



2018 OPERATING PLAN

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By the SPP Finance Department

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BACKGROUND INFORMATION

PURPOSE OF SPP

SPP's mission is "Helping our members work together to keep the lights on ... today and in the future." All of SPP's services are provided on a regional basis, independently, focused on reliability and cost effectiveness. The benefits of SPP are derived from this mission and the diligence to bring value to SPP members and their customers. SPP administers reliability coordination, transmission services and wholesale markets for the benefit of all electric utility operations in the region SPP serves. SPP is mandated by the Federal Energy Regulatory Commission (FERC) to ensure reliable supplies of power, adequate transmission infrastructure, and a competitive wholesale electricity marketplace.

SPP's primary services provided to members and customers include:

- Facilitation
- Reliability Coordination
- Tariff Administration
- Transmission Planning
- Market Operations
- Compliance
- Training

REGULATORY

SPP is directly regulated by FERC. All changes to the SPP regional tariff must be filed with and approved by FERC prior to implementation. Failure by SPP to comply with tariff provisions and/or FERC directives must be reported to FERC and may be subject to penalties and fines.

GOVERNING DOCUMENTS

OPEN ACCESS TRANSMISSION TARIFF (OATT, OR "TARIFF")

The SPP tariff defines the majority of the required workload for SPP's operations and engineering departments. Significant duties include, but are not limited to:

- Tariff administration services, including scheduling
- Ancillary service provisions
- Market operations
- Balancing authority operations
- Settlement of all transactions under the OATT
- Administration of credit services for OATT customers
- Complete system impact studies
- Completion of the annual SPP Transmission Expansion Plan
- Study generation interconnection requests
- Evaluate long-term transmission service requests
- Administer the competitive process for transmission expansion
- Administer the Southwestern Power Administration transmission system beyond their tariff
- Monitor activities in SPP's energy markets and exercise plans to mitigate market power

MEMBERSHIP AGREEMENT (MA)

The MA is an agreement between SPP and each of its members. The MA obligates SPP to perform the services outlined, including those in the OATT. Additionally, the MA describes other significant duties which include, but are not limited to:

- Act as the reliability coordinator for the bulk electric system (BES)
- Develop regional reliability plans and emergency procedures
- Review and approve all planned maintenance of the BES
- Coordinate the maintenance of generation units
- Administer an Open Access Same Time Information System

BYLAWS

The bylaws describe the organizational operation of SPP, specifically outlining the duties of the board of directors and committees advising the board. SPP has a responsibility to facilitate meetings of every organizational group. The scope of the organizational structure is as follows:

- Board of directors (1)
- Regional State Committee (1)
- Members committee (1)
- Board-level committees (6)
- Working groups (19)
- Task forces, subcommittees, strike teams (35+)

PROTOCOLS AND BUSINESS PRACTICES

SPP has well-documented business practices which detail the administrative practices SPP follows in administering the OATT, including coordinating the sale of transmission service. SPP also has well-documented market protocols which detail how customers and SPP are to interact. These documents are developed through SPP's stakeholder process.

ORGANIZATIONAL STRUCTURE

SPP operates via two distinct organizational structures. The first, referred to as the governance structure (see Appendix A: Group Organizational Chart), begins with the board of directors and cascades into board level committees and then to working groups. This organizational structure is populated largely with representatives from SPP's member companies. Generally, the output of this structure is directives on the work SPP is expected to accomplish.

The second organizational structure, the internal staff (see Appendix B: SPP Organizational Chart), illustrates reporting relationships between employees. The staff structure begins with the SPP president and cascades into vice presidents, departmental directors/managers, etc. The staff structure is generally aligned based on functional responsibilities. This structure receives the directives from the external structure and then goes forward in acting on the directives.

FUNDING

SPP funds its ongoing operating costs through charges to customers under the tariff and customers of specific non-tariff services. SPP's operating costs are inclusive of scheduled principal and interest payments on its outstanding debt but are exclusive of depreciation and amortization expenses

incurred. SPP is able to collect up to 100% of its operating costs from charges to transmission customers up to a cap of 43¢/MWh. SPP is charging customers 41.9¢/MWh for service in 2017.

SPP's capital expenditures are funded with borrowings from periodic debt issuances and with 20% equity allocation included in the transmission service charge referenced above. SPP's debt issuances are generally unsecured, have a one-to-two year, interest-only payment period and then fully amortize by the maturity of the notes. SPP is required to obtain regulatory approvals prior to issuing new debt. SPP carries an A rating from Fitch Ratings which was last affirmed in August 2017. SPP staff believes SPP will need to issue new notes in 2018 to fund capital expenditures.

Short-term liquidity is provided by managing SPP's cash float. SPP has a committed \$30 million revolving credit facility to provide additional liquidity support. SPP is soliciting funding for a larger committed guidance line with a 5 year maturity to fund capital expenditures. The key aspect requested in the guidance facility is the ability to convert outstanding balances to fixed rate term notes. Staff expects to complete negotiations with lenders late 4Q'17 and, if successful, present a proposal to the SPP Board of Directors in early 2018.

2018 EXPECTED BUSINESS ENVIRONMENT

The expectations described below largely resemble those in last year's Operating Plan, with attention given to cybersecurity, the proliferation of renewable energy resources, and the impact of energy efficiency on load. An exception, though, is found in the regulatory arena, where a new presidential administration and subsequent changes in policy and regulatory and legislative leadership have brought numerous issues into question.

