1.1.1.601/37716 – Small Hydro Interconnection Benchmarking
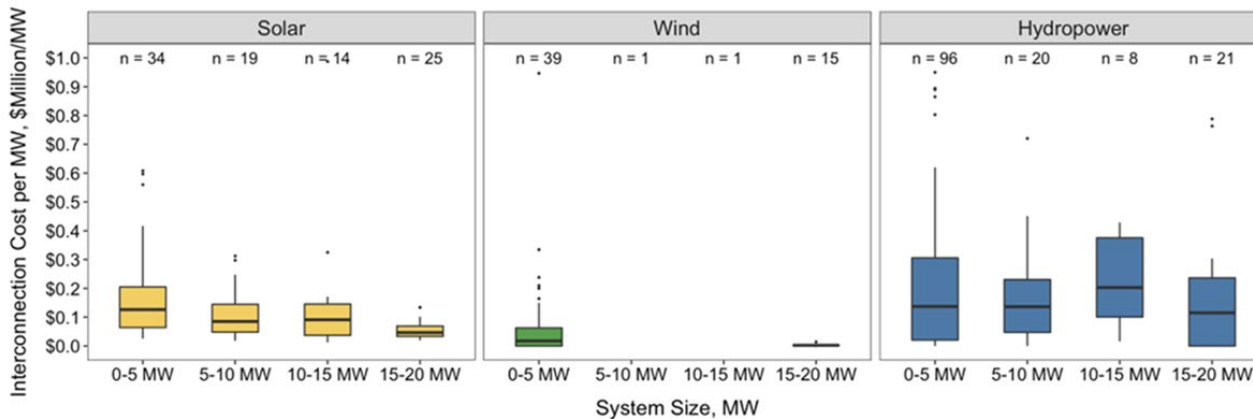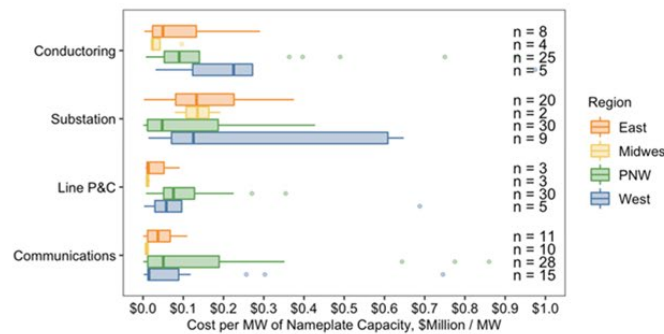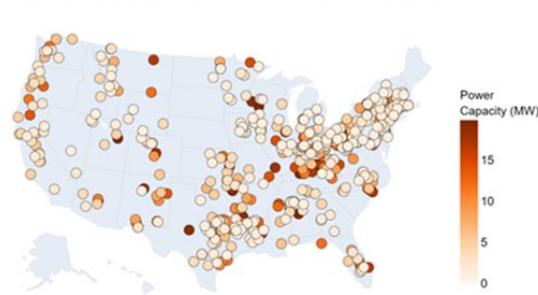
Todd Wall, Alison Colotelo, Chris O'Reilley, and Hope Corsair

Pacific Northwest National Laboratory (PNNL) and Oak Ridge National Laboratory (ORNL)

todd.wall@pnnl.gov, AlisonHA.Colotelo@pnnl.gov, oreilleycj@ornl.gov, corsairhj@ornl.gov

July 26, 2022

Project Overview

Project Summary

- Small capacity projects (<5 Megawatts) account for the largest portion of new hydropower projects. However, interconnecting them to the grid has proven to be a major obstacle, brought on by inconsistent interconnection protocols across the states, stretched project timelines, lack of power system knowledge, and costly grid upgrades. This project searches and consolidates relevant datasets into a central location to educate and inform stakeholders in the interconnection process.

Intended Outcomes

This project produced four distinct products:
- Taxonomy presenting small hydropower potential across the United States.
- State-by-state collation of interconnection processes, policies, or procedures
- Database of common grid system upgrades mined from over 200 small hydropower project reports
- Best practices comparing small hydropower interconnections to solar PV and distributed wind.

Project Information

Principal Investigator(s)

- Travis Douville was the PI during the period of performance covered by the 2022 Peer Review.

Project Partners/Subs

- Pacific Northwest National Laboratory and Oak Ridge National Laboratory.
- Chris O'Reilley and Hope Corsair both of ORNL.

