

Digitizing Utilities

Prize



AMERICAN
MADE
U.S. DEPARTMENT OF ENERGY



Official Rules

OCTOBER 2022

Preface

The U.S. Department of Energy's Digitizing Utilities Prize will be governed by 15 U.S.C. § 3719 and this Official Rules document. This is not a procurement under the Federal Acquisitions Regulations and will not result in a grant or cooperative agreement under 2 CFR 200. The Prize Administrator reserves the right to modify this Official Rules document if necessary and will publicly post any such notifications and notify registered prize participants.

Date	Modification

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1 Executive Summary

The U.S. Department of Energy (DOE) Office of Electricity is launching the American-Made Digitizing Utilities Prize. This prize aims to connect utilities with interdisciplinary teams of software developers and data experts to facilitate transforming digital systems in the energy sector and data analytics for utilities.

1.1 Prizes

The Digitizing Utilities Prize offers a total prize pool of \$1.1 million across two phases. In Phase 1 – Plan, teams of developers will form and propose a plan on how to address issues presented. Teams can choose to address challenges from two identified partner utilities for this prize, or teams can identify their own utility partner. The teams will have demonstrated a thorough understanding of the presented problem, as well as their ability to access relevant resources that can be leveraged for this prize. They will have given examples of their applicable skills and expertise to solve the proposed problem. The teams will have defined their approach and plan of action to solve the issue presented. Up to nine winning teams will receive up to \$75,000 each in cash and will be eligible to compete in Phase 2 – Progress.

In Phase 2 – Progress, winning teams will work with the utility partners over 6 months to develop and refine a software solution that addresses the issues that the utilities are dealing with. The teams will be able to present their progress toward implementing their solution. At the end of Phase 2 – Progress, one competitor from each utility partner will be selected as a winner and will receive a prize of \$100,000 each. One grand prize winner will be selected from these winners to receive an additional \$125,000 cash prize.

1.2 Key Dates

- **Phase 1 – Plan Submission Opens:** 10/11/2022 (Tuesday)
- **Phase 1 – Plan Submission Closes:** 5 p.m. EST on 1/26/2023 (Thursday)
- **Phase 1 – Plan Winner Announcement:** (anticipated) 3/9/2023 (Thursday)
- **Phase 2 – Progress Opens:** (anticipated) 3/9/2023 (Thursday)
- **Phase 2 – Progress Submission Closes:** 8/23/2023 (Wednesday)
- **Phase 2 – Progress Winner Announcement:** 9/20/2023 (Wednesday)

1.3 Eligibility and Competitors

The competition is open only to private entities (for-profits and nonprofits); nonfederal government entities such as states, counties, tribes, and municipalities; academic institutions; and individuals, subject to the following requirements:

- Employees of the Track 1 and Track 2 utility partners are not eligible to apply.
- Private entities must be incorporated in and maintain a primary place of business in the United States with majority domestic ownership and control.
- Academic institutions must be based in the United States.
- An individual prize competitor or group of competitors who are not competing as part of an incorporated private entity must all be United States citizens or legal permanent residents.
- Individuals competing as part of an incorporated private entity may participate if they are legally allowed to work in the United States.

- DOE employees, employees of sponsoring organizations, members of their immediate families (e.g., spouses, children, siblings, or parents), and persons living in the same household as such persons, whether or not related, are not eligible to participate in the prize.
- Individuals who worked at DOE (federal employees or support service contractors) within 6 months prior to the submission deadline of any contest are not eligible to participate in any prize contests in this program.
- Federal entities and federal employees are not eligible to participate in any portion of the prize.
- DOE national laboratory employees cannot compete in the prize.
- Entities and individuals publicly banned from doing business with the U.S. government such as entities and individuals debarred, suspended, or otherwise excluded from or ineligible for participating in federal programs are not eligible to compete.
- Entities and individuals identified as a restricted party on one or more screening lists of the U.S. Departments of Commerce, State, or the Treasury are not eligible to compete. See Consolidated Screening List.
- This prize competition is expected to positively impact U.S. economic competitiveness. Participation in a foreign government talent recruitment program¹ could conflict with this objective by resulting in unauthorized transfer of scientific and technical information to foreign government entities. Therefore, individuals participating in foreign government talent recruitment programs of foreign countries of risk are not eligible to compete. Further, teams that include individuals participating in foreign government talent recruitment programs of foreign countries of risk² are not eligible to compete.
- As part of your submission to this prize program, you will be required to sign the following statement:

