EPCI

Forecast Arbiter and Open-Source Development

David Larson EPRI Grid Ops & Planning

DOE OSS Workshop October 12, 2022 Albuquerque, NM





Forecast Arbiter is the result of many folks



Will Holmgren



Tony Lorenzo



Leland Boeman



Cliff Hansen



Justin Sharp



Aidan Tuohy



David Larson



Adam Wigington



EPGI

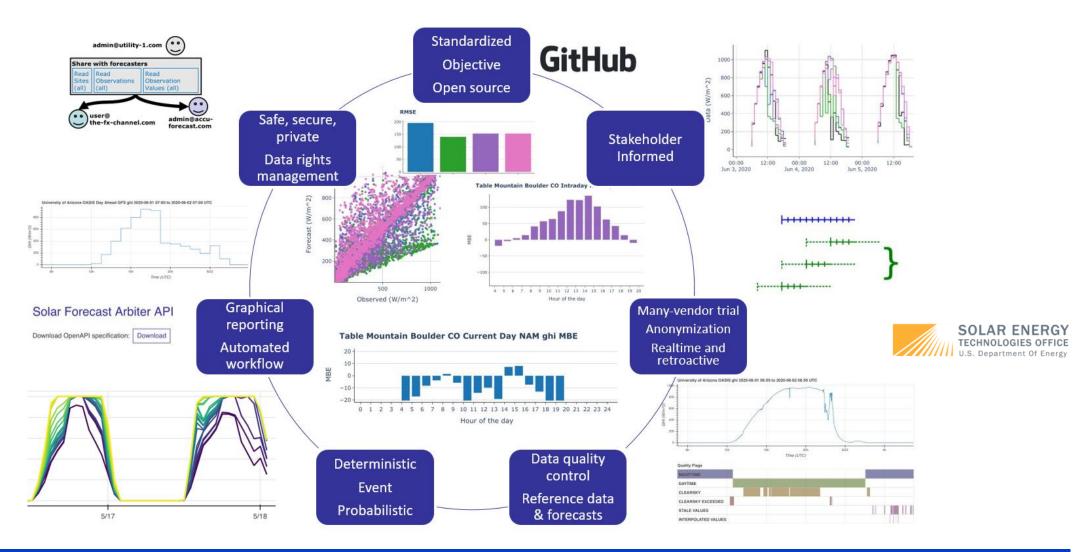
EPRI

University of Arizona

Sandia National Labs

Sharply Focused

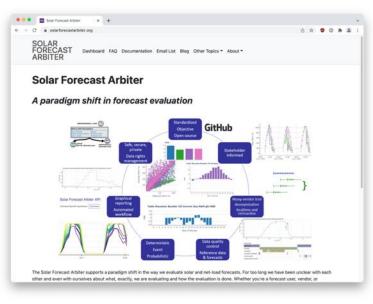
Forecast Arbiter (aka Solar Forecast Arbiter)

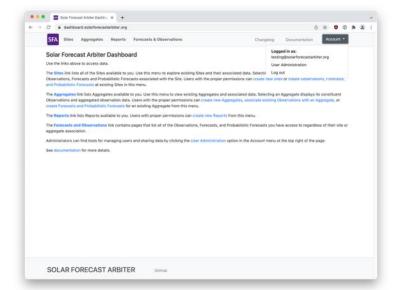


Clear, transparent forecast evaluation tool

Forecast Arbiter consists of 3 components:

(1) Info site





(2) Dashboard



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Q, Search		
Introduction	> Introduction	
Authentication		
Sites	This webpage documents the public Solar Forecast Arbiter API. This RESTIG API is primarily meant to be accessed by the Solar Forecast Arbiter dashboard. The API relies primarily on JSON data structures in requests and responses, with the notable	
Observations	 exception of the forecast and observation GET/POST data endpoints which also support CSV files. 	
Forecasts	Most users will interact with the API indirectly through actions on the dashboard.	
Probabilistic Forecasts	Those users who require direct access to the API may include observational data providers, forecast data providers, and reference data users.	
Reports	 An OpenAPI generator such as https://github.com/OpenAPITools/openapi-generator may be used to generate client libraries for most languages to access the API. The 	
Aggregates	OpenAPI spec for the Solar Forecast Arbiter API is available in JSON and YAML formats. Care must be taken to match the OpenAPI generator version with the	
Climate Zones	> version found in the spec file.	
Users	>	
Users-By-Email	> Interaction for Observational Data Providers	
Roles	>	
Permissions	Observational data providers will likely use the API to programmatically upload data	

Documentation, guides, etc. (publicly available) Web interface (secure access)

Programmatic interface (secure access)

https://forecastarbiter.epri.com

EPRI

Why use the Forecast Arbiter?