Cybersecurity

The threat of cyber-attacks continues to be one of SPP's and the entire industry's top risks. Critical infrastructure protection standards continue to evolve to cover areas such as supply chain protection, and such standards serve as robust, base-level requirements to secure our critical assets. The culture throughout the electric industry, though, is maturing from one of compliance to a culture of security.

SPP and its peers must remain involved in the development and implementation of regulations and standards to ensure that they allow for the flexibility needed to meet the security challenges they face in continuing to provide reliable, affordable electricity to consumers. The industry must continue to prioritize cybersecurity maturity above and beyond that which is required for compliance as evolving threats and emerging technologies surface faster than standards can be contemplated and promulgated.

Energy Efficiency

Continued innovation in the arena of energy efficiency, and particularly with regard to consumer goods, will continue to impact the load profiles of SPP and the entire electric utility industry. In the short-term, more efficient appliances and consumer electronics will continue to hold demand low. Soon, though, new technology and products – e.g., electric and autonomous cars – will become cheap enough to proliferate the consumer market, at which time the industry should expect load to grow significantly.

Renewable Proliferation

SPP expects continued growth in wind generation on our system. By the end of 2017, SPP will have more than 17 GW of wind capacity, and there is more than 36 GW of additional wind capacity in the generator interconnection study queue. While SPP has reliably managed wind penetration levels of

more than 50 percent and anticipates levels of 60 percent by 2018, a saturation point will be reached at which wind resources will need to be exported to other regions or curtailed to remain economically and reliably viable.

The SPP region has still seen only limited growth in solar, but that is soon expected to change. With regard to pending generator interconnection requests, solar power is second only to wind with more than 7 GW in SPP's study queue.

Distributed Energy Resources

Utility experts continue to wrestle with the question of the eventual impact of distributed energy resources (DER) on the reliability of the grid. Former FERC Chairman Cheryl LaFleur has suggested that decentralization may have already reached a tipping point, meaning utilities and grid operators will be forced to deal with DERs, whether as a threat or compliment to existing models. This may be hastened by the nation's changing resource mix (see "Renewable Proliferation" above), which is driving down the cost of solar photovoltaic and energy storage technology. Regardless of how decentralized the grid of tomorrow will become, adequate transmission infrastructure will play a crucial role in ensuring its reliability. SPP will also need to respond to changes prompted by its members and their customer bases, including those related to market support for locational issues.

Regulatory Changes and the Trump Administration

The election of President Trump and the coupling of his administration with Republican majorities in Congress will likely bring change to the power and utilities sector. Given the decreased threat of a presidential veto, there is potential for comprehensive energy legislation to be passed by Congress for the first time since 2005. Such legislation could lead to a significant amount of planning and analysis by regional transmission organizations (RTO), including SPP. The last attempt at comprehensive energy legislation failed during the previous administration but its policy provisions are likely to resurface during the current session of Congress.

The most notable and potentially relevant policy provisions to SPP are those related to grid hardening and security and provisions related to markets and distributed energy resources. For example, the House version of the 2016 energy bill would have required a "strategic reserve" of spare power transformers and emergency mobile substations to restore the grid after physical or cyberattack, electromagnetic pulse attack, geomagnetic disturbance, severe weather, or seismic events.

In addition to influencing the odds of comprehensive energy legislation, the new administration has resulted in a new FERC with four of the five commissioners being newly appointed to their posts. While there remains some regulatory uncertainty as to the priorities of this new FERC, the Department of Energy's (DOE) grid study provides some insight into the likely policy issues FERC will address in the coming year.

The study calls for FERC to expedite its efforts with states, RTO/ISOs, and other stakeholders to improve energy price formation in centrally-organized wholesale electricity markets, including negative pricing. And it directs the agency to study and make recommendations regarding efforts to require valuation of new and existing essential reliability services by creating fuel-neutral markets.

It is also expected that FERC will continue its focus on energy infrastructure issues that enable policies to streamline permitting for critical energy assets, especially to the degree the facilities support the resiliency and affordability themes laid out in the DOE staff report.

Perhaps the most immediate impact on utilities under the Trump administration is the elimination of aggressive deadlines for carbon emissions reductions from the generation fleet that were prescribed under the Environmental Protection Agency's Clean Power Plan. To comply with the Clean Power Plan, some utilities had taken steps to bring down emission levels, which included the shutting down of old coal-based power plants, investing in emission control equipment, and increasing the share of natural gas and other energy sources in electricity generation.

Although the CPP may be repealed or replaced with a less stringent emission standard, it is unlikely the decline in coal-fired power generation will be reversed; however, coal-focused electric utilities will likely be able to run their coal units for a longer period than expected earlier. This is because in many cases, the switch from coal to natural gas and renewables is being driven by factors beyond federal regulations. The primary driver has been and will continue to be economic. Coal is not competitive with lower-priced and widely-available natural gas, and the cost of developing renewable energy resources continues to decline. Therefore, it is expected that natural gas use increases across the SPP footprint with continued investment in natural gas-fired combined cycle resources while coal consumption decreases as coal loses market share to natural gas and renewable generation in the electric power sector.