I am providing this submission package as part of my participation in this prize. I understand that I am providing this submission to the federal government. I certify under penalty of perjury that the named competitor meets the eligibility requirements for this prize competition and complies with all other rules contained in the Official Rules document. I further represent that the information contained in the submission is true and contains no misrepresentations. I understand false statements or misrepresentations to the federal government may result in civil and/or criminal penalties under 18 U.S.C. § 1001 and § 287.

In keeping with the goal of growing a community of innovators, competitors are encouraged to form multidisciplinary teams while developing their concept. The HeroX platform provides a space where parties interested in collaboration can post information about themselves and learn about others who are also interested in competing in this contest.

¹ A foreign government talent recruitment program is defined as an effort directly or indirectly organized, managed, or funded by a foreign government to recruit science and technology professionals or students (regardless of citizenship or national origin, and whether having a full-time or part-time position). Some foreign government-sponsored talent recruitment programs operate with the intent to import or otherwise acquire from abroad, sometimes through illicit means, proprietary technology or software, unpublished data and methods, and intellectual property to further the military modernization goals and/or economic goals of a foreign government. Many, but not all, programs aim to incentivize the targeted individual to physically relocate to the foreign state for the above purpose. Some programs allow for or encourage continued employment at U.S. research facilities or receipt of federal research funds while concurrently working at and/or receiving compensation from a foreign institution, and some direct participants not to disclose their participation to U.S. entities. Compensation could take many forms including cash, research funding, complimentary foreign travel, honorific titles, career advancement opportunities, promised future compensation, or other types of remuneration or consideration, including in-kind compensation.

² Currently, the list of countries of risk includes Russia, Iran, North Korea, and China.

2 Background

2.1 Prize Background

The Digitizing Utilities Prize is part of the American-Made Challenges program, which is your fast track to the clean energy revolution. Funded by the U.S. Department of Energy, we incentivize innovation through prizes, training, teaming, and mentoring, connecting the nation's entrepreneurs and innovators to America's national labs and the private sector.

The electric industry sector is facing an “explosion” of data coming from a variety of sources. New types of sensors have been deployed with fast-streaming data sets (one such example is data from phasor measurement units), challenging the traditional methods of data acquisition, use, and storage in utilities. Meanwhile, the market offering of big data analytics products and related services for the utility industry is limited, with only modest electricity domain expertise. Electric sector stakeholders are facing an emerging need to define how to capitalize on large data sets, both the ones they create and data from other sources (like weather data), to improve reliability and resilience and meet the changing system dynamics from renewable integration. Utilities are beginning to leverage information and communication technologies and automation techniques to create new business opportunities and manage market-driven change. Many of these challenges are outlined in the Electricity Advisory Committee’s report [“Big Data Analytics: Recommendations for the U.S. Department of Energy,”](#) which outlines the need for DOE support in advancing data analytics for existing data sources within utilities.

For the electricity sector to fully utilize the data it is creating, it must undergo a transformation in how it manages data quality, storage, and processing. Often, before a new tool can be utilized, infrastructure operators and engineers must first ensure their underlying digital infrastructure is conducive to the new types of analytics being developed. Traditional data storage and management tools in utilities may not be well suited to the large volumes, variety, and velocity of the data.

The U.S. Department of Energy Office of Electricity is committed to accelerating research, development, and demonstration of new technologies and tools within the electricity sector to advance reliability, resilience, and affordable operation of the power system.

This prize aims to connect utilities with interdisciplinary teams of software developers and data experts to facilitate transforming digital systems in the energy sector and data analytics for utilities. These challenges can include not only utilizing data with analytics, but also developing pipelines for processing, data quality assurance, data storage, and deletion.

