



Final Technical Report: SolarAPP+ Enhancements and Commercialization

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1 National Renewable Energy Laboratory

2 Spark Ranch

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NREL/TP-6A20-93843
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Final Technical Report (FTR)

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b. Award Number	38029	
c. Project Title	SolarAPP+ Enhancements and Commercialization	
d. Recipient Organization	National Renewable Energy Laboratory	
e. Project Period	<i>Start:</i> 3/1/2021	<i>End:</i> 12/31/2024
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h. Certifying Official (if different from the PI or BC)	N/A	

Emily Dalecki
Signature of Certifying Official

2/6/2025
Date

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1 Project Summary

With millions of distributed photovoltaic (PV) systems expected to be installed over the next five years, the permitting and inspection processes of authorities having jurisdiction (AHJs) may become overburdened, causing delays and increased costs for installed systems (Cruce et al. 2022). The central goal of this project was to automate and streamline permitting processes for distributed PV systems and complementary technologies, such as battery storage. Deploying automated permitting has been hypothesized to reduce permit review times, resulting in reduced costs and improved customer experience. This has the potential to expand the PV and PV-plus-storage market nationwide.

The National Renewable Energy Laboratory (NREL) and its project partners, including UL Solutions, the Interstate Renewable Energy Council (IREC), the International Code Council (ICC), and more, developed the Solar Automated Permit Processing (SolarAPP+™) software platform to reduce permit review times. NREL and its partners also collaborated with the solar industry, the building safety community, and local governments to develop SolarAPP+.

The SolarAPP+ platform was initially designed to permit residential rooftop PV. Through the project's period of performance, NREL improved on the initial SolarAPP+ software by expanding available features, including more permitting functionality for complementary technologies like PV and storage. The SolarAPP+ online platform is the first of its kind, developed to automate rooftop residential PV and battery storage system permitting. These software improvements allow SolarAPP+ to serve AHJs at no cost to the jurisdiction. In addition to implementing improved functionality in SolarAPP+, the NREL team also focused on increasing adoption of the software platform.

As of December 31, 2024, SolarAPP+ has been adopted by 256 AHJs in 13 states and has issued permits for more than 36,500 residential rooftop PV projects and an additional 28,500 PV-plus-storage projects for a total of over 65,000 permits issued.¹ The impacts of SolarAPP+ adoption include reduced timelines, streamlined permitting processes, and reduced PV installation costs. As of December 2024, SolarAPP+ has transitioned from NREL to the SolarAPP Foundation, a nonprofit established to manage the software platform, through a software license agreement.

¹ Based on internal NREL data collection and adoption tracking

2 Project Objectives and Outcomes

The project's primary objectives were to enhance the SolarAPP+ software platform with additional permitting functionality; increase the adoption of the enhanced platform; streamline permitting and reduce permit review times resulting in reduced costs and improved customer experience; and finally, transition management of the software to a long-term host.

During the period of performance, NREL enhanced the software to meet the needs of users and expand functionality, including:

- AHJ and installer self-onboarding forms, which provide an improved user experience and the ability to input all necessary account information
- Accommodate permitting of residential main panel upgrades when combined with a solar project
- New permitting specifications for updated code cycles, including the International Building Code, International Residential Code, and National Electric Code
- AHJ government software application programming interfaces
- Permitting for residential battery storage.²

NREL increased the adoption and awareness of SolarAPP+ through a dedicated prize program, direct AHJ outreach, technical assistance, AHJ piloting and onboarding, AHJ and installer training, and coordinated product education. The prize program consisted of a two-step competition, which incentivized communities to adopt automated processing of residential solar permits by awarding them \$15,000 if they adopted SolarAPP+ within the identified time frame. The prize was launched on September 12, 2022, and concluded on January 4, 2024. In total, the program awarded \$90,000 to six AHJs that successfully adopted SolarAPP+ during the prize time frame.

