CALIFORNIA ENERGY COMMISSION

Energy Research and Development Division

Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency:

Near Term Fire Risk Decision-support Tool Brief

PYREGENCE™

REAX ENGINEERING

Spatial Informatics Group

Gavin Newsom, Governor
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PREPARED BY:
Primary Author: Chris Lautenberger, PhD, PE, Reax Engineering Inc. 1921 University Ave., Berkeley, CA 94704, 510-387-2155, https://reaxfire.com and **Shane Romsos**, Spatial Informatics Group, https://sig-gis.com/

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David Saah (Spatial Informatics Group, LLC)
Principal Investigator

Shane Romsos (Spatial Informatics Group, LLC)
Project Manager

PREPARED FOR:
California Energy Commission

Alex Horangic
Commission Agreement Manager

Laurie ten Hope
Deputy Director, Energy Research and Development Division

Drew Bohan
Executive Director

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Purpose

The purpose of this briefing is to describe how the Project Team will attempt to integrate key products from Task 6 into operating practices at IOUs during Phase II.

Task 6 Products Overview

Wildfire presents a dynamic risk to the built environment and especially to electrical infrastructure that spans across forested and vegetated lands in California. Consistent monitoring of fire danger conditions and forecasting of fire spread are needed to obtain actionable information for fire mitigation efforts. Available weather prediction and fire modeling technologies have greatly improved situational awareness regarding potential ignitions and active fire risk and threats, especially when packaged within an easily accessible and user-friendly fire forecasting tool, as is being developed through Task 6 of this CEC EPIC funded project (EPC-18-026). A summary of Task 6 products and their associated purpose follows:

- *Near-term Risk Forecast Baseline Needs Assessment Summary* - identify and document the needs of anticipated end-users of scientific results, model outputs and associated tools related to near-term wildfire forecasting. Anticipated users of project outcomes include investor-owned electric utilities (IOUs), tribal land and fire managers and various State and federal agencies with a role in either natural resources management and/or emergency services.
- *Near-term Risk Forecasts Modeling Framework Summary* - present the methodology behind the development and deployment of near-term fire spread and risk forecasts.
- *Near-term Risk Forecast Data Archive* - to distribute project outputs to IOUs and collect IOU electric asset and analysis information. The web-based platform is available on the project website (https://pyregence.org/wildfire-forecasting/data-repository/) and includes (or will include data or code when available) the following:
    - A feature to upload GIS data, source code, outputs, and analysis.
    - A feature for IOUs to upload pertinent data and view Task outputs; and
    - A feature for separating proprietary and public domain data.

  A "log-in" feature has been incorporated into the Pyrecast interface that allows for IOUs to upload proprietary data (e.g., electric distribution lines). At least two IOUs (PacifiCorp and Liberty Utilities) are currently using
- *Near-term Risk Forecast Dataset* - to establish a centralized repository for disseminating native format geospatial data related to real-time fire spread and risk forecasting. A repository for geospatial has been create and is accessible at - https://data.pyregence.org:8443/geoserver/web/
- *Near-term Risk Forecast Cost-benefit Analysis Fact Sheet* – provide an assessment of the anticipated costs and benefits (to rate payers) that are provided by the operationalization of easy to access near-term models and tools.
- *Decision-support Tool Brief* – Description of how Recipient will integrate the Task 6 products into operating practices at IOUs during Phase II (this document).
- *Near-Term Risk Forecasts Outputs (i.e., updated Near-term Risk Forecast Data Archive)* prepare the following (Due 6/17/2022):

    - *Near-Term Risk Forecasts Outputs* for 1) examples of forecasted risk to electric grid assets on a near-term time horizon, and 2) estimated fire threat from ignitions from electric assets.
    - *Near-Term Risk Forecasts Docker Container* which will include a single package to deploy Version 2 of near-term risk forecasts models and tools on conventional High-Performance Computing resources.
    - Set of open-source code for models.
- *Near-term Risk Forecasts User's Guide* - provide guidance on deploying, running, analyzing, and visualizing the Near-Term Risk Forecast outputs (i.e., how to use the near-term forecast user interface).