2.2 Prize Phases

The Digitizing Utilities Prize contains two phases—Plan and Progress—to incentivize competitors to develop innovative solutions to help transform data analytics and system digitization at utilities. Based on the challenges DOE has identified in this space, utility partners have provided examples of these problems related to data, such as energy use data, synchrophasor data, weather data, fire assessment data, and more. Utility partners were identified through a Sources Sought notice issued by the National Renewable Energy Laboratory (NREL) prior to the launch of the prize. DOE invites anyone, individually or as a team, to compete to work with utilities to build solutions for the identified digital transformation needs. DOE intends for the solutions developed under this prize to be shared as examples with the broader utility community on how to solve data-related challenges.

The two phases:

Phase 1 – Plan: Teams of developers (e.g., software developers, automation engineers, data scientists) will form robust teams that are willing to solve one of the utility issues presented. Teams demonstrate that they have an understanding of the problem and propose how they would solve the problem.

Phase 2 – Progress: Teams implement their proposed solution by developing a software solution that addresses the issues presented by the utilities. Teams also demonstrate how their methods and process could be utilized by other utilities in the future.

2.3 Prize Tracks and Utility Partners

Competitors will select to compete in one of three tracks for this prize. The first two tracks each have a predetermined utility partner providing a data or digitization challenge to be solved. Competitors respond directly to the challenge outlined in the appendices of this rules document. Predetermined utility partners in Tracks 1 and 2 alleviate the burden on competitors interested in solving these problems to identify and connect with a utility on their own. The third track allows for competitors to identify their own utility partner and data or digitization challenge. Teams in the third track—Competitor-Identified—can be led by either a utility or an independent team that has a preexisting partnership with a utility.

All tracks will have the same submission requirements and scoring criteria. However, competitors in Track 3 – Competitor-Identified should also include information about the problem they are addressing and why it is important. It is anticipated that there will be up to three winners for each track. Utility partners will participate in the review process for Tracks 1 and 2. Track 3 will be reviewed by industry experts. All winner decisions will be made by the U.S. Department of Energy.

Prize Tracks

Track 1 – Load Modeling: The specific load modeling challenge for Track 1 was provided by Bonneville Power Administration (BPA) and Clark PUD. In this track, competitors engage in load modeling activities to help correctly forecast future demand. Transmission planning studies are conducted routinely to ensure the bulk electric power system can be operated reliably under anticipated conditions, as well as unexpected events, such as the unplanned loss of a large generator or transmission line. In order to correctly forecast future demand, it is critical to build models that accurately represent the current load composition. Unfortunately, information related to individual buildings served by a feeder is not always readily available, and mathematical methods of determining electrification have been historically inadequate. To support the efforts of load modeling, Track 1 competitors should propose methods to address the dynamic nature of weather-sensitive loads for residential and commercial buildings. Full details on the Track 1 challenges for competitors to address can be found in Appendix 2.

Track 2 – Data Analysis Automation: The specifics for Track 2 were provided by Dominion Energy. In this track, competitors propose methods for automation of data analysis. Inverter-based generation, staggering localized loads, regulatory demands, and sustainability objectives are significantly changing how the grid operates. With petabytes of grid sensor data, working at this scale requires thoughtful development of capabilities to synthesize, model, and surface the necessary insights to help engineers scrutinize and evaluate a data-driven approach to resolving nuanced complexities across the system. Competitors in Track 2 will capitalize and innovate on growing data resources and provide a clear roadmap with capabilities to ensure Dominion meets their vision of maintaining reliability and resiliency as part of the evolving system. Full details for Track 2 can be found in Appendix 3.

Track 3 – Competitor-Identified: In this track, teams with an existing utility partner apply with their own digitization or data challenge and propose their plan for solving it. Proposed challenges and solutions must have an implementation path within the utility they are working with. Topics can include, but are not limited to:

- Addressing data quality, interoperability, and processing at the source of data generation within a utility.
- Integration of data sets across different sources, including both inside and outside a utility.
- Data analytics to improve resilience and system operation, including predicting asset health and maintenance needs.
- Utilizing energy data to improve energy equity efforts within a utility.
- Data analytics to address wildfires, earthquakes, storms, and other natural hazards.
- Providing better data visualization and informational displays to operators and engineers at utilities.
- Improving a utility's ability to evaluate and integrate new software tools.
- Transparent automation of menial operational and analytical tasks within utilities.
- Making operational data available for use within utilities while maintaining security.
- Automating data anonymization and data set creation for sharing with outside researchers and third parties securely.