Throughout 2018 and beyond, renewable generation will continue to grow. With a continued tax credit and declining capital costs, it is expected that solar capacity growth continues across the SPP footprint in the long term while tax credits provided for plants entering service until, but no later than 2024, provide incentives for new wind capacity in the near term.

MAJOR 2018 PROJECT INVESTMENTS

SETTLEMENT SYSTEM REPLACEMENT (STARTED IN 2016)

Replace the current market and transmission settlement systems with a custom designed, single, high-performance, scalable system solution.

BENEFITS

Expand automation of the settlements processes to improve accuracy, timeliness, and auditability of the processes. Expect significant reduction in long-term support costs for the settlement function.

STRATEGIC PLAN LINKAGE

Enhance member value and affordability: Existing settlement system has proven to be inefficient, resulting in many manual adjustment processes to complete daily settlements.

INVESTMENT AND TIMELINE

The project initiated in 2016 and is expected to complete in 2Q'19. Significant milestones are:

- Research and evaluation of opportunities **(completed)** 2016
- RFP and vendor selection.....**(completed)** 2017
- Formula builder.....**(completed)** July 2017
- Calculation engine Feb 2018
- User interface July 2018
- Development complete, market trials start..... Dec 2018
- Go-live May 2019

Capitalized Development Costs (\$million)

- Software..... \$5.30
- Allocated IT expenditures (virtual servers, storage, etc.)..... \$0.98
- **Total Capitalized Development Costs** **\$6.28**

SPP expects an increase of three full-time IT employees responsible for support and maintenance of the system. Once implemented, SPP will no longer pay for vendor provided support and maintenance of approximately \$1.4 million annually. Additionally, there will be replacements of hardware assets on SPP's standard five-year replacement schedule.

RISKS

Two significant risks have been identified:

- 1) New solution requires internal ownership for IT support and development of future enhancements. There is a risk internal IT would not be staffed appropriately to facilitate this required support and anticipated cost savings would not be realized. The project includes significant testing by SPP resources throughout code development to ensure familiarity with

the code. Hiring of incremental IT resources will occur early in 2018. These efforts are intended to mitigate the identified risk.

- 2) Settlement system solution represents a paradigm shift in the settlement and IT processes, including system and database approach. Cost savings are dependent on a successful shift in data gathering and processing. The vendor has a proven track record in customized financial system implementations and is nearing completion of similar settlement system replacement at a U.S. RTO.

VOLTAGE SECURITY ASSESSMENT TOOL (VSAT) (STARTED IN 2017)

The online VSAT will identify constraints on the transmission system that real-time operators will be able to mitigate using current congestion management tools. The VSAT will enable real-time operators and operational planning engineers to prepare for and react to stability concerns in order to maintain reliable operation of the BES.

BENEFITS

The most significant goal of this project is to identify areas of voltage concerns with real-time and near-term data. This can be done more efficiently using the VSAT's ability to construct a power-voltage curve with multiple defined contingencies. With the increase in variable generation in SPP's service area, power transfers and supply variability will become increasingly less predictable. VSAT will equip SPP to better predict the state of the system in order to facilitate reliable outage coordination, forward unit commitment, reliability assessments, and general reliable operation of the BES. VSAT will bolster SPP's compliance with NERC standards FAC-011-2, IRO-005-3.1a, IRO-008-2, IRO-009-2, and IRO-101-2.

STRATEGIC PLAN LINKAGE

- Reliability Assurance

INVESTMENT AND TIMELINE

VSAT implementation began in 2017 and will complete before the end of 2018. Initial capital costs include purchase of software, purchase of computer hardware, and new functionality added to the energy management system (EMS) software to facilitate the export of data. Total capital investment to bring the VSAT project to functional status is expected to be \$1.6 million.

RISKS

VSAT has been implemented at other RTOs that utilize an EMS on the Alstom (now GE) platform. Their implementations have been straightforward. SPP anticipates a similar implementation since this is a proven application and architecture. Internal resource constraints may impact the timeline for implementation but are not expected to be a factor.

TRANSIENT STABILITY ANALYSIS TOOL (TSAT)

Online TSAT helps prevent damage to generating equipment. Rotor angle stability, frequency stability and voltage stability are the three main breakdowns for analyzing power system stability. The TSAT application will monitor transient stability by taking an EMS snapshot case and performing power system transfers that stress the current case. Additional dynamic machine characteristics will be mapped to the EMS case. If the tool indicates transient stability issues corrective actions will be made in order to maintain reliable operation of the transmission system. TSAT will be used to ensure power

transfers do not cause a voltage collapse event or blackout. SPP’s current tools are not capable of identifying transient stability issues.

BENEFITS

The major benefit of the project is risk avoidance. This project will reduce reliability risk and improve the ability to operate at record variable generation levels. The reliability risk is directly associated with preventing damage to generation equipment. Transient stability is currently not evaluated in real-time operations. The additional awareness will provide SPP operators with increased situational awareness and lead to reduced risk operating the grid. Most North American ISO/RTOs have this tool in operation. SPP is the last to install this type of real-time sophisticated analysis at the ISO/RTO level.

Assuming TSAT prevents damage to one turbine shaft annually and considering the cost of a generator turbine shaft replacement (based on research papers indicating average cost to replace damaged equipment due to transient instability), cost savings would be approximately \$12million - \$21.5 million.