The primary culmination of Task 6 is deployment of enhanced open-source wildfire models to forecast spread of ongoing fires and forecast ignition probability and impacts (risk when multiplied together) from fires that may be ignited in the future. A beta version of the models and tools ("Pyrecast") were made available on-line in 2020 and can be accessed at https://pyrecast.org/. Underlying data files from Pyrecast are accessible to users by a web services and application programming interface (API) that facilitate easy integration with a user organizations' existing geospatial software infrastructure. The Pyrecast tool currently encompasses four separate but related areas:

1. "*Fuels*" tool provides spatial data visualization on the distribution of fuels and potential fire behavior from 3 different fuel models including: 1) stock LANDFIRE 2.0.0 (sourced from https://landfire.gov/), 2) Salo Sciences "California Forest Observatory" fuels data (sourced from https://forestobservatory.com/), and 3) Pyrologix' "2021 Fuelscape" which reflects updated fuel conditions through 2020.
2. "*Fire Weather*" provides eight-day forecasts of key fire weather parameters affecting wildfire behavior (temperature, relative humidity, winds, fire weather indices, etc.) Weather forecasts are updated every six hours in the Pyrecast interface.
3. "*Risk Forecast*" This interface displays outputs of modeled wildfire risk (i.e., burn probability, # of impacted structures, fire area, and fire volume) over a five-day forecast horizon. Underlying the outputs displayed on the Pyrecast user interface is a model that simulates over 500 million hypothetical fires ignited across California every day to evaluate potential fire risk, both across the landscape and areas specifically associated with electrical transmission lines.
4. "*Active Fire Forecast*" shows the locations of actively burning fires as identified through satellite-based heat detection and provides forecasts of where each fire is projected to spread based on forecasted weather, topography, fuels, and other variables over a three-day forecast horizon.

Additional functionalities include: 1) *AlertWildfire*[1] camera integration, 2) National Weather Service - *Red Flag*[2] warning areas, 3) 3-deminsional terrain pan and tilt, 4) National Incident Feature Service (NIFS)[3] fire perimeters, 5) VIIRS and MODIS hotspot layers[4], and 6) Live GOES16[5] satellite imagery.

[1] AlertWildfire - http://www.alertwildfire.org/index.html

[2] National Weather Service - https://www.weather.gov/mqt/redflagtips

[3] National Wildfire Coordination Group - https://www.nwcg.gov/publications/pms936/nifs

[4] Fire Information for Resource Management System (FIRMS) https://firms.modaps.eosdis.nasa.gov/

[5] NOAA https://www.star.nesdis.noaa.gov/GOES/index.php

Integration with Investor-Owned Utilities (IOU)

Since the launch of Pyrecast, the Project Team has been working directly with PacifiCorp and Liberty Utilities to integrate the Pyrecast tool into their operational practices. Liberty Utilities is utilizing the project's webservices and API to integrate Pyrecast forecast outputs into their internal ESRI portal, providing the utility with their own proprietary wildfire conditions viewing platform. PacfiCorp is downloading fire weather data to analyze ignition risk. To date, these integrations have been successful in that these IOUs are using project products to improve situational awareness within their respective service territories. These integration efforts will help to inform how the Project Team interfaces with other California IOUs. To date, we are not aware of Pyrecast usage by PG&E, SCE, SDG&E, or BVES.

In Phase 2 of the project, the Near-term Forecast Team (Workgroup #3) will continue refinements of wildfire models to improve accuracy and utility. The user interface will continue to be refined to reflect input on desired features and functionality from current users as well as enhancement to the user interface to improve ease of use. In addition, the Project Team will leverage tasks and products developed under Task 9 (*Near-Term Risk Forecast Integration*) of the project's scope of work.

Since all forecast data are currently available for viewing in the Pyrecast web tool as well as made available by API and direct download, no additional development or technical work is required from Workgroup 3 to facilitate integration with IOUs. Instead, Workgroup 3 will prepare and distribute to IOUs a user manual explaining the Pyrecast web tool, its API, and how underlying data can be accessed.

Anticipated Challenges

Although we expect that PacifiCorp, Liberty Utilities, and possibly BVES may find Pyrecast and its underlying data useful, we do not anticipate usage of Pyrecast within PG&E, SCE, or SDG&E. The primary reason for this is that these IOUs have already integrated overlapping commercial services from a third-party vendor into their operational practices for forecasting the spread of active fires and informing PSPS decisions. To date, the "Big 3" IOUs have expressed no interest in Pyrecast.

Additional barriers to adoption include:

- Forecast accuracy – a dedicated effort is needed to assess the accuracy of model outputs. An initial accuracy assessment is planned for Spring of 2022, and additional assessment anticipated following model algorithm enhancements.
- Sustainability of the system – IOUs and others need certainty that the system will be functional for the foreseeable feature. The Project Team is actively investigating funding opportunities/options to keep Pyrecast available over the long term. For example, we are preparing a response to CEC's EPIC Bridge funding opportunity. With that funding (or other sources), there is a potential to commercialize the system sufficiently to keep both the public facing and propriety version of the tool operational.
- IOUs and others use of existing forecasting tool - Currently, many IOUs and agencies have invested significantly in and are using subscription-based wildfire forecast systems. We plan to use the Task 6 *Near-term Risk Forecast Cost-benefit Analysis Fact Sheet* product deliverable to help demonstrate the cost/benefit of the system we have built ahead of interfacing with IOUs and others.