Competitors must include a letter of support from the utility they are working with.

2.4 Program Goal Requirements

Only submissions relevant to the goals of this program are eligible to compete. The Prize Administrator must conclude that all the following statements are true when applied to your submission:

- The proposed solution is related to the electric power industry.
- Most activities described in and supported by the submission package are performed in the United States and have the potential to benefit the U.S. electricity sector.
- The proposed solution represents an innovation that will move the industry beyond its current state.
- The proposed solution is not dependent on new, pending, or proposed federal, state, or local government legislation, resolutions, appropriations, measures, or policies.
- The proposed solution does not involve the lobbying of any federal, state, or local government office.
- The proposed solution is based on fundamental technical principles and is consistent with a basic understanding of the U.S. market economy.

2.5 Find Help

2.5.1 Power Connectors

Power Connectors are Connectors who play a more substantial role in the competition and receive funds to expand and amplify DOE and NREL's efforts. These stakeholders work to identify and support participants in Phase 1 and provide targeted support for the execution of impact plans in Phase 2. Power Connectors are ineligible for all recognition rewards. Power Connectors are rewarded for efforts that:

- Increase the number of new, high-quality competitors.
- Expand the network of partners, resources, and tools.
- Increase the diversity of funding sources for competitors and the program.
- Produce engaging and well-attended national demo day showcases.
- Expand the number of manufacturing and technological challenges addressable by the program.
- Provide leadership and support within the increasingly robust American-Made Network.

Updates on training sessions, mentorship contacts, and office hours will be periodically posted on the [HeroX platform](#), and competitors are encouraged to leverage these opportunities.

2.6 Additional Requirements

Please read and comply with additional requirements in Appendix 1.

COMPETITORS WHO DO NOT COMPLY WITH THESE REQUIREMENTS MAY BE DISQUALIFIED.

3 Plan Phase

3.1 Goal

Competitors will have demonstrated a thorough understanding of the utility's presented problem, as well as their ability to access relevant resources that can be leveraged for this prize. They will have given examples of their applicable skills and expertise to solve the proposed problem. The teams will have defined their approach and plan of action to solve the issue presented by the partner utility.

3.2 Prizes

Up to nine cash prizes of \$75,000 each. It is anticipated that up to three winners will be partnered with each utility partner and will be encouraged to work with the utility in the Progress Phase.

3.3 How To Enter

Go to [HeroX](#) and follow the instructions for registering and submitting all required materials before the phase deadline. Competitors can also form teams or find partners through the HeroX platform.

3.4 Important Dates

Refer to the timeline on <https://www.herox.com/digitizingutilities> HeroX for relevant dates and deadlines.

3.5 Plan Phase Process

The Plan Phase consists of the following steps:

1. **Review Utility Partner Challenge Statements:** Competitors review the utility partner challenge statements and select which problem they want to address. Competitors may also choose to work with a utility that they identify independent of the formal utility partners for this prize.
2. **Activation and Submission:** Competitors complete their submission packages and submit online before the Plan Phase closes.

3. **Assessment:** For Tracks 1 and 2, representatives from the utility partners serve as the review panel. For Track 3, industry experts review the submissions. Reviewers make recommendations to the U.S. Department of Energy, who is the final judge for the prize.
4. **Announcement:** The Prize Administrator publicly announces the winners, and winners begin to compete in the Progress Phase.

3.6 What To Submit

A complete submission package for the Plan Phase should include the following items:

- 90-second video (public)
- Cover page content
- Narrative that answers three questions
- Summary PowerPoint slide
- Letters of commitment or support (optional).

The following details provide more guidance on what information to provide and how reviewers evaluate and score your submission. Reviewers will evaluate your submissions by assigning a single score for each scored submission section, based on their overall agreement or disagreement with a series of statements.

1	2	3	4	5	6
Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree

3.6.1 Online Public Video (Will Be Made Public)

Online Public Video – *Who is your team and what is your solution in 90 seconds?*

Suggested Content Competitor Provides

- Describe your team and how it is uniquely qualified to solve the selected utility's problems.
- Describe your proposed solution and why it is the best approach to the utility's problem.

