

Open Framework for Integrated Data Operations

OpenFIDO



Operated by Stanford University for the US Department of Energy under contract DE-AC02-76SF00515.
  

Meeting agenda



- Project description
- Goals and objectives
- Summary of major technical tasks
- Summary of results
- Conclusions and moving forward
- Q&A / Discussion

Project Description



The Problem

- Need reliable and consistent data and model exchange
- Ingest from many sources
- Curation of heterogeneous data
- Run complex analyses on multiple tools
- Delivery of data with long-term availability

The Solution

- Identify exchange and analysis requirements for California IOUs
- Develop and test a platform to satisfy identified needs
- Demonstrate solution for primary use-cases identified
- Commercialize platform to enable large scale deployment

Goals and Objectives

Support major use-cases

- ICA
- End-use electrification
- Tariff design
- Resilience analysis

Other use-cases identified

- CYME to GLM conversion
- Forecasting (e.g., load weather)
- Data access (e.g., vegetation)

Validation

- Forecasting load at National Grid
- Resilience analysis at SCE
- Tariff and electrification tests

Pathways to commercialization

- Adoption by commercial entity

Summary of Major Technical Tasks



Task 1 - Management

Task 2 - Requirements Analysis

Task 3 - Implementation

Task 4 - Testing and Validation

Task 5 - Finalize Production

Task 6 - Evaluation of Benefits

Task 7 - Technology Transfer

Summary of Major Technical Tasks



Task 1 - Management

- Subtask 1.1 - Products
- Subtask 1.2 - Kick-off Meeting
- Subtask 1.3 - CPR Meetings
- Subtask 1.4 - Final Meeting
- Subtask 1.5 - Progress Reports
- Subtask 1.6 - Final Report
- Subtask 1.7 - Match Funds
- Subtask 1.8 - Permits
- Subtask 1.9 - Subcontracts
- Subtask 1.10 - TAC
- Subtask 1.11 - TAC Meetings

 CALIFORNIA ENERGY COMMISSION



FINAL PROJECT REPORT

Open Framework for Integrated Data Operations (OpenFIDO)

Agreement Number: EPC-17-047

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Month Year | CEC-500-XXXX-XXX

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Summary of Major Technical Tasks



Task 2 - Requirements Analysis

Establish requirements needed for OpenFIDO extension to VADER and to assess those requirements for the data exchange implementation to VADER.

Deliverables

1. [Data Exchange Requirements and Assessment Presentation](#)
2. [Data Exchange Implementation and Validation Plan](#)
3. [Data Exchange Implementation and Validation Presentation](#)

Summary of Major Technical Tasks



Task 3 - Implementation

Implement the data import and export codes in VADER software that meet the requirements established in Task 2.

Deliverables

1. [Implementation Report - CPR Report 1](#)

Summary of Major Technical Tasks



Task 4 - Testing and Validation

Verify the VADER code functionality and validate the data exchange capabilities between VADER software and external tools.

Deliverables

1. [Testing and Validation Presentation](#)
2. [Testing and Validation Report](#)

Summary of Major Technical Tasks



Task 5 - Finalize Production

Prepare and release the final OpenFIDO extensions of VADER software.

Deliverables

1. [Developer and User Training Documentation](#)
2. [Final Product Release Report](#)
3. [Production Report \(CPR Report #2\)](#)

Summary of Major Technical Tasks



Task 6 - Evaluation of Benefits

Report the benefits resulting from this project.

Deliverables

1. Kick-off Meeting Benefits Questionnaire
2. Final Meeting Benefits Questionnaire

Summary of Major Technical Tasks



Task 7 - Technology Transfer

Develop a plan to make the knowledge gained, experimental results and lessons learned available to the public and key decision-makers.