- standardized process to evaluate forecast performance
- anonymized, multi-vendor forecast trial capability
- track forecast accuracy over time and locations
- automated reports with wide range of error metrics
- support for both deterministic and probabilistic forecasts
- benchmark forecasts and reference data for 200+ sites already included
- share forecast performance across users (bulk summary metrics in anonymized or detailed reports)
- upcoming support for wind power and load forecasts

...and many more features!

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Figure: Screenshot of sample report.

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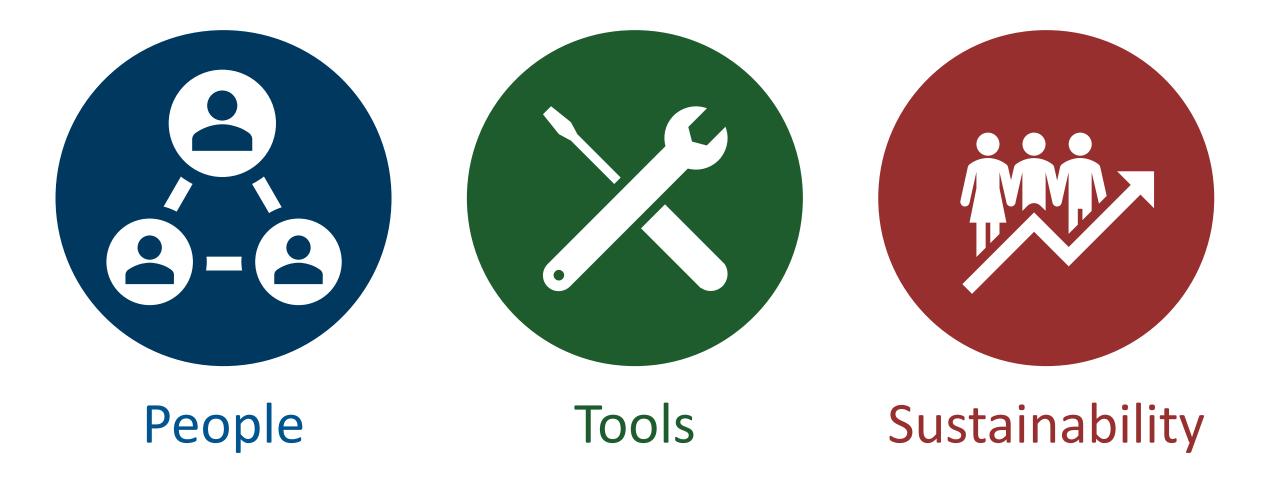


Open-source development from the start (Jan. 2019)

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Search or jump to 7 Pull requests Issues Mark	etplace Explore	Q +• 🚱•
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Popular repositories		⊙ View as: Public →
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Core data gathering, validation, processing, and reporting package for the Solar Forecast Arbiter	Contains the Solar Forecast Arbiter static website	You can create a README file or pin repositories visible to anyone.
● Python ☆ 21 ♀ 12	● Jupyter Notebook ☆8 ♀8	Get started with tasks that most successful organizations complete.
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		Top languages

https://github.com/Solar Arbiter

Thoughts on open-source software





Examples of EPRI open-source software

OpenDSS

(distribution system simulator)



https://www.epri.com/pages/sa/opendss

DER-VET

(energy valuation and planning tool for DERs)

ect Configuration	Project Configuration				
ibuted Energy Resources	Name	CAISO Pre-Defined Case			
	Start Year	2020	Year the project starts.		
	Analysis Window				
	Analysis Horizon Mode	 User-defined The shortest DER lifetime The longest DER lifetime 	Define when to end cost benefit analysis. Choose it yourself, or by the lifetimes of your equipment		
	Analysis Horizon	10 years	The number of years the analysis will go for. The analysis will not consider equipment lifetime or anything else when determining the number of years to run for.		
	Time Series Data				
	Data Year (Baseline)	2020	Commonly the project start year. Data for additional years will be escalated from this value.		
	Timestep	60 V minutes	What is the frequency of the time-series data?		
	Grid Domain	Generation Transmission Distribution Customer	Which grid domain or location the project will be connected to. Please refer to documentation for furthe guidance on which services are available in your selected domain.		
	Ownership	Customer Utility Granty	Who owns the assets?		