STRATEGIC PLAN LINKAGE

- **Reliability Assurance:** The increasing amount of volatility from renewable resources has the potential to create unstable conditions that SPP’s current tools are not equipped to identify. This project addresses issues found in the last two SPP wind studies, closes a potential compliance gap, and largely increases the reliability of the BES with the large amount of changing resource fuel mix. Wind generation has different characteristics than the conventional coal, gas and hydro generation (inertia, frequency response, voltage and reactive control, response to faults, etc.) Having a substantial part of the load covered with wind generation and less with traditional coal, gas and hydro changes the dynamic behavior of the BES. Other contributing areas that create a more complex behavior of the BES: use of phase shifters, high parallel flows from external RTO’s, DC lines parallel to AC lines.

INVESTMENT AND TIMELINE

The project will begin once the VSAT application is complete in production, which is expected to be in 1Q’18. The TSAT application is expected to be in production 1Q’19.

Capitalized Development Costs (\$million):

• Hardware	\$0.77
• Licenses	\$0.29
• Consulting.....	\$0.36
• Other allocated IT Expenditures (virtual servers, storage, etc.)	<u>\$0.20</u>
Total Capitalized Development Costs.....	\$1.62

Once implemented, the project is expected to require expenditures for annual license fees and software maintenance. Additionally, there will be replacements of the hardware assets on SPP’s usual five-year replacement schedule.

RISKS

The most significant risk to timely implementation is the capacity of SPP staff to perform work associated with this project in addition to its routine daily workload. This project will require meaningful attention from SPP’s operations engineering staff, already operating at full capacity.

TRAINING AND TESTING SIMULATED ENVIRONMENT (TTSE)

SPP’s Dispatcher Training Simulator (DTS) does not meet the requirements of SPP’s Operations department with the addition of balancing authority, reliability unit commitment and real-time balancing market functions, due to the lack of an integrated market system. Since the implementation of the Integrated Marketplace and SPP becoming the consolidated balancing authority, market systems have become integral to maintaining reliability and balancing. Realistic simulation training, using market systems, is imperative to SPP operator readiness and ultimately increased reliability for the SPP footprint.

The project was initially proposed in three phases:

- Phase 1: create stand-alone DTS separate from SPP’s customer training system
- Phase 2: create market system environment
- Phase 3: add virtualization tools mimicking those available in the control center

BENEFITS

The major benefit of the project is risk avoidance. SPP stakeholders expect operations staff performing SPP’s critical real-time functions to be well-trained. Existing capabilities do not contemplate market solutions and impacts, resulting in the unrealistic simulations.

STRATEGIC PLAN LINKAGE

Reliability Assurance: Provides realistic training simulations for SPP’s real-time operators to best prepare them for the challenges experienced while on shift.

INVESTMENT AND TIMELINE

Phase 1 of the project initiated in 2016 and resulted in the implementation of a stand-alone training simulation environment for SPP’s operations staff. Phase 2 of the project will result in the addition of market simulation capability and contains two components: a) assembly of market simulation hardware and environment and b) build and integrate market simulation software. Phase 3 of the project will add visualization tools to the simulation environment closely mimicking the screens available at the real-time desks.

The completion timelines for each phase are:

- Phase 1: EMS Simulation **(Complete)** Dec 2016
- Phase 2: Market Simulation
 - 2A.....Sept 2017
 - 2B..... Dec 2019
- Phase 3: Visualization Dec 2018

Capitalized Development Costs (\$million)

- Phase 1 \$0.23
- Phase 2A \$0.18

• Phase 2B	\$3.00
• Phase 3	\$0.09
Total Capitalized Development Costs.....	\$3.50

Once implemented, the project is expected to require expenditures for annual license fees and software maintenance of nearly \$0.30 million annually. Additionally, replacement of the hardware assets will occur on SPP’s standard five-year replacement schedule.

RISKS

The market integration piece of this project (Phase 2B) was based on a proposal from AREVA/Alstom/GE. Due to the \$3 million turnkey quote, SPP staff has been evaluating a number of potential in-house solutions. In April 2017, as the complexity of Phase 2 evolved, it was split into A and B sub-phases to get the hardware and initial market environment in place to test potential solutions and determine the best path forward before committing more resources and capital.

The primary challenge is synchronizing the market time, which runs on wall clock/server time, with DTS scenario time. The DTS can be paused or restarted from a previous point, whereas the market runs continually. Unlike other RTOs with a GE market system, SPP’s market system has a market control component. This increases the complexity and unknowns of the project, as this is something GE has not utilized in a simulation system before.

DEFERRED, CONTINGENT OR DECLINED PROJECTS

The following projects have been identified as valuable but are not recommended for budget approval at this time. Reasons for not recommending the projects generally are due to uncertainty about regulatory requirements, timelines, solution, etc.

DISTRIBUTED GENERATION FUNCTIONALITY

Project would enhance SPP’s markets to allow participation by distributed generation resources and storage devices. FERC has issued a notice of proposed rulemaking but has not issued a final order detailing the requirements for compliance.

Estimated capital investment: \$1.8 million

RELIABILITY COMMUNICATIONS TOOL

Project would create an application to facilitate the systematic issuance, receipt, and auditable documentation of operating instructions.

Estimated capital investment: \$0.25 million

FREEZE DATE REPLACEMENT

The project will update the process that calculates firm rights used in real-time congestion processes in accordance with new rules and requirements agreed upon by CMP (SPP, MISO, PJM, TVA, AECI, MHEB, LGEE) members.

