

Sand Bar Phase Shifting Transformer Asset Condition



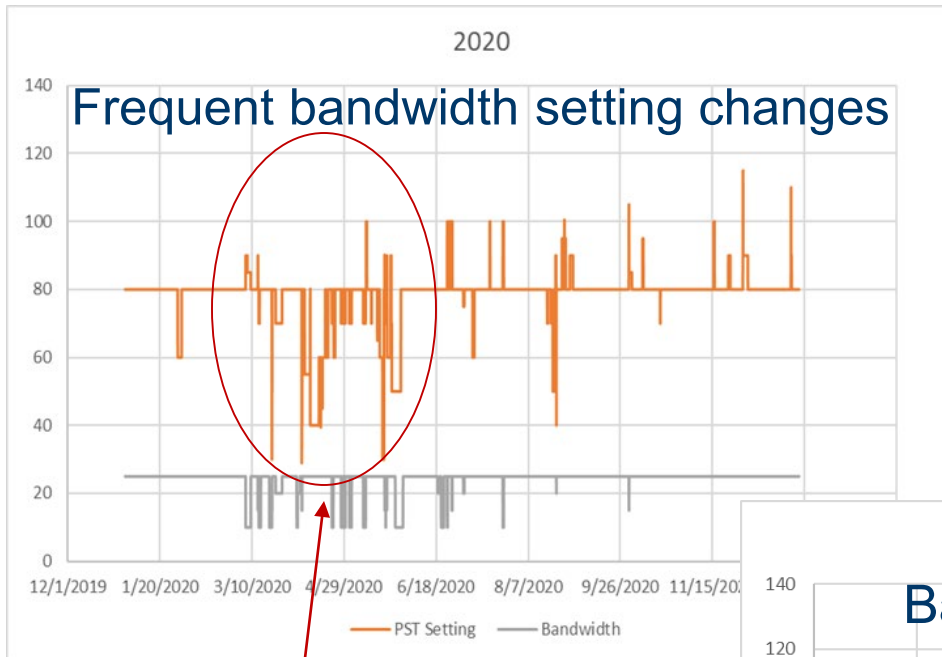
VSPC Geographic Targeting
Subcommittee

June 19, 2024

Sand Bar PST failure

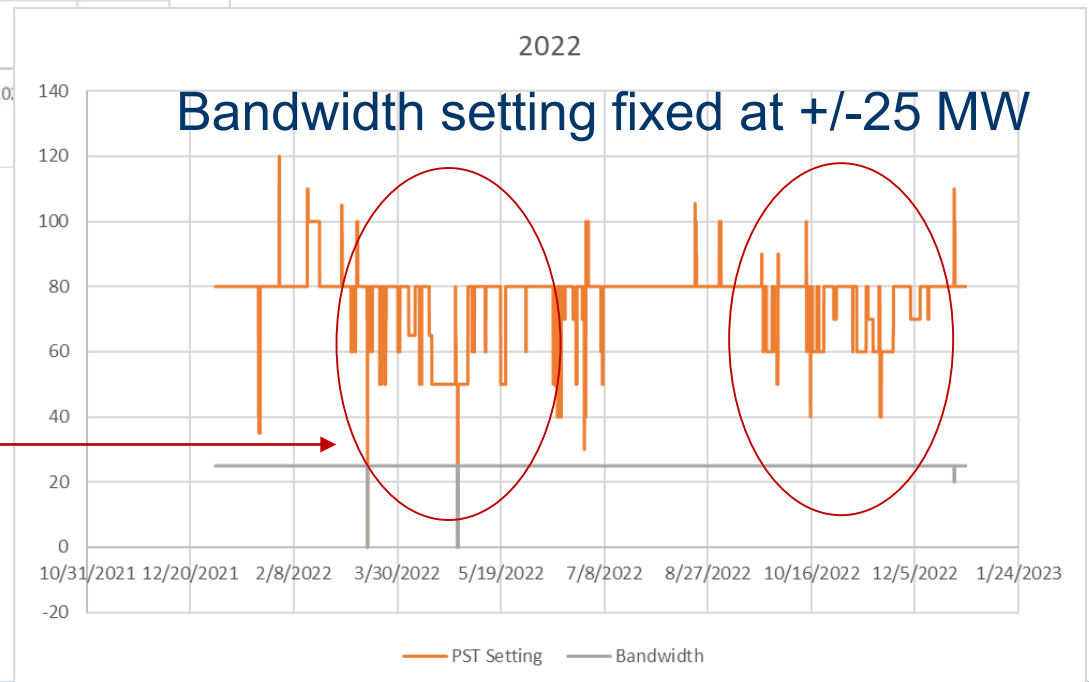
- Internal fault on Feb 22, 2021
- PV20 line remained open until restoration
 - Found fault location
 - Effected on-site fix in lieu of shipping to Europe
 - Moved one Granite PST to Sand Bar in May 2021
 - 62 miles on dirt road, highway, and city streets – 12 hours
 - Limited VT roads meant significant transportation impacts (seasonal limitations, permitting, dirt roads)
 - PST placed in service at Sand Bar in July 2021
 - Repaired PST returned to Granite in Nov 2023
- Cost of repair and transportation
 - \$3.5M