Deliverables

1. [Initial Fact Sheet](#)
2. [Final Project Fact Sheet](#)
3. Final Presentation Materials
4. [Technology/Knowledge Transfer Plan](#)
5. [Technology/Knowledge Transfer Report](#)

Summary of Results



Capabilities delivered in pipelines

Data/Model Handling

1. Weather
2. Census
3. Address
4. CYME Converter

Analysis Tools

1. Hosting capacity analysis
2. Electrification impacts analysis
3. Resilience analysis
4. Tariff design analysis

Commercialization by LF Energy

The screenshot shows the GitHub organization page for 'OpenFIDO'. The page includes a repository summary with 42 repositories, a 'Getting Started' section, and links to documentation and discussions.

OpenFIDO
Open Framework for Integrated Data Operations (OpenFIDO) is a data and model processing framework funded by the California Energy Commissions (EPC 17-047).
2 followers • United States of America • <https://www.openfido.org/>

Overview **Repositories** 42 **Projects** **Packages** **Teams** 1 **People** 11 **Settings**

README .md

Openfido

Welcome to the Openfido Organization's repository hub! Here is where you can find the repositories used to build our open-source application, as well as the pipeline's used within the Openfido framework.

Getting Started

There are several options to help new users starting out with OpenFIDO, which is accessible through several distinct methods, or developers looking to help contribute to the project.

Sign up to shared app

<https://source.openfido.org/>

Summary of Results



Capabilities delivered in pipelines

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1. Weather
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3. Address
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Analysis Tools

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2. Electrification impacts analysis
3. Resilience analysis
4. Tariff design analysis

Commercialization by LF Energy

The image displays four screenshots of GitHub repository pages, each showing a different dataset or tool developed by OpenFido:

- openfido/weather**: A public repository containing scripts for reading NSIDB weather archive access pipeline (debain1, main, openfido.sh). It includes GitHub workflows for updates, an autoexec file, and examples for deploying the pipeline.
- openfido/census**: A public repository for generating census data (deban1, main, openfido.sh). It includes GitHub workflows for initial commits, attributes files, and examples for creating a census TIGER geodata.
- openfido/address**: A public repository for an address resolution pipeline (Deban1, main, openfido.sh). It includes GitHub workflows for main.yml, autoexec, and attributes files, along with examples for creating a license and README.
- openfido/cyme-extract**: A public repository for a CYME model extractor (Deban1, main, openfido.sh). It includes GitHub workflows for adding support for CYME 8 models, autoexec, and attributes files, along with examples for creating a license and README.

<https://source.openfido.org/>

Summary of Results

SLAC

Capabilities delivered in pipelines

Data/Model Handling

1. Weather
2. Census
3. Address
4. CYME Converter

Analysis Tools

1. Hosting capacity analysis
2. Electrification impacts analysis
3. Resilience analysis
4. Tariff design analysis

Commercialization by LF Energy

The figure consists of four separate GitHub repository pages arranged in a grid. Each page has a header with the repository name and a 'Code' button highlighted in green. Below the header is a commit history showing several commits from the 'main' branch. The commits include actions like 'Create LICENSE', 'Update main.yml', and 'Initial commit'. There are also sections for 'Releases' and 'About'.

- openfido/hosting_capacity**: Grid-AB-D solar hosting capacity analysis template (slagsimms/gridabd/main, openfido.sh)
- openfido/electrification**: Grid-AB-D electrification analysis template (slagsimms/gridabd/main, openfido.sh)
- openfido/resilience**: Grid-AB-D resilience anticipation template (slagsimms/gridabd/main, openfido.sh)
- openfido/tariff_design**: Grid-AB-D tariff design template (slagsimms/gridabd/main, openfido.sh)

<https://source.openfido.org/>

Summary of Results



Capabilities delivered in pipelines

Data/Model Handling

1. Weather
2. Census
3. Address
4. CYME Converter

Analysis Tools

1. Hosting capacity analysis
2. Electrification impacts analysis
3. Resilience analysis
4. Tariff design analysis

Commercialization by LF Energy

The screenshot shows the LF ENERGY website, which is part of THE LINUX FOUNDATION PROJECTS. The header includes the SLAC logo and navigation links for About, Projects, Join Us, Community, Newsroom, and social media icons. The main banner features a blue hexagonal background with three circular images: a person working on a computer, a solar panel array, and a person in a control room. A code snippet is overlaid on the left side of the banner. Below the banner, the text "Leading the energy transition through global open source collaboration" is displayed. At the bottom, there are logos for four projects: CoMPAS, POWSYBL, EVERest, and RTDIP.

