PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

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Grid operations

QUESTION 004

P. 358 of PG&E's WMP states, with regard to DTS-FAST: A prototype field test installation was completed on a 115kv tower in Martinez and a wood pole in Santa Cruz in 2021. The valuable lessons learned have been updated to streamline designs, increase scalability, and reduce costs. In 2022, we filed a non-provisional patent application for DTS-FAST. For 2023, we have no field installation plans but will be working through the patent examination process.

a) Please provide data on the results of the field test installation in Martinez.

b) Other than working through the patent examination process, what steps does PG&E plan to take in 2023 to further develop DTS-FAST?

c) When does PG&E expect to begin additional DTS-FAST installations?

d) Through the end of 2022, how much has PG&E spent on DTS-FAST?

e) What portion of your response to part (d) is related to the patent application and examination process?

f) What are your forecast costs for DTS-FAST through the 2023-2025 period?

g) What portion of your response to part (f) is related to the patent application and examination process?

ANSWER 004

a) DTS-FAST is an integrated system of sensors and technologies that are established and available on the market, working together to mitigate wildfire risk. Testing focused on validating sensor functionality in wildfire and utility user scenarios, encompassing functional testing, environmental testing, and long-term resilience testing. Learnings were immediately applied to optimize sensor configuration.

Key learnings from the Martinez installation and testing include:

- Sensors – we installed over 25 devices and tested their intended functionality for accuracy and reliability. These are the types of tests performed:

- Reproducibility testing verifies the consistency and reliability of sensor measurements by repeating measurements multiple times and checking the results for consistency. This test criterion ensures that the sensing device provides consistent and reproducible measurements.
- Sensitivity testing evaluates the sensors' ability to detect and respond to small changes or variations in input. This is achieved by varying the input parameters and verifying if the sensor's output changes accordingly.
- Range testing evaluates the sensor's operating range by evaluating its performance across its specified range of operation. This involves testing the sensor at its minimum and maximum limits, as well as at different points within its operating range.
- Stability tests evaluates the sensor's stability over time by monitoring its output for a prolonged period under normal operating conditions. This can help identify any drift or instability in sensor readings.
- Environment played a major factor in the sensor's performance under different conditions that may affect its operation such as temperature, humidity, vibration, and electromagnetic interference. This can help ensure that the sensor is robust and reliable in real-world operating conditions.
- Failure testing evaluates the sensor's response to failure conditions, such as sensor malfunction, signal loss, or power failure, and verify if the sensor's behavior is appropriate and safe during such scenarios.
- The key takeaway is to test multiple brands of similar devices to verify vendor specifications on operating range and performance. During our testing, approximately 50% tested successfully. Keep in mind, none of these devices were intentionally developed to be installed on 115kV electric towers. We think most failed due to long exposure to high sustained EMF (Electro Magnetic Field) disturbances, or environmental conditions (i.e., temperature, humidity, dust, rain, fog, wind, vibration). Based on the exhaustive testing conducted before field installation (lab test environment) and after installation at Martinez, and the lessons learned from these results, it has been determined that relying solely on manufacturer specifications may not be sufficient – it is recommended to conduct retesting of the equipment based on the specific application requirements in the specific environment of install to ensure reliable performance. For example, a specific sensor manufacturer may specify an 800 feet detection range, but in our tower installation use case, the data shows 600 feet is the maximum functional operating distance before we get false alarms. Due to the disparity between the manufacturer's intended use case for their device and our use cases, it is imperative to conduct thorough testing to ascertain the functionality of the product in our wildfire applications.

- Telecommunications – the Microwave network performed successfully, but was complex to install, configure, and operate. The wireless Field Area Network (FAN) did not perform reliably, and Cellular service was spotty and inconsistent. The lesson learned is to seek edge computing technologies that do not need

constant high bandwidth telecommunications, and only transmit critical data, such as alarms.

- Power – we installed a large power transformer to provide direct system power to the local control box and devices. The power is reliable, but the installation required tower structural modifications to be able to support the 800lb transformer, and additional electrical grounding upgrades. The lesson learned is to use low power devices that can be operated from a solar & battery power supply to eliminate the power transformer.

b) The DTS-FAST team will continue to test recent technologies to expand sensor capabilities, increase system performance, reduce power consumption, reduce installation complexity, and reduce overall costs.

c) We plan to install an updated version of the DTS-FAST system in summer 2023.

d) Through the end of 2022, we have spent $21.6M on our DTS-FAST work.

Year	Cost ($M)
2020	$5.6
2021	$13.6
2022	$2.4
Total	$21.6

e) These costs are negligible SME costs and legal costs and are therefore not specifically being tracked or included in the answer to part (d).

f) Our forecast costs for DTS-FAST work from 2023 through 2025 are as follows:

Year	Cost ($M)
2023	$3
2024	TBD
2025	TBD

g) As noted in response to subpart (e), these costs are negligible SME costs and legal costs are not specifically tracked or included in the answer to part (f).