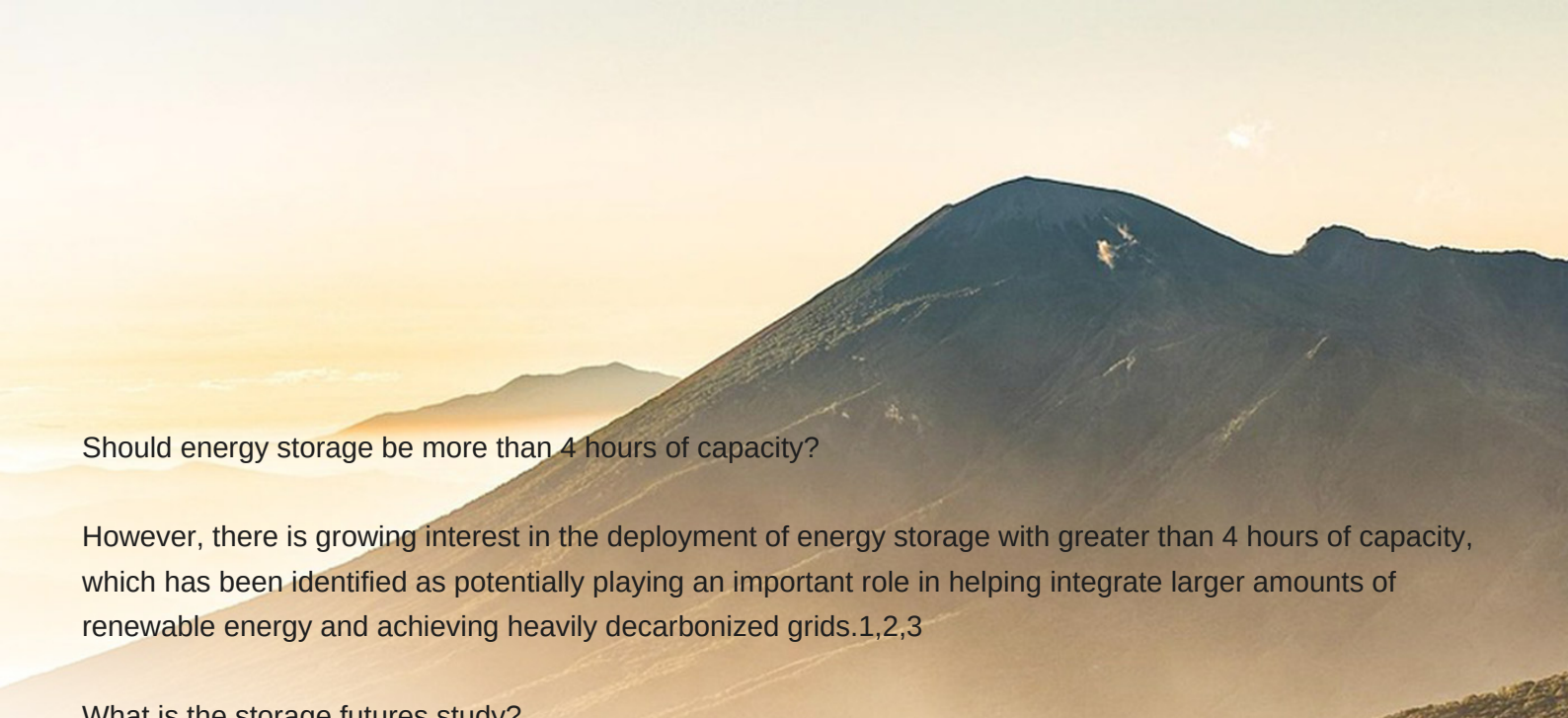


Should energy storage be more than 4 hours of capacity?

However, there is growing interest in the deployment of energy storage with greater than 4 hours of capacity, which has been identified as potentially playing an important role in helping integrate larger amounts of renewable energy and achieving heavily decarbonized grids.1,2,3

What is the storage futures study?

The Storage Futures Study series provides data and analysis in support of the U.S. Department of Energy's Energy Storage Grand Challenge, a comprehensive program to accelerate the development, commercialization, and utilization of next-generation energy storage technologies and sustain American global leadership in energy storage.

Will a 4 hour solar system increase storage capacity during summer peaks?

Overall,while continued deployment of solar can maintain the ability of 4-hour storage to provide significant capacity during summer peaks,this solar deployment will also accelerate the shift to net winter peaks in much of the country. This then will likely drive the decline in capacity value of 4-hour storage and incentivize longer durations.

Can 4 hour storage meet peak demand?