Estimated capital investment: \$0.35 million

REPLICATED DATA SERVER UPGRADE

The replicated data server gives SPP transmission operators and transmission owners a near real-time view of SPP's real-time models, substation one-line drawings, SCADA measurements, powerflow solution results, and real-time contingency analysis warnings and violations.

Estimated capital investment: \$0.26 million

2018 MAJOR TECHNOLOGY INVESTMENTS

SPP's ability to provide the vast majority of its services is contingent on a robust and resilient technology infrastructure. SPP operates two data center facilities with full fail-over capacity in the event a single data center is unavailable. Within the data centers exist over 1,900 physical and virtual servers across multiple environments interconnected by a high availability network. Significant investments are made annually to maintain the existing capabilities of the technology infrastructure and enhance it to address new demands on the system, cyber security requirements, and incremental additions to SPP's service menu.

SYSTEMS ADMINISTRATION

The major initiatives in the 2018 fiscal year include:

- Technology refresh of aged server systems (*based on IT's lifecycle policy*)
- Additional data storage for both data center sites (*production and backup capacity*)
- IT service management tool upgrade/replacement

TECHNOLOGY/SERVER REFRESH

The systems administration team manages approximately 450 physical servers and roughly 1500 virtual servers. Generally speaking, IT's policy is to replace physical hardware after a five-year useful life based on exposure to increased failure rates, discontinued or unaffordable vendor support, operating system incompatibility, and the need for faster application performance and connectivity requirements.

SPP has approximately 160 physical servers (dedicated and virtualized) targeted for replacement during 2018 at a total expected replacement cost of \$2.8 million. In concert with the server refresh, SPP will continue to deploy and expand virtualization technology to maximize the utilization of computer hardware and software wherever possible.

DATA STORAGE

SPP utilizes multiple storage technologies to manage data based on the speed, confidentiality, and frequency of use of the stored data. The total capacity of all storage platforms and technologies in place at SPP is 1.5 petabytes. SPP's need for additional storage grows annually based on the retention of years of Integrated Marketplace data and due to additional entrants to SPP's transmission and market services. SPP expects to add flash storage technology in 2018 at a cost of nearly \$1.0 million.

SERVICE MANAGEMENT

SPP's current tool to perform incident, problem, change, asset, release, service request, and knowledge management functions is nearing its end of life. This tool is critical for performing processes related to change and configuration management for CIP-010 and SOC-1 as well as patch management related to CIP-007. SPP is performing a complete review of the system to determine if an upgrade is viable or if replacing the tool with a different product is the more viable and reasonable solution to ensure SPP is leveraging the best possible ITSM tool for the best value. SPP is also seeking a more user friendly interface that allows for better self-service, full service visibility with dashboards and reporting to

make better decisions, and drive improvements with service and asset awareness. The costs of upgrade or full replacement are not known at this time.

IT ARCHITECTURE

SPP maintains an architectural roadmap to guide its evaluation of and evolution to emerging technologies. The 2018 initiatives aligning with the architectural roadmap include the following:

- Data-Lake and Big Data infrastructure foundation
- Analytic and visualization tools

DATA-LAKE AND BIG DATA

SPP utilized Netezza storage appliances as part of Integrated Marketplace project to store historical operational data for business analysis. The Netezza appliances started running out of storage as marketplace data exceeded initial business expectations. Also, the business started requesting access to more historical marketplace operational data (up to five years' worth) and keeping energy imbalance service production data online for time series analysis, data mining, and to produce reports. Data growth and new business requirements gave birth to the Data Lake project, which started in 2016 as an IT foundation project.

The Data Lake project's phase-one goals were to offload less frequently used data from production Netezza appliances to a cost-economical BigData storage solution that provides SQL access to the data, scales incrementally at both compute and storage levels depending on need, and postpones the need for purchasing new Netezza appliances. Phase 1 was successfully implemented and the purchase of new Netezza appliances was postponed.

Data Lake's Phase 2 is currently in progress and concentrates on data access controls, improving checkpoint/restart capabilities, improving SQL query performance, evaluating/implementing transactional capabilities, offloading more historical data from Netezza appliances, and evaluating technologies to feed data directly to Data Lake infrastructure.

Data Lake Phase 3 is slated for 2018. Its goals were to open more Data Lake functionality to business users to run existing processes on the Data Lake infrastructure, provide active-active infrastructure between data centers, implement technologies to feed data directly to Data Lake infrastructure, provide visualization and data analysis capabilities using the tools supported by the data services team, and reduce the dependency on costly Netezza type appliances.

This project reduces the cost of storing historical data for business analysis by reducing the dependency on large Netezza-type appliances. It eliminates the need for either new business tools or rewriting existing queries. It allows incremental scaling at either compute or storage independently which reduces capital and operation expenses. It eliminates time-consuming data migration and verification processes involved with appliance replacements. It also provides federated query capabilities to join the data for future optimizations in data storage.

SPP offloaded 50+ terabytes of data from production Netezza appliances as part of Data Lake phase 1 and postponed \$2.6 million in capital cost (need for purchasing new Netezza appliances).