While there are no specific scoring criteria for the video, it will be evaluated as part of the entire submission package. The video serves as a first introduction of your team and solution to the reviewers.

Post your publicly accessible video online (e.g., YouTube, Vimeo). Be creative and produce a video that conveys the required information in exciting and interesting ways, but do not focus on time-consuming activities that only improve production values (i.e., technical elements such as décor, lighting, and cinematic techniques). Assistance from others with experience in this area may be helpful. Members of the American-Made Network may be able to help you create your video.

3.6.2 Cover Page Content

List basic information about your submission, including:

- Project title
- Team name
- Track
- Short description
- Key project members (names, contacts, and links to their professional online profiles)
- Other partners (if any)
- Your city, state, and nine-digit ZIP code.

3.6.3 Narrative

You should answer each of the following three questions. The content bullets are only suggestions to guide your responses. You decide where to focus your answers. The individual answers to the three questions do not have a word limit; however, **the aggregate response to these three questions must not exceed 2,500 words**, not including captions, figures/graphs, or references. A word count must be included at the end of your submission (see template for details). You may also include **up to five supporting images, figures, or graphs**. The reviewers will score the questions based on the content you have provided.

Narrative Maximum 2,500 words and 5 supporting images or figures (PDF) Template:	
Team	
<i>Question 1: What is your team's past experience providing solutions for this or related problems?</i>	
Suggested Content Competitor Provides <ul style="list-style-type: none">● Describe your team, the organizations that comprise your team, and the backgrounds and expertise of your team members.● Describe the unique past experience or combination of capabilities your team brings to the table.● Describe the relevant algorithms, software models, or concepts your team has developed and can leverage for this prize.● Demonstrate that your team understands (for Tracks 1–2) or describe (for Track 3) the utility partner's problem, its broader context, and its negative impact on the utility.● Describe if and how your approach could be applied to other utilities facing a similar problem.	A single score on a scale of 1–6 is provided, taking the following statements into consideration: <ul style="list-style-type: none">● The team has the relevant skills and expertise to solve the proposed problem.● The team has access to relevant resources that can be leveraged for this prize.● The team demonstrates a thorough understanding of the utility's problem, its broader context, and the importance of solving this problem.● The team has sufficient interdisciplinary expertise to develop and integrate digital infrastructure and data analytics tools effectively.

<h3 style="text-align: center;">Solution</h3> <p><i>Question 2: What is your solution to the problem?</i></p>	
Suggested Content Competitor Provides <ul style="list-style-type: none"> Describe your solution to the problem and why you chose this method. Describe the specific benefits your solution will provide to the utility. Describe how the benefits can be quantified and measured following deployment. Describe how this work expands on your team's prior experience and capabilities. Describe what other solutions you considered and why you chose not to implement them. Describe the benefits of your approach over alternatives a utility might consider. 	A single score on a scale of 1–6 is provided, taking the following statements into consideration: <ul style="list-style-type: none"> The proposed solution is clear and directly addresses the utility's problem. The team has identified appropriate metrics for success. The team's past experience and capabilities indicate a high likelihood of success. The team is familiar with alternative solutions and provides strong justification for the selection of their approach over others. The team has a well-defined plan for implementing their solution.
<h3 style="text-align: center;">Implementation Plan</h3> <p><i>Question 3: How will you measure the success of your approach?</i></p>	
Suggested Content Competitor Provides <ul style="list-style-type: none"> Define your goals and implementation plan during the Progress Phase, including tasks, milestones timeline, and what you will deliver to the utility. Identify the data sets you will need to be successful and highlight any additional data sets needed that are not currently offered publicly or in the appendices. Describe any anticipated challenges and how they will be addressed. Provide evidence that if selected to move forward, your team can successfully complete the Progress Phase. 	A single score on a scale of 1–6 is provided, taking the following statements into consideration: <ul style="list-style-type: none"> The plan shows a commitment to solving the utility's problem. The plan is ambitious, yet reasonable, and the team has a high likelihood of successfully implementing it. The plan is built on reasonable assumptions and lessons learned from other notable efforts in this space. The required data sets are likely to be available. The team has the resources available to successfully implement the plan in the next phase.
<h3 style="text-align: center;">Reviewer Recommendation</h3>	
<ul style="list-style-type: none"> There is no direct corresponding submission requirement for this score. Rather, it is an overall assessment of all materials submitted in HeroX. 	A single score on a scale of 1–6 is provided, taking the following statement into consideration: <ul style="list-style-type: none"> The innovation, team, and plan should be strongly considered for a Plan Phase prize.