<https://www.lfenergy.org/>

Summary of Results



Activities

1. Operational support
2. Open issues/resolution
3. LF Energy commercialization

Online documentation

- <http://help.openfido.org/>
- <https://auth.openfido.org/apidocs/>
- <https://api.openfido.org/apidocs/>

Online tutorials

1. Getting Started
2. Use Case Tutorial
3. New Developer Build
4. Loadshape Analysis
5. Loadshape Synthesis
6. Weather Forecast
7. Resilience
8. Electrification
9. Tariff Design
10. Cyme Converter

Summary of Results



Online/cloud platform (AWS)

- Registered/invited users only
- <https://app.openfido.org/>

On-premise/private cloud platform

- Testing in progress at SCE

Local/private workstation platform

- Deployed via OpenFIDO CLI
- Available to general public
- <https://source.openfido.org/cli>

Use-case Pipelines

1. CYME model extractor
2. GridLAB-D (converters, geodata, tools)
3. Integration Capacity Analysis
4. Electrification
5. Tariff analysis
6. Resilience analysis (DOE/GMLC)
7. Wildfire analysis (DOE/CESER/DHS)
8. NERC load composition (DOE/OE)

Summary of Results



Two deployments on AWS

- Production (for users)

app.openfido.org

- Staging (for developers)

app-staging.openfido.org

The screenshot shows the AWS Console Home page. On the left, under 'Recently visited', there is a placeholder message: 'No recently visited services. Explore one of these commonly visited AWS services.' Below this are links for IAM, EC2, S3, RDS, and Lambda. In the center, the 'Cost and usage' section displays current month costs (\$335.37), forecasted month end costs (\$357.77, up 8% over last month), and last month costs (\$332.04). It also shows top costs for the current month, including Amazon Elastic Container Service (\$145.05) and Amazon Elastic Compute Cloud - ... (\$79.92). At the bottom of this section is a note: 'Costs shown are unbilled. Learn more'. On the right, there are three main sections: 'Welcome to AWS' (with links to Getting started with AWS, Training and certification, and What's new with AWS?), 'AWS Health' (showing 0 open issues, 0 scheduled changes, and 1 other notification), and 'Build a solution' (listing various AWS services and their creation steps, such as Launch a virtual machine, Start a development project, Connect an IoT device, etc.).

Conclusions and Moving Forward



Support for major use-cases

- ICA
- End-use electrification
- Tariff design
- Resilience analysis

Other use-cases supported

- CYME to GLM conversion
- Forecasting (weather, load)
- Data access (vegetation)

Validation completed

- Forecasting load at National Grid
- Resilience analysis at SCE
- Tariff and electrification

Pathway to commercialization

- Adopted by Linux Foundation

Conclusions and Future Work



Identified issues

1. Pipeline start dialog

*Lacks clear guidance as to what data/files
are required to successfully run pipeline*

2. Visualization dialog

*Needs options to handle various forms
CSV outputs (e.g., transpose)*

3. Lack of clear diagnostic outputs

*Output messages do not provide guidance
on how to fix the problem found*

Resolution status

1. Form-based pipeline start dialog

*Pipelines can present input form that
generates files needed to run*

2. Upgraded visualization dialog

*Visualization dialog will support
additional options and plot formats*

3. Improved diagnostic output

*Pipelines use error message
guidelines for troubleshooting*

Conclusions and Future Work



Load decomposition

End-use loadshapes from SCADA and AMI data

Census data

Customer demographic, economic, and population data for load modeling

Advanced building loads

Satellite imagery to generate/link building load models to network

Grid resilience analysis

Standardize PSPS optimization method, Support long term climate impacts analysis

Advanced workflows

Capability built-in but not publicly available needs to be connected to standard tools such as Apache BEAM

Shared data/model security

Security enhancements to share artifacts with state agencies and utility partners

Legacy data handling/aging

Access to long-term historical data repositories for weather, assets, usage, prices, etc.