Phases 1 and 2 included capital costs of \$1 million and allocated staff costs for 4.5 FTEs. Phase 3 capital costs are forecast at \$0.4 million and allocated staff of 2.25 FTEs. The project is expected to provide a 24.47% internal rate of return based on the seven-year cost model.

CYBER SECURITY

SPP intends to add numerous customizations to its arsenal of cyber monitoring, control, and remediation applications. These customizations will provide additional strength to SPP's already formidable cyber defenses. Additionally, SPP will be adding licenses for its cyber defense applications to allow deployment across other assets and data technologies.

KEEPING THE LIGHTS ON

Reliability is job number one at SPP. It is the central focus of every decision and action undertaken within the organization. Internally, this is known as “keeping the lights on” or KTLO. It is the central theme of the organization’s mission statement, “Helping our Members work together to **keep the lights on**... today and in the future.” SPP’s responsibility toward reliability and other important services is delineated in numerous agreements, contracts, tariff, protocols, standards, etc. Significant resources are dedicated directly to fulfilling these obligations and significant support resources are invested in helping the direct satisfaction of these obligations.

INTERNAL WORK GROUPS

SPP’s internal organizational structure is designed to ensure appropriate focus and leadership is deployed to address the KTLO work described above. Many groups have direct responsibilities to accomplish the work while others are available to provide necessary support.

OPERATIONS

Operations	Salary & Benefits	Travel	Services	Other	Total Exp	Cap Ex	Approved Staff
2018 Budget	\$ 22.5	\$ 0.3	\$ 0.3	\$ 0.1	\$ 23.1		162
2017 Forecast	\$ 21.4	\$ 0.2	\$ 0.2	\$ 0.1	\$ 21.9		162

SPP’s operations department is responsible for many of the duties and responsibilities outlined in the OATT and MA. Operations staff are the front-line employees who engage real-time in the reliability and market aspects of SPP on a 24-hour-a-day, seven-day-a-week basis. Staff consists of engineers, certified system operators and specialized support personnel. The department is organized across three distinct subgroups:

1. System operations
2. Markets
3. Operations support

Significant duties include regional reliability coordination, tariff administration, transmission service, real-time and day-ahead market operations, maintaining models for state estimator and commercial modeling tools, training, and balancing authority operations. Additionally, operations staff work with numerous stakeholder groups including the Markets and Operations Policy Committee, Business Practices Working Group, Balancing Authority Operating Committee, Generation Working Group, Operating Reliability Working Group, and Operations Training Working Group. Finally, staff represents SPP and its members at numerous North American Reliability Corporation working groups.

2018 Priorities	Strategic Plan Linkage
<p>Complete a Renewable Generation Integration Study overseen by the Transmission Working Group. The study will analyze inter-modal oscillations identified in the 2017 Variable Generation Integration Study. Additional studies will analyze the 60% and 80% variable generation penetration cases.</p>	<ul style="list-style-type: none"> • Reliability Assurance • Optimize Interdependent Systems
<p>Enhance operator tools – Implement voltage stability analysis systems, build transient stability analysis systems, continue analysis of PMU data from members and neighboring systems.</p>	<ul style="list-style-type: none"> • Reliability Assurance
<p>Enhance operator capabilities – implement formal “learning team” processes, enhance simulation exercises to track closer to real world experiences</p>	<ul style="list-style-type: none"> • Reliability Assurance

ENGINEERING

Engineering	Salary & Benefits	Travel	Services	Other	Total Exp	Cap Ex	Approved Staff
2018 Budget	\$ 10.6	\$ 0.3	\$ 2.1	\$ 0.6	\$ 13.7		80
2017 Forecast	\$ 9.9	\$ 0.3	\$ 1.9	\$ 0.5	\$ 12.7		80

Principal duties of SPP’s engineering department include planning SPP’s transmission system to meet future regional reliability, economic, and public policy needs in an optimized manner; tracking progress and costs of approved transmission expansion projects; and performing longer term (longer than one year) studies necessary to process requests for generation interconnection, transmission service, and transmission congestion rights. The department also performs data gathering and reliability assessment responsibilities in support of the SPP Regional Entity. The predominance of these duties are required by SPP’s tariff, business practices, MA, NERC Reliability Standards, and SPP Criteria.

2017 Priorities	Strategic Plan Linkage
<p>Improved Process Alignment: work with stakeholders to identify and recommend improvements to better align the Aggregate Transmission Service Study (ATSS), GI, congestion hedging, and transmission planning assumptions and processes to alleviate concerns about the planning assumptions and the inability of customers to convert transmission rights into transmission congestions rights.</p>	<ul style="list-style-type: none"> • Reliability Assurance • Enhance Member Value
<p>Planning Studies: Complete the initial ITP assessment under the processes approved by the Board and stakeholders in 2017. Study will complete in 2019.</p>	<ul style="list-style-type: none"> • Maintain Economical, Optimized Transmission System
<p>Customer Initiated Service Studies: Implement any improvements approved through the GI Improvement Task Force to enhance SPP's ability to process growing numbers of GI requests.</p>	<ul style="list-style-type: none"> • Reliability Assurance
<p>Capacity Margin Refinement: Address FERC identified deficiencies in SPP's reserve adequacy processes and implement the improved process.</p>	<ul style="list-style-type: none"> • Reliability Assurance • Enhance Member Value
<p>Rayburn Country Study: Complete PUCT requested study of the impact of moving Rayburn Country's facilities and load from SPP to ERCOT</p>	<ul style="list-style-type: none"> • Reliability Assurance • Maintain Economical, Optimized Transmission System