The NREL team faced challenges breaking into new states and accelerating adoption at the pace of the initial goals. Challenges that adopting AHJs faced included issues with integrating SolarAPP+ with existing permitting software, issues with payment processing, and conflicts with local codes (e.g., building, electrical, fire, or zoning codes) (Cook et al. 2024). Adoption target timelines were adjusted accordingly, and new support strategies, including standing office hours, were implemented by the NREL team. In addition, NREL shifted outreach strategies to focus on the code compliance and safety that SolarAPP+ offers in its permit reviews, as well as the benefits to AHJ staff (e.g., time savings).

The goals of the SolarAPP+ platform, once deployed, were to streamline permitting and reduce permit review times from seven or more business days to instant, reduce costs, and improve the customer experience. Research found that SolarAPP+ reduces median timelines by 14.5 business days. This analysis further estimates that in adopting AHJs, SolarAPP+ increased residential rooftop PV adoption by around 2%–17%, reduced PV installation costs by around 2%–13%, and

² SolarAPP+'s most up-to-date eligibility checklist for PV can be found at gosolarapp.org/eligibility/PV.pdf.

saved around 15,400 hours of AHJ staff time in 2023 alone, all while improving the customer experience (Cook et al. 2024).

As a final project accomplishment, NREL facilitated the transition of all software development, management, and outreach tasks to the long-term host of SolarAPP+, the SolarAPP Foundation. NREL worked in partnership with the SolarAPP Foundation to ensure a seamless transition of the software, including a period during which NREL and the SolarAPP Foundation software team worked in parallel to ensure that no delays to software releases or impacts to customer experiences occurred. As of December 2024, SolarAPP+ has transitioned from NREL to the SolarAPP Foundation through a software license agreement.

Please visit gosolarapp.org or reach out directly to the SolarAPP Foundation at support@gosolarapp.org for additional information on SolarAPP+.

Table 1. Project Milestones

Milestone	Delivery Date
Contact list for 1,250 AHJs completed	6/30/2021
Training plan and implementation roadmap created	
Installer outreach strategy developed	
Prioritized software product roadmap completed	
SolarAPP+ training checkpoint 1	9/30/2021
SolarAPP+ AHJ outreach and technical assistance (TA) checkpoint 1	
Software release 1	
SolarAPP+ AHJ outreach and TA checkpoint 2	12/30/2021
Software release 2	
SolarAPP+ AHJ outreach and TA checkpoint 3	3/31/2022
SolarAPP+ with updated codes released	
At least 300 small, medium, and large installer representatives engaged through direct and indirect activities	
Long-term manager remains committed to SolarAPP+	
Software release 3	6/30/2022
SolarAPP+ training checkpoint 2	
SolarAPP+ AHJ outreach and TA checkpoint 4	
Software release 4	9/30/2022
Accelerating SolarAPP+ adoption prize announced	
SolarAPP+ AHJ outreach and TA checkpoint	
SolarAPP+ training checkpoint 3	
Software release 5	12/31/2022
Report SolarAPP+ prize applicants	
SolarAPP+ prize update	3/31/2023
Software release 6	
SolarAPP+ interim adoption goal and progress update	6/30/2023
Solar-plus-energy-storage feature available for widespread use	9/30/2023
Software release 7	12/31/2023
SolarAPP+ long-term host license agreement signed	1/31/2024
SolarAPP+ transition plan updated and final adoption target progress update provided	
Final report of SolarAPP+ prize administration	3/31/2024
SolarAPP+ interim adoption goal and progress update	4/30/2024
SolarAPP+ adoption targets achieved	6/30/2024
Software domain/cloud operation transitioned to long-term host servers	8/13/2024
Transition of software operations to long-term host completed	9/30/2024
Transition of outreach to long-term host completed	12/31/2024

3 Path Forward

NREL will continue to conduct research about permitting, inspection, and interconnection timelines and processes nationwide that may have complementary benefits for automated permitting software platforms. Future research areas might include developing new automated permitting features, investigating the use of artificial intelligence in permitting, inspection, and interconnection, and continuing to explore the impacts of automated permitting on timelines, costs, and inspection failure rates.