Constant bandwidth after restoration



- Flow setting normally 80 MW
- Bandwidth setting
 - Normally +/-25 MW
- Tighter bandwidth when a different flow is needed
 - Frequently +/-10 MW

Variability appears to align with spring and fall low load/high renewables periods

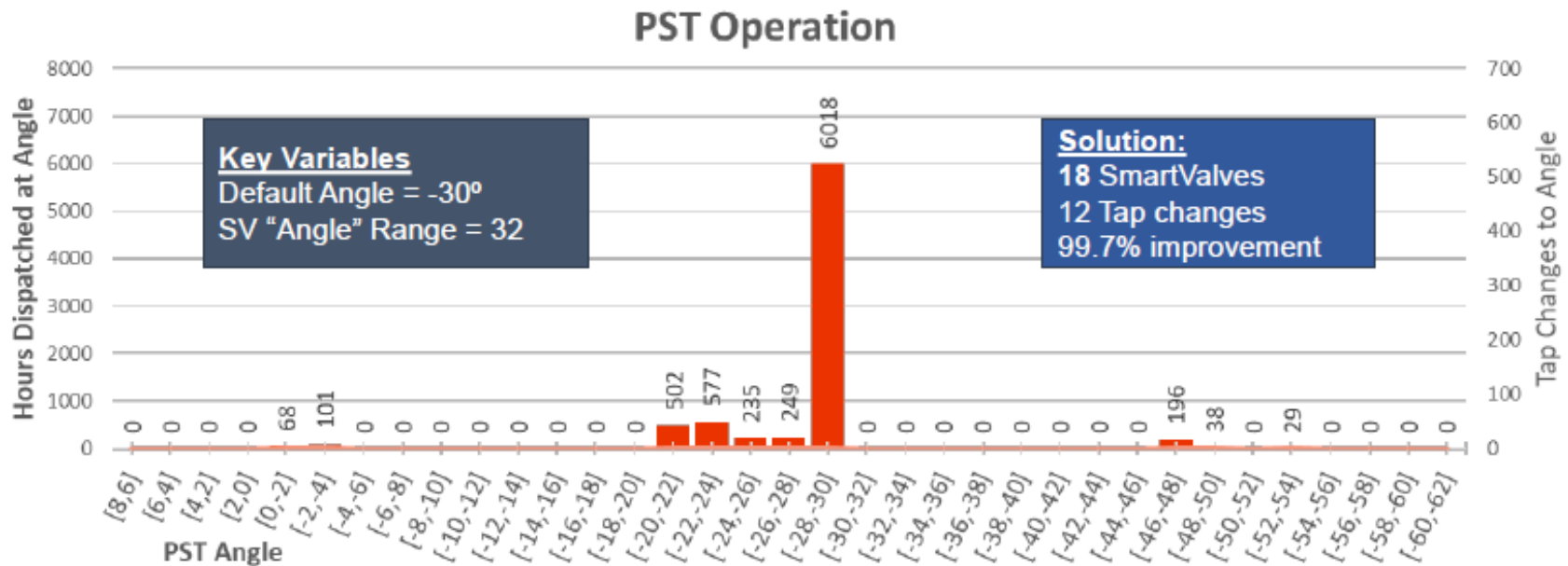


Need to extend PST asset life

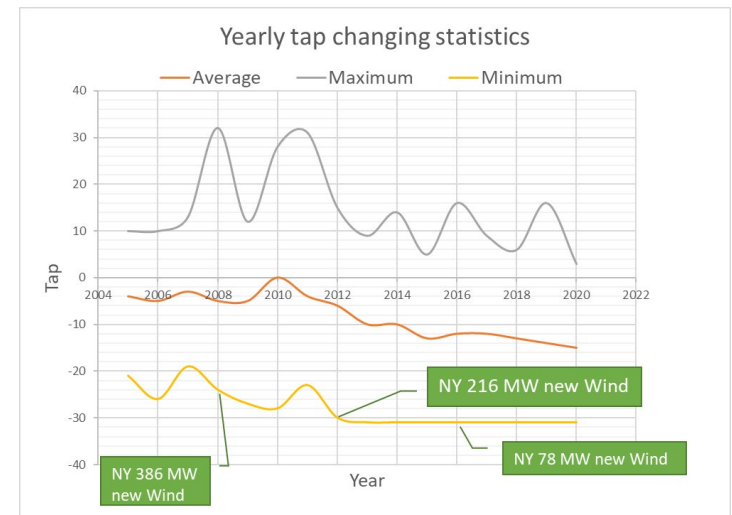
- Preferred alternative: Install a half replacement SMARTVALVE™ in series
 - High-level description
 - 6 valves per phase, VSC technology
 - Footprint 82' x 65'
 - Reduces number of tap changes to nearly 0
 - Other benefits
 - 50% redundancy – keeps line closed and flow controlled after a PST failure
 - Increases the control range by 50% with the PST in service
 - More precise control → More renewable generation delivery
 - Technology diversity – modular, expandable, faster failure recovery
 - SMARTVALVE™ modules can be reapplied at 230 kV
 - Two-year materials delivery time



PST tap changes reduced with SmartValve



- The PST stays at -30 degrees (at -15 tap step)
- The smart valve moves ± 32 degrees on either side of the PST setting
- The PST is adjusted only when the smart valve is at max or min angle



NTA Screening

For use in screening to determine whether or not a transmission system **reliability issue** requires non-transmission alternatives (NTA) analysis in accordance with the Memorandum of Understanding in Docket 7081. Projects intended for energy market-related purposes – “economic” transmission – and other non-reliability-related projects do not fall within the scope of the Docket 7081 process.

Identify the proposed upgrade:	<u>SmartValve Asset Condition Mitigation Project</u>										
Date of analysis:	_____ June 19th, 2024 _____										
<p>1. Does the project meet one of the following criteria that define the term “impracticable” (check all that apply)?</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 80%;">a. Needed for a redundant supply to a radial load; or</td> <td style="text-align: right;"><input type="checkbox"/></td> </tr> <tr> <td>b. Maintenance-related, addressing asset condition, operations, or safety; or</td> <td style="text-align: right;"><input checked="" type="checkbox"/></td> </tr> <tr> <td>c. Addressing transmission performance, e.g., addition of high-speed protection or a switch to sectionalize a line; or</td> <td style="text-align: right;"><input type="checkbox"/></td> </tr> <tr> <td>d. Needed to address stability or short circuit problems;¹ or</td> <td style="text-align: right;"><input type="checkbox"/></td> </tr> <tr> <td>e. Other technical reason why NTAs are impracticable. <i>Attach detailed justification that must be reviewed by the VSPC.