3.6.4 Submission Summary Slide (Will Be Made Public)

Make a public-facing, one-slide submission summary that introduces your team and/or organization and your mission. There is no template, so competitors are free to present the information in any format. Any text must be readable in a standard printed page and a conference room projection and should be at least 14-point font.

3.6.5 Letters of Support or Commitment (Optional)

Attach one-page letters (of support, intent, or commitment) from other relevant entities to provide context. Letters of support from partners or others that are critical to the success of your proposed solution will likely increase your score. General letters of support from parties that are not critical to the execution of your solution will likely not factor into your score. Please do not submit multipage letters. If you are working with a utility partner outside of the three identified for this prize, you must include a letter of support from your utility partner. Competitors in Tracks 1 and 2 should NOT submit letters from the pre-identified utility partners (BPA, Clark PUD, and Dominion).

3.7 How We Determine and Award Winners

The Prize Administrator screens all completed submissions and ensures the teams are eligible. Then the Prize Administrator, in consultation with DOE, assigns subject-matter-expert reviewers who independently score the content of each submission. The reviewers will be composed of federal and nonfederal subject-matter experts and representatives from the utility partners with expertise in areas relevant to the competition. They will review the competitors' submitted video pitches and impact plans according to the evaluation criteria described in Section 3.6.3.

3.7.1 Reviewer Panel Scoring

The scoring of submissions will proceed as follows:

- Experts will review each submission individually and assess the response from the competitor to each statement in the four criteria described in the tables in Section 3.6.3.
- Reviewers will score each section 1–6, depending on the degree to which the reviewer agrees that the submission reflects the statements for consideration.
- Each section score will be added together to generate a total score for the submission, which can be up to 24 points as described in the tables in Section 3.6.3.
- The total scores from each reviewer will be averaged to produce a final score for the competing team/organization. This score will inform the judges' decisions on prize awards.

3.7.2 Interviews

DOE may decide to interview a subset of competitors. The interviews would be held prior to the announcement of the winners and would serve to help clarify questions the reviewers may have. Participating in interviews is not required, and interviews are not an indication of a competitor's likelihood to win.

3.7.3 Final Determination

DOE will designate a federal employee as the judge before the final determination of the winners. Final determination of the winners by the judge will consider the reviewers' feedback and scores, application of program policy factors, and the interview findings (if applicable).

3.7.4 Announcement

Approximately 60 days after the contest closes, the Prize Administrator will notify the winners and request the necessary information to distribute the prizes. The Prize Administrator will then publicly announce the winners.

3.8 Additional Terms and Conditions

See Appendix 1 for additional requirements.

COMPETITORS THAT DO NOT COMPLY WITH THE ADDITIONAL REQUIREMENTS IN APPENDIX 1 MAY BE DISQUALIFIED.

4 Progress Phase

4.1 Goal

Competitors will have worked side by side with the selected utilities on the presented issue for 6 months to develop and refine a software solution that addresses the issues that the utilities are dealing with. The teams will be able to present their progress toward implementing their solution.

4.2 Prizes

One winner from each utility track will be selected as a winner and will receive a prize of \$100,000. One Grand Prize winner will be selected from these winners to receive an additional \$125,000. The total prize pool for Phase 2 is \$425,000.

4.3 How To Enter

Only competitors who won the Plan Phase may compete in the Progress Phase. Go to [HeroX](#) and follow the instructions for submitting all required materials before the phase deadline.

4.4 Important Dates

Refer to the timeline on [HeroX](#) for relevant dates and deadlines.