4 Inventions, Patents, Publications, and Other Results

NREL has published one software record, five fact sheets, and one conference poster under this project. In addition, NREL released new software features on a biweekly cadence throughout the period of performance for the SolarAPP+ platform. These publications are referenced below.

Software Records

Cook, Jeffrey, Robert Margolis, James Vezina, Jerrol Taylor, Robert Zimmerman, Sunrun, and U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. 2019. *SolarAPP+™ (Solar Automated Permit Processing Plus)*. Golden, CO: National Renewable Energy Laboratory. SWR-19-51. <https://doi.org/10.11578/dc.20240603.3>.

Fact Sheets

NREL. 2024. “5 Easy Steps to SolarAPP+ Adoption.” Golden, CO: National Renewable Energy Laboratory. NREL/FS-6A20-90814. <https://www.nrel.gov/docs/fy24osti/90814.pdf>.

NREL. 2024. “5 Easy Steps to SolarAPP+ Adoption.” Golden, CO: National Renewable Energy Laboratory. NREL/FS-6A20-85010. <https://www.nrel.gov/docs/fy23osti/85010.pdf>.

NREL. 2024. “Benefits of the SolarAPP+ Online Permitting Software.” Golden, CO: National Renewable Energy Laboratory. NREL/FS-6A20-90815. <https://www.nrel.gov/docs/fy24osti/90815.pdf>.

NREL. 2023. “Benefits of the SolarAPP+ Online Permitting Software.” Golden, CO: National Renewable Energy Laboratory. NREL/FS-6A20-85011. <https://www.nrel.gov/docs/fy23osti/85011.pdf>.

NREL. 2023. “Photovoltaic (PV) Quick Reference Guide.” Golden, CO: National Renewable Energy Laboratory. NREL/FS-6A20-85845. <https://www.nrel.gov/docs/fy23osti/85845.pdf>.

Posters

Cook, Jeffrey J., Sertac Akar, Daniel Chang, Anneliese Fensch, Katie Nissen, Eric O’Shaughnessy, Kaifeng Xu, Emily Dalecki, and Noah Frey. 2023. “SolarAPP+ reduces permitting timelines by 14 days in 2023.” Golden, CO: National Renewable Energy Laboratory. NREL/PO-6A20-90445.

5 Project Team

NREL's internal project team is summarized in Table 2.

Table 2. Project Team and Roles

Name	Role
Emily Dalecki	Principal Investigator
Jeffrey Cook	Principal Investigator
Anneliese Fensch	Intern
Dalila Lara	Intern
Damon Haley	Developer
Danny Chang	Intern
Jaclyn Tagani	Intern
James Vezina	Developer
Jenna Harmon	Researcher
Jeremy Jenkins	Developer
Jessica de la Paz	Intern
Kaifeng Xu	Researcher
Katie McMahon	Researcher
Katie Nissen	Researcher
Koenraad Beckers	Researcher
Mark Brunner	Researcher
Noah Frey	Researcher
Patrick Gibbs	Researcher
Paul Lee	Intern
Rosalie Yu	Intern
Sarah Nabirye	Intern
Seth Crew	Intern

External organizations that contributed to this project are summarized in Table 3.

Table 3. External Contributors and Roles

Organization	Key Participant	Role
UL Solutions	Myrna Bentzler	Provided subject matter expert support on relevant model codes
Interstate Renewable Energy Council (IREC)	Larry Sherwood	Developed SolarAPP+ related trainings
GreenLancer	Matt Howe	Provided customer support for SolarAPP+ users
International Code Council (ICC)	Joan O'Neil	Contributed to AHJ outreach and development of materials related to SolarAPP+
Spark Ranch	Jim Vezina	Provided software development services for SolarAPP+

References

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>.

Cruce, Jesse, Eric O'Shaughnessy, Jenna Harmon, Jesse Geiger, and Jeff Cook. 2022. *Residential Solar Adoption Timelines and Impacts from the COVID-19 Pandemic*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-83529.
<https://www.nrel.gov/docs/fy22osti/83529.pdf>