

Analysis of High-Penetration Levels of PV into the Distribution Grid in California



Barry Mather, PhD

Project Monitor

July 22nd 2010

Project Background



Installation in Fontana, CA

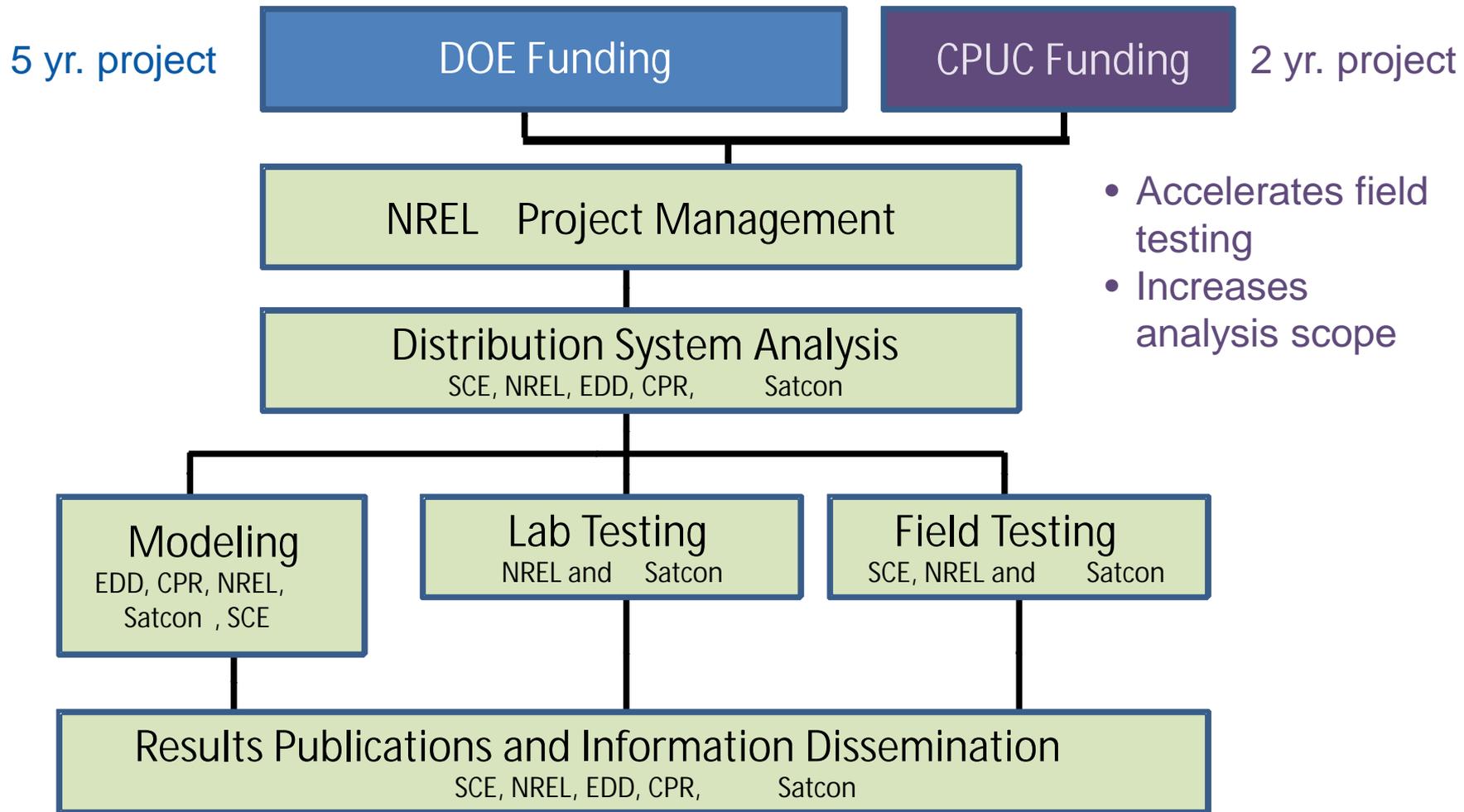
- Southern California Edison (SCE) has approval for 500MW of rooftop solar PV to be installed over the next five years
- Typical installation: 1-3MW installed on warehouse rooftops
- High-penetration PV levels will be reached on warehouse district feeder circuits

Objectives

NREL, SCE, CPR, EDD, and Satcon are partnered to:

- Use field verification to improve the ability to model and understand the impacts and develop solutions for high penetration PV deployments in electric utility systems.
- Disseminate information on the modeling tools that are developed and used
- Develop performance datasets that show the impact of the PV systems on the electric grid
- Publicize the resulting lessons learned and best practices for adopting high levels of PV.

Approach



Project Partners and Capabilities

- **NREL** - project management and laboratory testing as well as conducting modeling and analysis of fielded systems.
- **Southern California Edison (SCE)** - host utility and will install high penetration PV systems on a number of distribution circuits in their service territory. They will also participate in developing the distribution practices for installing high penetrations of PV.
- **Clean Power Research (CPR)** - develops, manages, and operates the world's most comprehensive suite of PV software tools that will be used to analyze PV system impacts for this project.

Project Partners and Capabilities II

- **Electrical Distribution Design (EDD)** - existing simulation models for electrical power systems and new tools to address high penetration scenarios. These will be integrated into an open source framework for conducting simulations of high penetration PV systems in electrical distribution systems.
- **Satcon** - advanced inverter technology and responsible for the development of advanced control systems for inverters and integration with the electric power system.

Major Tasks

1. Distribution System Assessment & Defining Advanced Inverter Functionality
2. Development of Advanced Inverter Hardware/Software
3. Modeling and Simulation of High-Penetration PV Distribution Circuits for Planning and Operation
4. Advanced Inverter Laboratory Testing
5. Advanced Inverter Field Testing
6. Results Publication and Information Dissemination
7. Project Management



Major Task Schedule

Task	Year 1	Year 2
Distribution system assessment and defining advanced inverter functionality	X	
Development of advanced inverter hardware/software	X	
Modeling and simulation	X	
Lab testing	X	
Deployment of advanced inverter hardware and field testing		X
Result and information dissemination	X	X
Project management	X	X

Research Schedule

Task	Year 1	Year 2
Distribution system assessment and defining advanced inverter functionality	<ul style="list-style-type: none"> • Develop advanced inverter hardware specifications (Month 3) 	
Development of advanced inverter hardware/software	<ul style="list-style-type: none"> • Complete development of inverter hardware (Month 6) 	
Modeling and simulation	<ul style="list-style-type: none"> • Develop model of PV inverter (Month 9) 	
Lab testing	<ul style="list-style-type: none"> • Complete lab testing of inverter (Month 12) 	
Deployment of advanced inverter hardware and field testing		<ul style="list-style-type: none"> • Field advanced inverter (Month 14) • Complete field evaluation (Month 20)
Result and information dissemination	<ul style="list-style-type: none"> • Semi-annual project reports (6th month of project) 	<ul style="list-style-type: none"> • Final report (last month of project)
Project management	<ul style="list-style-type: none"> • Summary of the project (1st month of project) • Monthly status reports (due on the 15th of the following month) 	<ul style="list-style-type: none"> • Monthly status reports (due on the 15th of the following month) • Final project report (last month of project)