INFORMATION TECHNOLOGY

Information Technology	Salary & Benefits	Travel	Services	Other	Total Exp	Cap Ex	Approved Staff
2018 Budget	\$ 21.7	\$ 0.1	\$ 4.7	\$ 22.0	\$ 48.4		164
2017 Forecast	\$ 20.1	\$ 0.1	\$ 4.1	\$ 20.4	\$ 44.6		161

The primary mission of IT is to develop, deploy, integrate and support the applications and infrastructure that supply SPP's operational and corporate systems. IT is divided into five primary groups (Enterprise Operations, Applications, Sourcing Strategy, Quality Control, and Cybersecurity), along with a chief architect.

The Enterprise Operations department provides 24x7-support for all communications and networking systems and all computer hardware and environmental needs for SPP's data centers. Each of these activities is critical to SPP's transmission, market, reliability and business processes. IT-Operations also provides technical direction, leadership, and architectural design for the communications, network,

storage, backup/recovery, and computing platforms for all aspects of the IT infrastructure utilized within SPP.

The IT-Applications department provides 24x7-support for existing systems including transmission, reliability, and Integrated Marketplace. The department is responsible for coordinating all software development efforts related to these key business systems, as well as planning and supporting the integration of new members/market participants such as Integrated Systems. IT-Applications plays an integral role in nearly all new projects, including the creation of requirements/test/rollback plans; developing software; providing technical leadership; defining, implementing and reviewing architecture; and providing ongoing maintenance and support for systems.

The Sourcing Strategy team is responsible for managing the IT budget and facilitating/negotiating business activities with major IT vendors. The team works closely with other IT departments to enact an appropriate short- and long-term budget and acquisition philosophy which incorporates vendor leveraging/relationships, asset lifecycles, and adequate maintenance coverage.

The Quality Control team works to identify and implement risk mitigation strategies to assist in compliance and protection of SPP’s assets. The team is responsible for conducting timely internal reviews of evidence to ensure ongoing compliance obligations are met. The team owns and maintains the documentation of all processes and procedures related to compliance for IT and select non-IT departments, including the associated and applicable Reliability Standard Audit Worksheets (RSAWs). The team also plays a significant role in IT EMBC/Recovery Planning, owning and facilitating applicable processes, procedures, and testing activities.

The Cybersecurity team was enhanced and consolidated in 2016 to ensure SPP complies with all requirements of the FERC-approved NERC cybersecurity standards. The team proactively evaluates and employs best practices to ensure SPP’s overall IT security is at optimal levels. They work closely with IT and SPP’s compliance departments to ensure security measures are adopted, implemented and followed according to SPP policies.

2018 Priorities	Strategic Plan Linkage
Automation: Areas of focus that will continue from 2017 into 2018 include patch management, server provisioning, and application testing. In each of these areas, IT staff spends significant time performing manual processes to build, track, replicate, and verify information. Implementation of automated processes will allow the team to reduce manual activities while providing improved quality and consistent outcomes.	<ul style="list-style-type: none">• Enhance Member Value

Reduce third-party consultant engagements: increased and aligned skills of internal staff to become more self-sufficient in supporting SPP’s infrastructure and applications and better positioned to assume support for enterprise projects (e.g., Z2 and Settlements replacement). Staff augmentation through consultants is projected at less than \$0.5 million in 2018 from a high of \$1.6 million in 2014

- Enhanced Member Value

Cybersecurity and CIP Compliance: The Cybersecurity team plans to perform routine training for all staff to quantify adherence to SPP policies and best -practices. At a corporate level the team plans to mitigate risk by implementing tighter controls over CIP assets/systems while performing ongoing penetration testing, vulnerability assessments and recovery exercises.

- Reliability Assurance
- Enhance Member Value

IT compute and data infrastructure: begin implementation of an alternative compute infrastructure during 2018 and beyond. Migration to the new platform will be a gradual process aligned with the refresh of existing servers and installations of new project requirements. This infrastructure will improve provisioning efficiency and manageability and as SPP adopts new platforms and environments

- Enhance Member Value

Data Governance: IT has attempted to implement a “fit for purpose” approach whereby the most cost-effective storage solution is aligned with user/application requirements. SPP will continue that approach with a focus on implementing effective processes to allocate/control/delete data in accordance with retention policies and/or end-user requirements. Success initiative will eliminate unnecessary/duplicative data and improve data life-cycle management.

- Enhance Member Value

CORPORATE

Corporate *							
	<u>Salary & Benefits</u>	<u>Travel</u>	<u>Services</u>	<u>Other</u>	<u>Total Exp</u>	<u>Cap Ex</u>	<u>Approved Staff</u>
2018 Budget	\$ 30.8	\$ 0.9	\$ 5.4	\$ 6.5	\$ 43.7		138
2017 Forecast	\$ 30.7	\$ 0.9	\$ 5.4	\$ 5.5	\$ 42.4		137

* Includes Admin/Officer, Corporate Services, Reg/Legal/RSC, Interregional Relations/Market Design, Communications/Government Affairs and MMU

The corporate group has responsibility for many broad aspects of the organization and includes the following support areas:

- Executive
- Communications
- Accounting
- Gov’t Affairs
- Legal
- Human Resources
- Regulatory
- Administration
- Settlements
- Facilities
- Credit
- Market Monitoring

This group holds the budget for several expenses which are not allocated across the company such as pension expense, corporate liability insurance, and board of director compensation.