Project Status

New

Project Duration

- Project Start Date – 10/1/2021
- Project End Date – 9/30/2022

Total Costed (FY19–FY21)

$304,593.00

Project Objectives: Relevance

Relevance to Program Goals:

- This project will inform potential investors and developers in the small hydropower industry by providing tools and guidelines developed by aggregating and organizing interconnection data mined from real-world projects and state-by-state policies and procedures.
- This project does not consider the particulars of inside-the-fence hydropower installations, but the interdependencies and challenges with which every new hydropower project must contend "outside of the fence" in dealing with the local serving utility and local public interconnection policies and protocols.

Project Objectives: Approach

Approach:

- This project aims to organize available material into four distinct buckets that any small hydropower developer must understand and be able to maneuver to build a successful project. A developer must understand:
  - Regional small hydropower development potential (Small Hydro Taxonomy).
  - Local and regional interconnection policies and requirements (Interconnection Processes).
  - How to gauge the economic success of a project by understanding project development costs and distribution grid upgrades (Interconnection Benchmarking).
  - How to compare interconnection standards and costs of the PV and wind industries to small hydropower.

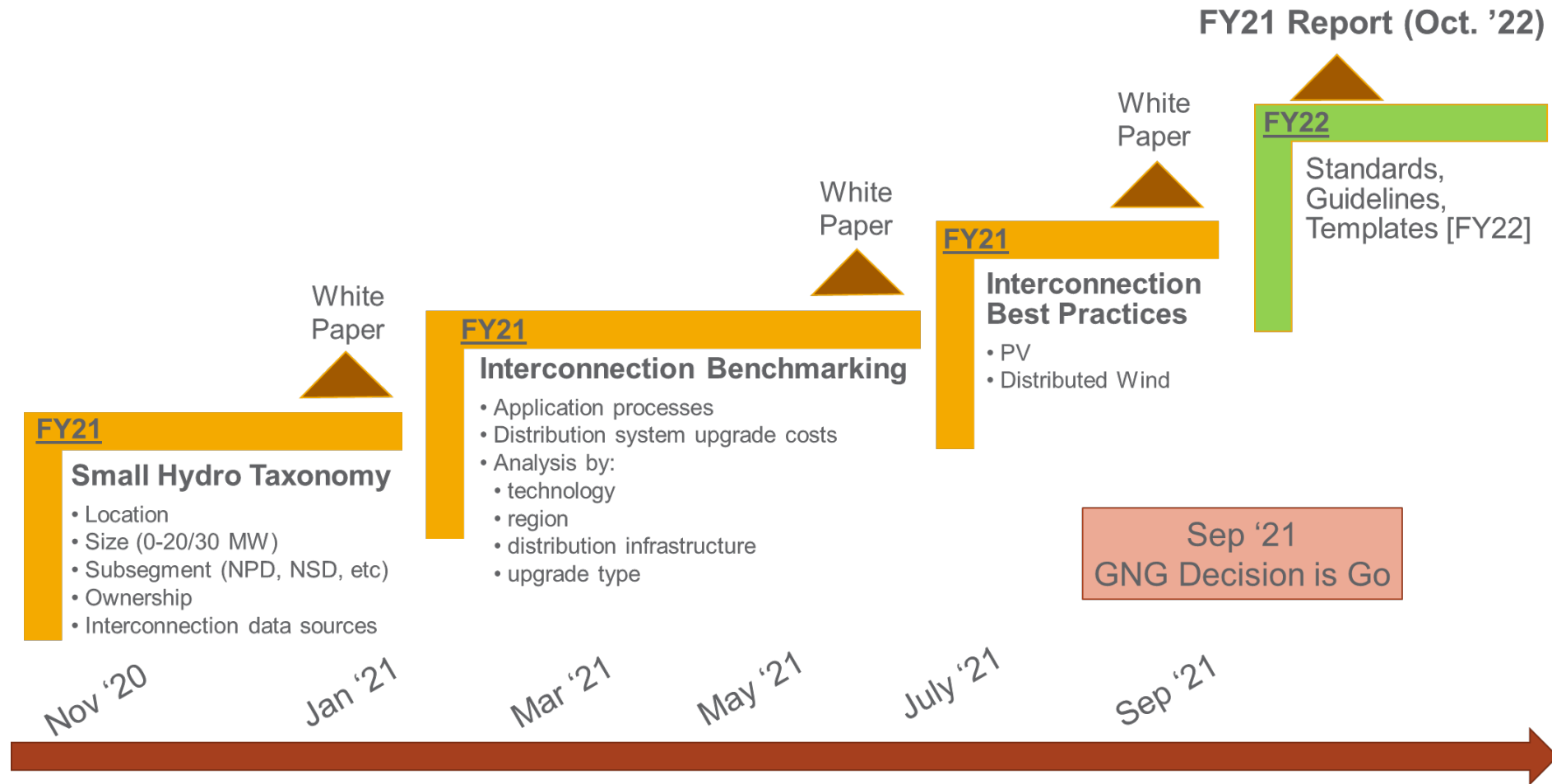# Project Objectives: Expected Outputs and Intended Outcomes

Outputs:

- This project will produce a report that will be published on PNNL's website.