https://www.der-vet.com/

EPSI

Closing thoughts on open-source software

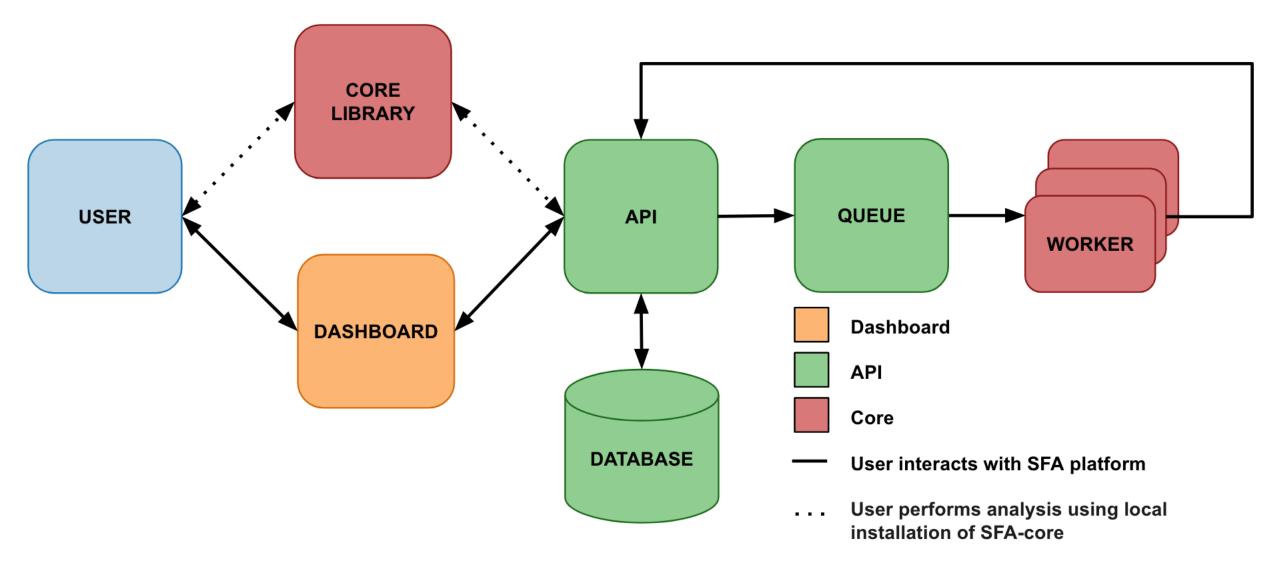
Using open-source software

Developing open-source software

Supporting open-source software

Together...Shaping the Future of Energy™

Forecast Arbiter: Software Architecture





Forecast Error Metrics

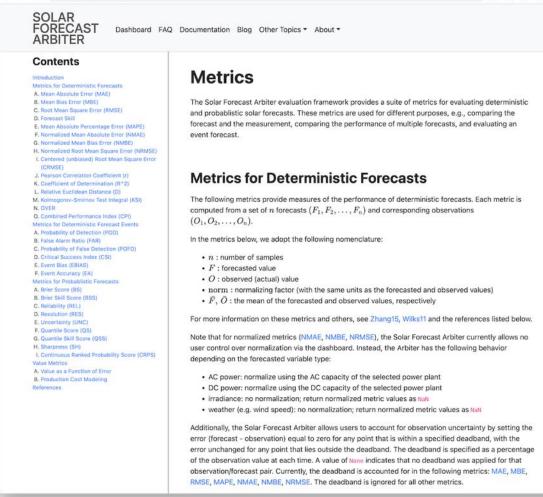
- Deterministic forecasts:
 - Mean Absolute Percentage Error (MAPE)
 - Root Mean Square Error (RMSE)
 - Mean Bias Error (MBE)

- Probabilistic forecasts:
 - Brier score

...

...

 Continuous Ranked Probabilitity Score (CRPS)



https://forecastarbiter.epri.com/metrics/

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