



# SolarAPP+ Performance Review: Final Technical Report

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*1 National Renewable Energy Laboratory  
2 Clean Kilowatts*

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Contract No. DE-AC36-08GO28308

**Technical Report**  
NREL/TP-6A20-91752  
November 2024



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## Suggested Citation

Dalecki, Emily, Sertac Akar, Danny Chang, Jeff Cook, Seth Crew, Jessica de la Paz, Anneliese Fensch, Sushmita Jena, Katie Nissen, Eric O'Shaughnessy, Tim Rivard, Minahil Sana Qasim, Kaifeng Xu, and Rosalie Yu. 2024. *SolarAPP+ Performance Review: Final Technical Report*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-91752. <https://www.nrel.gov/docs/fy25osti/91752.pdf>.

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## Technical Report

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This work was authored in part by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Solar Energy Technologies Office under Award Number 37009. The views expressed herein do not necessarily represent the views of the DOE or the U.S. Government.

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## Final Technical Report (FTR)

<b>a. Federal Agency</b>	U.S. Department of Energy	
<b>b. Award Number</b>	37009	
<b>c. Project Title</b>	Pilot Analysis of SolarAPP+	
<b>d. Recipient Organization</b>	National Renewable Energy Laboratory	
<b>e. Project Period</b>	<i>Start:</i> 7/1/2020	<i>End:</i> 09/30/24
<b>f. Principal Investigator (PI)</b>	Jeffrey J. Cook, Ph.D. Acting Solar Analysis Program Lead Jeff.cook@nrel.gov 720-610-1150	
<b>g. Business Contact (BC)</b>	Jeffrey J. Cook, Ph.D. Acting Solar Analysis Program Lead Jeff.cook@nrel.gov 720-610-1150	
<b>h. Certifying Official (if different from the PI or BC)</b>	N/A	

Jeff Cook  
Signature of Certifying Official

10/22/24  
Date

## Acknowledgements

This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Award Number 37009.

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# 1 Project Summary

The National Renewable Energy Laboratory (NREL) and its project partners have developed the Solar Automated Permit Processing Plus (SolarAPP+) platform. SolarAPP+ is an online portal designed to facilitate and expedite permitting of residential rooftop solar photovoltaic (PV) and battery storage systems. The main objective of this research was to analyze the implementation of SolarAPP+. Analysis was conducted by identifying the benefits, trade-offs, and overall performance of SolarAPP+, including the extent to which it achieved its goals of delivering automated permit review for code compliant PV systems, reducing permitting cycle times, and improving application submittals and/or inspection performance. The NREL team published the results of this analysis in four annual SolarAPP+ Performance Review technical reports between 2022 and 2024, featuring data from 2021–2023.

## 2 Project Objectives and Outcomes

This research is providing authorities having jurisdiction (AHJs), contractors, and the broader solar industry with information on the performance of SolarAPP+ in a diverse set of AHJ applications that reflect the market today. This research provides quantified evidence on how traditional AHJ permitting activities compare to post-SolarAPP+ adoption activities to identify code compliance performance, cost and resource savings/trade-offs, and impacts on overall permitting processes and related cycle times.

The most recent analysis conducted for this project estimated that in 2023:

- A typical SolarAPP+ project was permitted and inspected 14.5 business days sooner than traditional projects (based on median timelines).
- Automatic SolarAPP+ permitting saved around 15,400 hours of AHJ staff time and collectively accelerated PV permitting by around 150,000 business days in 2023.
- SolarAPP+ reduced PV installation costs by around 2%–13%, increased rooftop PV deployment by around 2%–17%, abated around 0.5–2.0 million tons of CO<sub>2</sub> emissions, and saved around \$945,000 in household electricity costs in SolarAPP+ AHJs.

Communications efforts included sharing the report via NREL and SolarAPP+ newsletters and hosting annual webinars with the release of each report. Cumulatively, at the time of publication, reports published through this research have 12,365 downloads. The SolarAPP+ pilot analysis report from Williams et al. (2022) has 3,911 downloads; the 2021 performance review from Cook et al. (2022) has 3,275 downloads; the 2022 performance review from Cook et al. (2023) has 3,318 downloads; and the 2023 performance review from Cook et al. (2024) has 1,861 downloads.