- Future outputs will include a detailed flow process that will guide a developer through a region's interconnection policies and procedures. Also, a database will be developed that will serve as a means for developers to compare prospective projects to past projects within a particular area. The two prior future outputs will pull from the data produced in FY21.

Outcomes:

- This project's outcomes will arm developers with the proper tools and knowledge to better gauge the success of small hydropower projects at the outset by providing relevant historical interconnection data and tools.

- Through proper data and tools, developers will be prepared with regional hydropower potential, interconnection policies relevant to a particular region, and a comparative method of gauging whether utility-imposed grid upgrades are necessary and prudent.

Project Timeline

FY21 Report (Oct. '22)

FY22
Standards,
Guidelines,
Templates [FY22]

White
Paper

FY21
Interconnection Best Practices
• PV
• Distributed Wind

White
Paper

FY21
Interconnection Benchmarking
• Application processes
• Distribution system upgrade costs
• Analysis by:
  • technology
  • region
  • distribution infrastructure
  • upgrade type

White
Paper

FY21
Small Hydro Taxonomy
• Location
• Size (0-20/30 MW)
• Subsegment (NPD, NSD, etc)
• Ownership
• Interconnection data sources

Sep '21
GNG Decision is Go

Nov '20   Jan '21   Mar '21   May '21   July '21   Sep '21

- The project received a "Go" decision during Sep, 2021.
- This project is a fact-finding activity; thus, risks are minimal.
- FY22 work will produce a process flow to guide small hydro developers through grid interconnection and specific to the region. Additionally, a database will organize historical interconnection data based on real-world project data gathered in FY21.

Project Budget

FY21	Total Actual Costs FY19–FY21
Costed	Total Costed
$305K	$305K

- A major deliverable of this work is a report that combines the results of the four distinct works described earlier. The report was originally slated to come out in FY21; however, its delivery was later changed to FY22. The budget to support this work will be spent in FY22, thus accounting for the shortfall in spending in FY21.

End-User Engagement and Dissemination

- The primary stakeholders to which this project applies are small hydropower developers, electric utilities, and regulators.
  - Under the period of performance of which this peer review applies, the team assembled a Technical Advisor Group (TAG) comprised of members of private developers, utilities, and advocacy groups.
  - The normal mode of engagement with the TAG was through quarterly meetings during which progress would be reviewed after which the group would engage in discussion and Q&A.
  - The rationale for this stakeholder/end-user engagement strategy stemmed from early discussions with small hydropower developers who expressed concern over prohibitive interconnection obstacles they had encountered, for the most part focused on high system upgrade costs and inconsistent construction timelines. The objectives of the project were formulated based on these conversations.
  - The project is especially engaging in consumer advocacy groups who represent the ratepayer as a means of keying in on customer needs and expectations.
- The project results will be disseminated through a final report that will be published on the PNNL website. Future results will be disseminated through web platforms and conferences.

Performance: Accomplishments and Progress

- During FY21, the project produced the following:
  - A Small Hydropower Taxonomy surveyed and categorized small hydropower potential across the United States. This was the first step to inform developers where the most development potential exists.
  - The Interconnection Processes mined salient interconnection criteria from publicly available sources and electric utility procedures across the 50-states. Selected criteria include fast-track programs, established interconnection schedules, and capacity brackets. The processes serve as a means to compare interconnection standards of one state against another or between utilities.
  - The Benchmarking Database pulled data from over 250 small hydropower project reports and categorized grid upgrades and associated costs into common buckets, thus establishing a comparative cost set of which developers can gauge the validity of utility-imposed upgrades of future small hydropower development.
  - A Best Interconnection Practices study compared small hydropower findings from this project to similar metrics in the solar PV and distributed wind industries and found that small hydropower interconnection costs exceeded those of solar PV and distributed wind.

Future Work

- Activities proceed in FY22 as follows:
  - Using findings and material under FY21 work, ORNL with PNNL assisting is developing two deliverables.
    - The first will be a flow process in the form of clickable PDF that a developer can use as a guide and navigation tool to assist them through the interconnection process. The flow process will be region specific thus making use of the Interconnection Processes work done in FY21.
    - Second will be an Interconnection Tool that will be comprised of formulated queries that will automatically pull from the Interconnection Benchmarking Database (FY21 work) in accordance with the user's conditional inputs. The tool's utility will be the capability of presenting comparative results among already completed projects.
  - The present budget projections are sufficient to complete the project tasks.

Q&A