The ability of 4-hour storage to meet peak demand during the summeris further enhanced with greater deployments of solar energy. However,the addition of solar,plus changing weather and electrification of building heating,may lead to a shift to net winter demand peaks,which are often longer than can be effectively served by 4-hour storage.

Why should energy storage be a long-duration option?

Provision of additional services such as transmission congestion relief and resilience could also increase opportunities for longer-duration storage. Several storage technology options have the potential to achieve lower per-unit of energy storage costs and longer service lifetimes.

Can stationary storage move past 4 hours?

To understand the potential opportunities for moving past 4 hours, we first explore why 4 hours or less has

provided the majority of the market for stationary storage in the past decade. The United States has about 23 GW of pumped storage hydropower (PSH), largely completed before 2000 (and most of these plants have 8 hours or more of storage).

In 2007, SPP launched its Energy Imbalance Service (EIS) market, which was designed to provide energy companies within its footprint a real-time market for least-cost power. In 2014, EIS was replaced with the more robust Integrated Marketplace, which includes EIS" Real-Time market as well as a Day-Ahead market with transmission congestion

A stochastic continuous-time model was formulated for unit commitment and reserve scheduling problem in [8], with the inclusion of energy storage in [9] and a method for load estimation and

SPP CONTINUOUS RUN TIME REQURIEMENTS ENERGY STORAGE

energy storage, the duration of the energy storage resources, the dispatch strategy, and the solar capacity on the SPP system. In addition to the stand-alone storage analysis, combined storage and solar projects were also evaluated. RESULTS STAND ALONE BATTERY RESULTS The following figures summarize the capacity credit results.

SPP proposes that for fast-start resources that are market storage resources, the composite energy offer will only apply to the discharge portion of the resource's energy offer curve.20 SPP further proposes that composite offers will be subject to the energy offer cap described under current section 4.1.1 of Attachment AE.21 c. Minimum Run

report are solely those of the SPP Market Monitoring Unit (MMU), the independent market monitor for Southwest Power Pool, Inc. (SPP). The MMU and SPP make no representations or warranties of any kind, express or implied, with respect to the accuracy or adequacy of the information contained herein. The MMU

SPP CONTINUOUS RUN TIME REQURIEMENTS ENERGY STORAGE

energy storage, the duration of the energy storage resources, the dispatch strategy, and the solar capacity on the SPP system. In addition to the stand-alone storage analysis, combined storage and solar projects were also evaluated. RESULTS STAND ALONE BATTERY RESULTS The following figures summarize the capacity credit results.

Southwest Power Pool, Inc. 2024 Operating Plan August 25, 2023 7 2024 EXPECTED BUSINESS ENVIRONMENT In 2024, SPP will face opportunities and challenges related to increasing levels of electrification, continued changes to the generation mix, increased planning reserve margin requirements,

The concept of Power-to-Gas (PtG) proposed and developed over the past three decades has become a very promising technology recently, since it enables a vast amount of renewable energy to be stored in the form of gaseous chemicals [9] using excess electrical power generated by RES to produce synthetic gases, it permits seasonal energy storage and ???

SPP CONTINUOUS RUN TIME REQURIEMENTS ENERGY STORAGE

Additional site control requirements for GEN tie lines; New financial security and study deposit risks and readiness thresholds; Transition requirements under the newly revised SPP Tariff, Attachment V; Southwest Power Pool 201 Worthen Drive ??? Little Rock, AR 72223-4936

THE ENERGY STORAGE ASSOCIATION continuous run time requirements for qualifying the resource adequacy contribution of resources, provision to be specified in business practice manuals. Thus, in the instant filing, SPP seeks approval of the minimum run-time 2 Southwest Power Pool, Inc., 169 FERC ? 61,048 (October 17, 2019). 3

storage to gain a better understanding of storage and how SPP should address these issues in the future. This white paper will be delivered to the Market and Operations Policy Committee (MOPC), Regional State Committee, and Board of Directors/Members Committee in January 2020. The white paper should include tactical and strategic recommendations.

SPP CONTINUOUS RUN TIME REQURIEMENTS ENERGY STORAGE

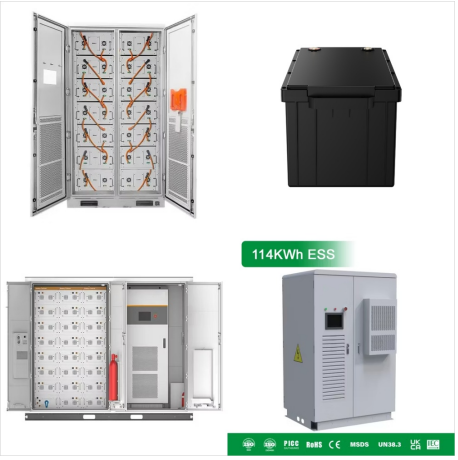
FEDERAL ENERGY REGULATORY COMMISSION Southwest Power Pool, Inc.) Docket No. ER19-____-000 COMPLIANCE FILING OF SOUTHWEST POWER POOL, INC. Nicole Wagner Manager, Regulatory Policy Southwest Power Pool, Inc. 201 Worthen Drive Little Rock, AR 72223 Telephone: (501) 688-1642 Fax: (501) 482-2022 jwagner@spp ???

