**Interconnection barriers to distributed PV in the West**

**Draft Research Plan**

1. Barriers assessment and questionnaire. Obtain information from PV developers, utilities, and other stakeholders in Western states to identify the highest priority interconnection barriers in each state. Because barriers can vary significantly across states and the level of PV penetration, this effort would focus on understanding how key barriers vary across states. Data will be collected through an email or online questionnaire and supplemented with interviews with solar developers in the West.
2. Assessment of interconnection practices and procedures in the Western States. Collect data and prepare a report that will review interconnection practices in Western states and explore emerging issues and best practices for reducing costs, delays, or uncertainty. The report will summarize current practices in each state, based on information collected publicly, from utilities and developers, and interviews. It will cover residential systems as well as several size categories of commercial systems. We will seek to obtain data from the largest utilities in each state. The first part of the report will cover current practices, with an emphasis on procedures that could potentially have substantial impact on PV markets, and the second part will cover emerging issues and best practices. Specific topics that may be covered in these sections are listed below.
   1. Part 1 will assess where states stand in terms of a variety of interconnection processes and practices, such as the following.
      1. Standardized interconnection processes across utilities
      2. Public availability of utility interconnection documents
      3. Information about local grid and hosting capacity maps
      4. Use of public project queues
      5. Transparency in application review status
      6. Use of electronic submissions
      7. Pre-application processes and treatment of incomplete applications
      8. Application fees and application review costs
      9. Use of automation in processes
      10. Information on project complexity and level of review required
      11. Data on length of time to review
      12. Timeliness of granting permission to operate
      13. Utility data management requirements, if any
      14. Utility inspection requirements, particularly for small systems
      15. Dispute resolution procedures
      16. Locational benefits and interconnection costs
      17. Requirements surrounding allowable penetration on feeder
      18. Cost certainty provisions (utility providing interconnection cost estimates
      19. Interconnection standards for PV systems with storage
   2. Part 2 will explore emerging issues and best practice examples in more depth. This section will cover topics, such as:
      1. Storage requirements. What are best practices for interconnecting PV with storage?
      2. Hosting capacity and development of locational information. What are issues and uncertainties surrounding the development of hosting capacity maps? How can hosting capacity and locational siting information help to streamline the interconnection process?
      3. Locational benefits and interconnection costs. What practices are emerging to encourage siting DPV in locations that avoid grid upgrades?
      4. Queuing processes transparency. What are best practices for managing interconnection queues and weeding out inactive projects?
      5. Mechanisms for providing cost certainty. What policies are used to provide cost certainty to developers to shed light on costs early in the process before significant project development work has been completed?
      6. Cost allocation and distribution system planning. How can emerging distribution system planning processes be used to help more equitably allocate costs for distribution system upgrades required for interconnection? How can costs be allocated so that the last DER on the system does not have to pay all of the upgrade costs?
      7. Utility data management. What types of requirements could be considered for utility data and how is it managed? Are there examples of this?
      8. Automated processes. Where have automated processes been used and what have been the impacts on costs and timeliness?

1. Deeper dive analysis on upgrade cost issues. Explore cost-related issues in greater depth. One challenge for PV deployment is if projects are required to implement costly system upgrades when less expensive solutions may be available. For example, use of smart inverters could potentially address some grid issues. NREL will conduct a deep dive on these cost issues that could either be included as a chapter in the assessment report, or perhaps a stand-alone report.

For the issue of upgrade costs, the project team will seek to obtain data from utilities and project developers on the costs and types of upgrades required for particular project sizes and grid concerns. To the extent that sufficient data can be obtained, the team will assess the types of solutions that have been commonly used. The team will also assess the cost of various types of upgrades and alternatives that may be viable for certain types of grid challenges.