4.5 Progress Phase Process

The Progress Phase consists of the following steps:

1. **Implement Proposed Solution:** Competitors implement the solution they proposed during the Plan Phase in consultation with the utility partner.
2. **Submission:** Competitors complete their submission packages and submit online before the Progress Phase closes.
3. **Assessment:** A panel of industry experts reviews the submissions and provides a recommendation to the U.S. Department of Energy, who is the selection official for this prize.
4. **Announcement:** The Prize Administrator publicly announces the winners and Grand Prize winner..

4.6 What To Submit

A complete submission package for the Progress Phase should include the following items:

- 90-second video (public)
- Cover page content
- Narrative that answers four questions
- Summary PowerPoint slide
- Letters of commitment or support (optional).

The following details provide more guidance on what information to provide and how reviewers evaluate and score your submission. Reviewers will evaluate your submissions by assigning a single score for each scored submission section, based on their overall agreement or disagreement with a series of statements.

1	2	3	4	5	6
Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree

4.6.1 Online Public Video (Will Be Made Public)

Online Public Video – *Who is your team and what is your solution in 90 seconds?*

Suggested Content Competitor Provides

- Describe your team and how it is uniquely qualified to solve the selected utility's problems.
- Demonstrate your solution.
- Describe why it is the best approach to the utility's problem.

While there are no specific scoring criteria for the video, it will be evaluated as part of the entire submission package. The video serves as a first introduction of your team and solution to the reviewers.

Post your publicly accessible video online (e.g., YouTube, Vimeo). Be creative and produce a video that conveys the required information in exciting and interesting ways, but do not focus on time-consuming activities that only improve production values (i.e., technical elements such as décor, lighting, and cinematic techniques). Assistance from others with experience in this area may be helpful. Members of the American-Made Network may be able to help you create your video.

4.6.2 Cover Page Content

List basic information about your submission, including:

- Project title
- Team name
- Track

- Short description
- Key project members (names, contacts, and links to their professional online profiles)
- Other partners (if any)
- Your city, state, and nine-digit ZIP code.

4.6.3 Narrative

You should answer each of the following four questions. The content bullets are only suggestions to guide your responses. You decide where to focus your answers. The individual answers to the four questions do not have a word limit; however, **the aggregate response to these four questions must not exceed 2,500 words**, not including captions, figures/graphs, or references. A word count must be included at the end of your submission (see template for details). You may also include **up to five supporting images, figures, or graphs**. The reviewers will score the questions based on the content you have provided.

<p style="text-align: center;">Narrative</p> <p>Maximum 2,500 words and 5 supporting images or figures (PDF)</p> <p>Template: Posted on HeroX</p>	
<p style="text-align: center;">Team and Problem Overview</p> <p><i>Question 1: What problem were you trying to solve?</i></p>	
<p>Suggested Content Competitor Provides</p> <ul style="list-style-type: none"> • Briefly describe the problem and how it was impacting the utility. • Describe the problem's broader impact on the industry. • Describe what you have learned about the problem during the Progress Phase. 	<p>A single score on a scale of 1–6 is provided, taking the following statements into consideration:</p> <ul style="list-style-type: none"> • The team understands the utility's problem and its broader context on the industry. • The team significantly advanced their understanding of the problem during the Progress Phase.
<p style="text-align: center;">Solution Implementation</p> <p><i>Question 2: Did you perform the plan identified in the Plan Phase?</i></p>	
<p>Suggested Content Competitor Provides</p> <ul style="list-style-type: none"> • Briefly describe your solution. • Describe how you implemented your plan to solve the problem and if you were able to meet your planned goals. • Highlight key activities and milestones completed during the Progress Phase. • Describe the interactions you had with the utility during the Progress Phase. • Explain if and why you had to deviate from your plan. • Describe the data sets used in your solution. • Describe how your team's experience and capabilities were used to solve the problem. • Describe the challenges you faced and how you overcame them. 	<p>A single score on a scale of 1–6 is provided, taking the following statements into consideration:</p> <ul style="list-style-type: none"> • The team demonstrates impressive and convincing progress made to implement the solution. • Activities and milestones accomplished directly related to the implementation plan. • The team reasonably followed the plan from the Plan Phase, and any deviations from the plan were well justified. • The data sets used were relevant to the problem and the solution. • The team achieved their goals.