Thank you!



Questions and Discussion

Contact David Chassin (dchassin@slac.stanford.edu)

Website <https://github.com/openfido>

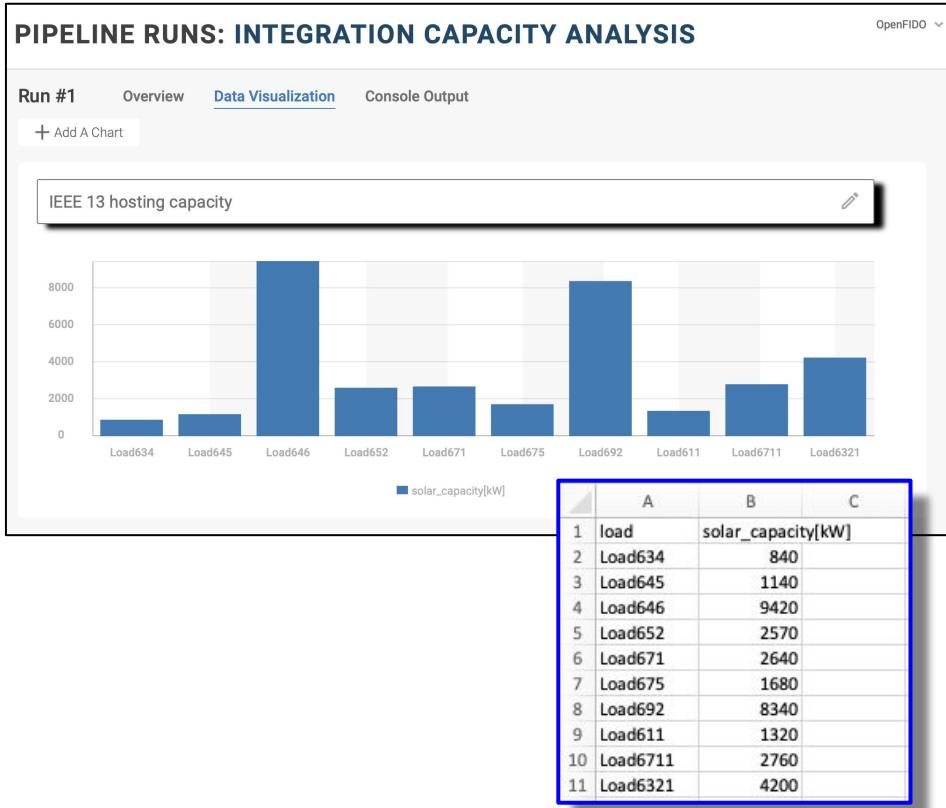
Online <https://app.openfido.org/>

Results: Hosting Capacity



Finds maximum PV capacity

- ANSI voltage limits
- 3% voltage fluctuations
- Over-current limits
- Applies PV at all loads
- Runs time-series if enabled
- Includes weather, DR, etc.

