293,733	Direct and Tangible
FAN Bus Sys Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Direct and Tangible
FAN Bus Sys WiMAX Cost	20,915	625,692	1,081,829	726,163	687,157	186,029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,327,784	2,666,303	Direct and Tangible
FAN Bus Sys Contingency	16,156	277,164	492,892	255,195	241,487	65,376	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,348,270	1,089,335	Direct and Tangible
TOTAL - Communications	37,070	902,856	1,636,054	1,096,905	1,039,458	355,598	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,067,941	4,049,371	
IT Systems and Integration																						0	
Xcel Personnel [ADMS IVVO Integration]	0	0	803,466	1,375,982	2,021,270	2,024,401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,225,118	4,611,361	Direct and Tangible
External resources (Consultants, contractors etc.) [GEMS]	0	0	520,914	265,849	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	786,763	639,234	Direct and Tangible
GEMS hardware	0	0	104,183	53,170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157,353	127,847	Direct and Tangible
Varentec PM & Services	0	0	52,091	26,585	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78,676	63,923	Direct and Tangible
IT Project Management	0	0	52,091	26,585	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78,676	63,923	Direct and Tangible
IT Travel Expenses	0	0	10,418	5,317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,735	12,785	Direct and Tangible
Security	0	0	104,183	53,170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157,353	127,847	Direct and Tangible
Contingency	0	0	130,158	158,367	190,817	188,381	0	0	0	0	0	0	0	0	0	0	0	0	0	0	667,722	500,682	Direct and Tangible
Program Management	0	0	104,183	319,018	325,622	332,362	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,081,185	802,089	Direct and Tangible
TOTAL - IT Systems and Integration	***0***	***0***	***1,881,688***	***2,284,042***	***2,537,708***	***2,545,144***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***9,248,582***	***6,949,692***	
TOTAL CAPITAL	**37,070**	**902,856**	**3,517,741**	**3,380,947**	**3,577,166**	**2,900,742**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**14,316,523**	**10,999,063**	
O&M ITEMS																							
Communications Network																							
On-going Communications Network costs	0	0	0	0	4,920	15,829	25,585	35,371	36,103	36,850	37,613	38,392	39,187	39,998	40,826	41,671	42,533	43,414	44,312	45,230	567,832	250,941	Direct and Tangible
FAN Network Business Systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Direct and Tangible
FAN WiMAX Cost	14,600	22,328	26,697	27,143	35,140	65,503	40,850	0	0	0	0	0	0	0	0	0	0	0	0	0	232,261	173,920	Direct and Tangible
NOC Opco Allocation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Indirect and Tangible
FAN Network Bus Sys Contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Direct and Tangible
TOTAL - Communications	***14,600***	***22,328***	***26,697***	***27,143***	***40,060***	***81,332***	***66,435***	***35,371***	***36,103***	***36,850***	***37,613***	***38,392***	***39,187***	***39,998***	***40,826***	***41,671***	***42,533***	***43,414***	***44,312***	***45,230***	***800,094***	***424,861***	
IT Systems and Integration																							
Program Management	0	0	22,576	35,446	36,180	36,929	0	0	0	0	0	0	0	0	0	0	0	0	0	0	131,132	98,245	Direct and Tangible
TOTAL - IT Systems and Integration	***0***	***0***	***22,576***	***35,446***	***36,180***	***36,929***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***131,132***	98,245	
TOTAL O&M	**14,600**	**22,328**	**49,273**	**62,590**	**76,240**	**118,261**	**66,435**	**35,371**	**36,103**	**36,850**	**37,613**	**38,392**	**39,187**	**39,998**	**40,826**	**41,671**	**42,533**	**43,414**	**44,312**	**45,230**	**931,225**	**523,106**	
GRAND TOTAL CAPITAL & O&M	**51,670**	**925,184**	**3,567,014**	**3,443,536**	**3,653,406**	**3,019,003**	**66,435**	**35,371**	**36,103**	**36,850**	**37,613**	**38,392**	**39,187**	**39,998**	**40,826**	**41,671**	**42,533**	**43,414**	**44,312**	**45,230**	**15,247,748**	**11,522,169**	

PUBLIC DOCUMENT – NOT PUBLIC DATA HAS BEEN EXCISED
Schedule 11 – Business Systems AMI RFP Results
Schedule 12 – Business Systems FAN RFP Results

Trade Secret Justification

Schedules 11 and 12 are internal assessment summaries that the Company has designated as Trade Secret information in their entirety as defined by Minn. Stat. § 13.37, subd. 1(b). The analysis and information contained therein has not been publicly released. These summaries were prepared by Business Systems and Sourcing employees and their representatives in 2017 (Schedule 11) and 2015 (Schedule 12), in conjunction with the Company's review of hardware and software needs for its Advanced Metering Infrastructure (AMI) and Field Area Network (FAN) projects, respectively. These Schedules contain information regarding bidder responses to requests for proposal (RFPs) issued by the Company, including sensitive pricing and other bid data; the Company's proprietary analysis of selected bids; market intelligence; and potential comparative bidder cost and negotiation planning information. Because these overall analyses derive independent economic value from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use, Xcel Energy maintains this information as a trade secret pursuant to Minn. Rule 7829.0500, subp 3.