rules for energy storage providing peaking capacity and resource adequacy. As an example, a California Public Utilities Commission (CPUC) rule for California's investor-owned utilities states that storage with 4 hours of continuous discharge capacity is eligible to meet resource adequacy requirements (Chow and Brant 2017; CPUC 2017).

ENERGY STORAGE RESOURCES IN GENERATOR INTERCONNECTION STUDIES GI Improvement Task Force . Published October 19, 2018 By SPP GI Improvement Task Force . Southwest Power Pool, Inc. REVISION HISTORY DATE OR VERSION NUMBER AUTHOR CHANGE DESCRIPTION COMMENTS September 19, 2018 SPP GI Dept. Initial Draft

SPP CONTINUOUS RUN TIME REQURIEMENTS ENERGY STORAGE

Southwest Power Pool, Inc. Market Monitoring Unit . State of the Market 2020 . Acknowledgement . The following members of the . Market Monitoring Unit . contributed to this report: Keith Collins . Jodi Woods . Greg Sorenson . John Luallen . Cristie Arnold . Kevin Bates . Jason Bulloch . David Daniels . Jared Greenwalt . Esat Serhat Guney



On May 26, 2023, the Commission accepted Southwest Power Pool, Inc.'s ("SPP") proposed revisions to its Tariff to establish the "framework under which an. One firm, endless possibilities. FERC Approves SPP Proposal for Energy Storage to Be Considered Transmission-Only Assets. By Quintessa Davis & Elizabeth McCormick on June 22, 2023.

SPP Storage may participate as an existing resource type or under a new market storage resource (MSR) model exclusive to energy storage Capacity: 4-hour resource adequacy minimum run-time AS: Regulation service, SPP will optimize output between AS and Energy markets Energy: Buy and sell into market at wholesale locational marginal price

SPP CONTINUOUS RUN TIME REQURIEMENTS ENERGY STORAGE

/06/2023 SPP Added information related to RR569 and updated the From the time in a continuous set of commitments at which the SCUC process does not consider Multi-Day Min Run Time . 4 iii. The Energy Offer Curve used to de termine a ???

Southwest Power Pool, Inc. Market Monitoring Unit . State of the Market 2019 . Acknowledgement . The following members of the . Market Monitoring Unit . contributed to this report: Keith Collins . Jodi Woods . Greg Sorenson . John Luallen . Cristie Arnold . Kevin Bates . Jason Bulloch . Jared Greenwalt . Esat Serhat Guney . David Hurtado

Working together to responsibly and economically SouthwestPowerPool SPPorg southwest-power-pool keep the lights on today and in the future. SOUTHWEST POWER POOL: Improve SPP's resource adequacy requirements. 11 PLANNED VERSUS ACTUAL RESERVE MARGINS. 12 0.07 0.59 0.85 0.9 2.1 0.57 1.2 0.35 insufficient time to resolve deficiencies. 14

SPP CONTINUOUS RUN TIME REQURIEMENTS ENERGY STORAGE

minimum run-time specified in the SPP Planning Criteria, in contrast to external resources whose requirements are specified in sections 7.3 and 7.5 and that are not subject to the continuous minimum run-time requirement. SPP requests an effective date of October 28, 2019, the date that the

Astrap? Consulting was contracted by SPP to examine the capacity credit of energy storage resources on the SPP system using two methodologies: (1) Capacity Value and (2) Effective Load Carrying Capability (ELCC). Astrap? performed simulations to examine the

An Overview of the SPP System. SPP has members in 14 states: Arkansas, Colorado, Iowa, Kansas, Louisiana, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas and Wyoming. W e have customers in all or part of 23 states and provinces through our western energy services.

SPP CONTINUOUS RUN TIME REQURIEMENTS ENERGY STORAGE

ISO/RTO Energy Storage Market Modeling Working Group Binary Storage Facility; CSF: Continuous Storage Facility; DAM: Day-ahead Market; DARD: Dispatchable Asset PSH: Pumped Storage Hydro; RTM: Real-time Market; SOC: State of Charge; SOCM: SOC Management [2] Electricity Market Design Implications for Bulk Energy Storage. EPRI, Palo ???