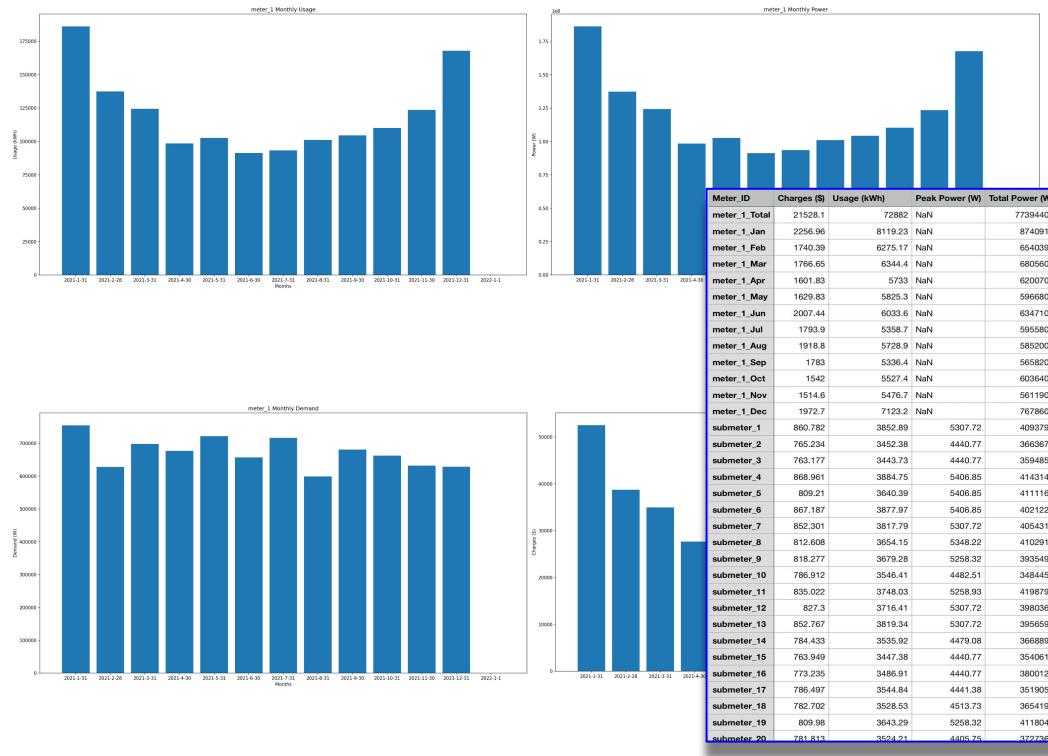


Results: Tariff Design

SLAC

Monthly power, energy, and costs aggregated to feeder level.

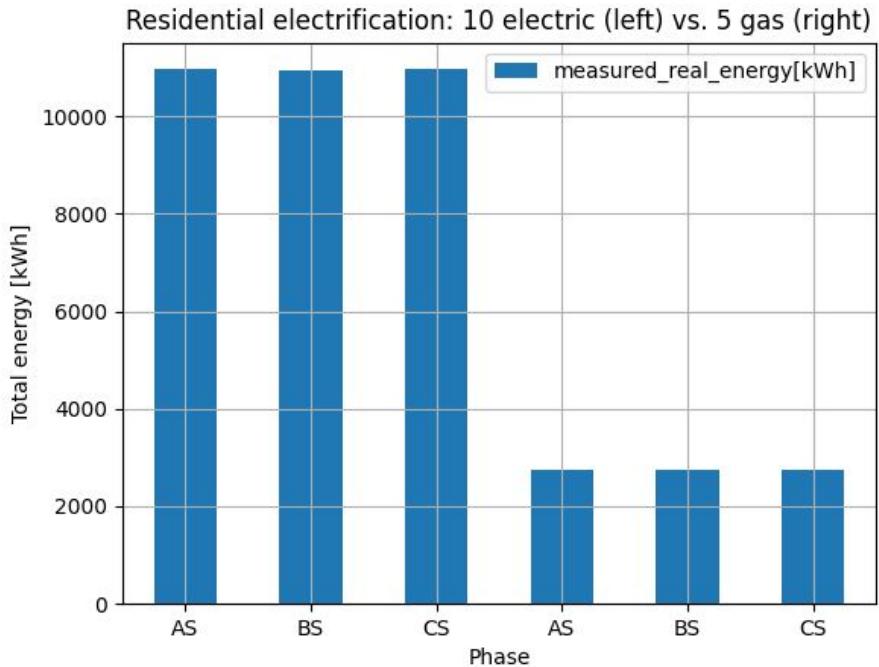
- Data from OpenEI utility rate database (NREL)
- Uses `create_meters` tool to generate meters for models, as needed.
- Validated on IEEE-13 and DOE taxonomy feeders.
- 99% accuracy between manual calculation and template.