**Table 1. Project Milestones**

<b>Milestone</b>	<b>Delivery Date</b>
Draft pilot analysis roadmap	9/1/2020
Select 5–8 pilot AHJs for analysis	9/1/2020
Pilot Round 1 begins with 2–3 AHJs entering the pilot phase	12/31/2020
Pilot Round 2 begins with an additional 3–5 AHJs entering the pilot phase	6/30/2021
Draft results of solar-only pilots, detailing SolarAPP+'s impacts on permitting timelines, staff time, adoption cycle times, and inspection outcomes. Underlying data is made publicly available	9/30/2021
Publish technical report that incorporates the piloting results from the five communities, outlining SolarAPP+'s performance and impacts on permitting timelines, staff time, adoption cycle times, and inspections	12/31/2021
Identify partner AHJs and contractors recruited and methodology for performing feature evaluations	6/30/2022
Publish annual review as a technical report, summarizing the performance of SolarAPP+ over the 2021 calendar year	7/12/2022
Draft results for the storage and inspection feature analyses	6/30/2022
Draft an outline of the SolarAPP+ Long-Term Adoption and Estimated Impacts report	6/30/2022
Identify partners and methodology for final feature analysis	9/30/2022
Draft results of third feature analysis	12/31/2022
Draft annual review of SolarAPP+ utilizing data from Calendar year 2022	5/30/2023
Draft SolarAPP+ Long-Term Adoption and Estimated Impacts report	6/30/2023

### 3 Path Forward

As SolarAPP+ integrates new features, increases capabilities to issue permits for new technologies, is adopted by more jurisdictions, and is adopted in new states, there will be opportunities to continue to analyze the tool's impacts. NREL will continue to analyze the implementation of SolarAPP+ in adopting AHJs to identify the benefits, trade-offs, and overall performance of SolarAPP+, including the extent to which it is achieving its goals of automatically permitting code compliant PV systems, reducing permitting cycle times, improving application submittals, assessing adoption and impacts in disadvantaged communities, and/or improving inspection performance. New analysis may include an expanded impacts section, more emphasis on storage, and long-term trends for AHJs for which we have several years of data. NREL will publish the findings of this new analysis in two technical reports featuring data from the 2024 and 2025 calendar years.



## 4 Inventions, Patents, Publications, and Other Results

NREL has published four SolarAPP+ technical reports. All of these publications are summarized below.

### Technical Reports

Cook, Jeff, Sertac Akar, Danny Chang, Anneliese Fensch, Katie Nissen, Eric O’Shaughnessy, and Kaifeng Xu. 2024. *SolarAPP+ Performance Review (2023 Data)*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-89618. <https://www.nrel.gov/docs/fy24osti/89618.pdf>.

Cook, Jeffrey J., Eric O’Shaughnessy, Kaifeng Xu, Sushmita Jena, Minahil Sana Qasim, and Seth Crew. 2022. *SolarAPP+ Performance Review: 2021 Data*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-83046. <https://www.nrel.gov/docs/fy22osti/83046.pdf>.

Cook, Jeff, Rosalie Yu, Kaifeng Xu, Sushmita Jena, Tim Rivard, and Jessica de la Paz. 2023. *SolarAPP+ Performance Review (2022 Data)*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-85827. <https://www.nrel.gov/docs/fy23osti/85827.pdf>.

Williams, Juliana, Jeffrey J. Cook, Jesse R. Cruce, Kaifeng Xu, Seth Crew, Minahil Qasim, and Matt Miccioli. 2022. *SolarAPP+ Pilot Analysis: Performance and Impact of Instant, Online Solar Permitting*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-81603 <https://www.nrel.gov/docs/fy22osti/81603.pdf>.

## 5 Project Team

The project team is summarized in Table 2.

**Table 2. Project Team and Roles**

<b>Name</b>	<b>Role</b>	<b>Organization</b>
Jeffrey Cook, Ph.D.	Principal Investigator	NREL
Sertac Akar	Data Analyst	NREL
Danny Chang	Data Analyst	NREL
Seth Crew	Data Analysis Intern	NREL
Emily Dalecki	Data Analyst	NREL
Jessica de la Paz	Data Analysis Intern	NREL
Anneliese Fensch	Data Analysis Intern	NREL
Sushmita Jena	Data Analyst	NREL
Katie Nissen	Data Analysis Intern	NREL
Eric O'Shaughnessy	Data Analyst	Clean Kilowatts
Tim Rivard	Data Analyst	NREL
Minahil Sana Qasim	Data Analysis Intern	NREL
Kaifeng Xu	Data Analyst	NREL
Rosalie Yu	Data Analysis Intern	NREL