2018 Priorities	Strategic Plan Linkage
Membership expansion: to the extent Mountain West Transmission Group proceeds with membership in SPP, considerable focus on ensuring the implementation proceeds timely and smoothly	<ul style="list-style-type: none"> • Optimize Interdependent Systems
Settlements: build of the replacement system will consume the entire year. The project plan utilizes the “agile” delivery process which enables ongoing testing of the delivered components throughout the construction phase.	<ul style="list-style-type: none"> • Enhance Member Value

PROCESS INTEGRITY

Process Integrity	<u>Salary & Benefits</u>	<u>Travel</u>	<u>Services</u>	<u>Other</u>	<u>Total Exp</u>	<u>Cap Ex</u>	<u>Approved Staff</u>
2018 Budget	\$ 7.9	\$ 0.3	\$ 1.0	\$ 0.1	\$ 9.3		54
2017 Forecast	\$ 7.1	\$ 0.2	\$ 0.5	\$ 0.1	\$ 8.0		53

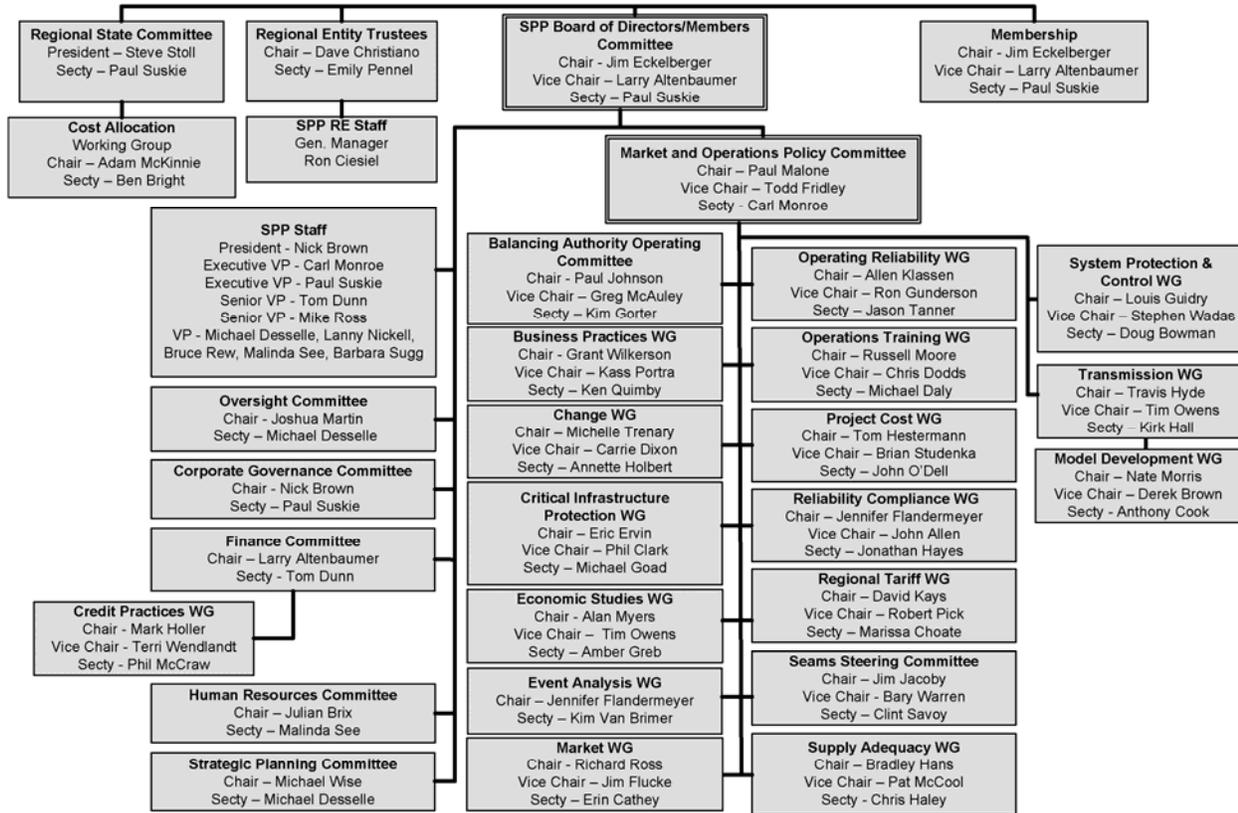
Primary responsibilities in the Process Integrity group include internal audit, reliability standards compliance, stakeholder services (including external member training and customer service), corporate project management, and interregional activities. Departments in this group work closely with the SPP Oversight Committee.

2018 Priorities	Strategic Plan Linkage
Compliance: performance of an internal mock audit to gauge effectiveness of SPP’s processes and procedures designed to comply with NERC CIP v5 standards	<ul style="list-style-type: none"> • Reliability Assurance • Enhance Member Value

APPENDIX A



Group Organizational Chart



Updated 08/14/17

APPENDIX B

SPP Organizational Chart - September 19, 2017
Officers with detailed headcount
Full Headcount 616