Results: Electrification

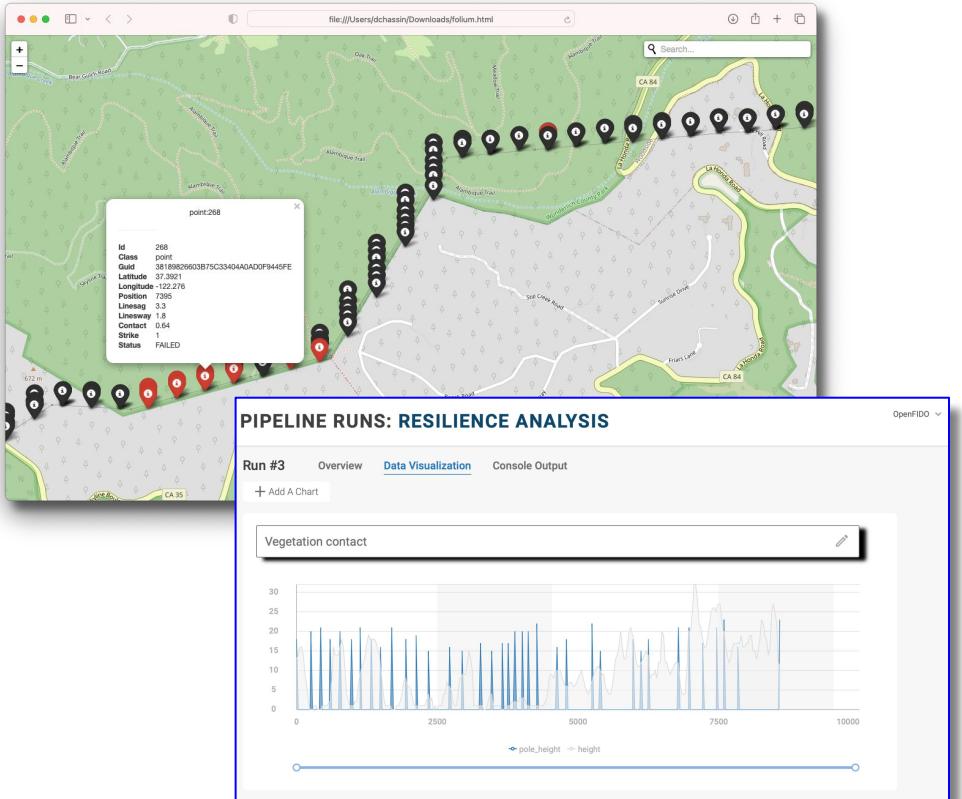
Determines the increased load at substation due to residential electrification

- Validated via manual calculations using component validation.
- Available for different climate regions
- Additional summer peaks are exposed due to availability of A/C under electrification



Results: Resilience

- Deployed at SCE
- Vegetation analytics tested using PG&E 230kV line
- Pole Analysis validated using manual calculations.
 - Automated skeleton grid formulation for bulk pole analysis
 - Integration with utility distribution grid available



Linux Foundation Energy Commercialization

SLAC

- Adopted January 2023
- Open-source release
- Support for ongoing AWS operations
- Initial Technical Steering Committee meeting TBD
- TSC positions open to all interested parties

The screenshot shows a web browser displaying the LF Energy website at lfenergy.org. The page header includes the Linux Foundation logo and navigation links for About, Projects, Join Us, Community, Newsroom, and social media icons. The main content discusses the mission of LF Energy and announces three new open source projects:

- Dynawo: A hybrid C++/Modelica open source suite of simulation tools for power systems.
- OpenFIDO: An open framework for integrated data operations, based on GridLAB-D technology.
- Real Time Data Ingestion Platform (RTDIP): A platform for easy access to high-volume, historical and real-time process data for analytics applications.

A yellow box highlights the OpenFIDO project description.

<https://www.lfenergy.org/>