</i></td> <td style="text-align: right;"><input type="checkbox"/></td> </tr> </table> <p><i>If any box above is checked, project screens out of full NTA analysis.</i></p>		a. Needed for a redundant supply to a radial load; or	<input type="checkbox"/>	b. Maintenance-related, addressing asset condition, operations, or safety; or	<input checked="" type="checkbox"/>	c. Addressing transmission performance, e.g., addition of high-speed protection or a switch to sectionalize a line; or	<input type="checkbox"/>	d. Needed to address stability or short circuit problems; ¹ or	<input type="checkbox"/>	e. Other technical reason why NTAs are impracticable. <i>Attach detailed justification that must be reviewed by the VSPC.</i>	<input type="checkbox"/>
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<p>2. What is the proposed transmission project’s need date? _____ <u>Not applicable</u></p> <p><i>If the need for the project is based on existing or imminent reliability criteria violations (i.e., arising within one year based on the controlling load forecast), project screens out of full NTA analysis.</i></p>											

VSPC presentation:

https://www.vermontspc.com/sites/default/files/2024-04/Sand_Bar_PST_Asset_Condition_VSPC_V1.pdf

¹ “Stability” refers to the ability of a power system to recover from any disturbance or interruption. Instability can occur when there is a loss of synchronism at one or more generators (rotor angle stability), a significant loss of load or generation within the system (frequency stability), or a reactive power deficiency (voltage stability). Stability problems are influenced by system parameters such as transmission line lengths and configuration, protection component type and speed, reactive power sources and loads, and generator type and configuration. Due to the nature of instability, non-transmission alternatives involving addition of generation or reduction of load will not solve these problems.

Thank you!

<https://www.smartwires.com/>

<https://www.sgb-smit.com/products/large-power-transformers/phase-shifting-transformers>