Solution Impact	
Question 3: What benefits were provided to the team's utility partner?	
Suggested Content Competitor Provides <ul style="list-style-type: none"> Describe what you delivered to the utility. Describe any feedback you received from the utility when you delivered your solution. Using the metrics identified in the Plan Phase, quantify the benefits your solution is providing. Describe to what extent your solution has solved the utility's problem and what additional steps are needed. 	A single score on a scale of 1–6 is provided, taking the following statements into consideration: <ul style="list-style-type: none"> The team delivered an appropriate solution to their utility partner. The team integrated feedback received from the utility to increase the value of the solution. The benefits of the solution are clear and measurable. The team effectively addressed the utility's problem.
Future Plans	
Question 4: What is the potential impact of your work moving forward?	
Suggested Content Competitor Provides <ul style="list-style-type: none"> Describe additional steps the utility is planning or should plan in response to this work. Describe how your solution can be integrated into the regular operations of the utility and what resources would be needed to do so. Describe how the solution could be expanded to provide additional benefits. Describe how other utilities could benefit from your solution. Describe how your specific solution could be transferred to other utilities. 	A single score on a scale of 1–6 is provided, taking the following statements into consideration: <ul style="list-style-type: none"> The solution has the potential to be integrated into the utility's regular operations. The solution has potential for broader impact moving forward. Other utilities will be interested in implementing solutions based on this work.

Reviewer Recommendation	
<ul style="list-style-type: none"> There is no direct corresponding submission requirement for this score. Rather, it is an overall assessment of all materials submitted in HeroX. 	A single score on a scale of 1–6 is provided, taking the following statement into consideration: <ul style="list-style-type: none"> The innovation, team, and plan should be strongly considered for a Progress Phase prize.

4.6.4 Submission Summary Slide (Will Be Made Public)

Make a public-facing, one-slide submission summary that introduces your team and/or organization and your mission. There is no template, so competitors are free to present the information in any format. Any text must be readable in a standard printed page and a conference room projection and should be in at least 14-point font.

4.6.5 Letters of Support or Commitment (Optional)

Attach one-page letters (of support, intent, or commitment) from other relevant entities to provide context. Letters of support from partners or others that are critical to the success of your proposed solution will likely increase your score. General letters of support from parties that are not critical to the execution of your solution will likely not factor into your score. Please do not submit multipage letters. If you are working with a utility partner outside of the three identified for this prize, you must include a letter of support from your utility partner.

4.7 How We Determine and Award Winners

The Prize Administrator screens all completed submissions and ensures the teams are eligible. Then the Prize Administrator, in consultation with DOE, assigns subject-matter-expert reviewers who independently score the content of each submission. The reviewers will be composed of federal and nonfederal subject-matter experts and representatives from the utility partners with expertise in areas relevant to the competition. They will review the competitors' submitted video pitches and impact plans according to the evaluation criteria described in Section 4.6.3.

4.7.1 Reviewer Panel Scoring

The scoring of submissions will proceed as follows:

- Experts will review each submission individually and assess the response from the competitor to each statement in the five criteria described in the tables in Section 4.6.3.
- Reviewers will score each section 1–6, depending on the degree to which the reviewer agrees that the submission reflects the statements for consideration.
- Each section score will be added together to generate a total score for the submission, which can be up to 30 points as described in the tables in Section 4.6.3.
- The total scores from each reviewer will be averaged to produce a final score for the competing team/organization. This score will inform the judges' decisions on prize awards.

4.7.2 Interviews

DOE may decide to interview a subset of competitors. The interviews would be held prior to the announcement of the winners and would serve to help clarify questions the reviewers may have. Participating in interviews is not required, and interviews are not an indication of a competitor's likelihood to win.

4.7.3 Final Determination

DOE will designate a federal employee as the judge before the final determination of the winners. Final determination of the winners by the judge will consider the reviewers' feedback and scores, application of program policy factors, and the interview findings (if applicable).

4.7.4 Announcement

Approximately 30 days after the contest closes, the Prize Administrator will notify the winners and request the necessary information to distribute the prizes. The Prize Administrator will then publicly announce the winners.

The winners will provide information on their solutions for each track will be publicly shared by DOE through a combination of written materials, webinars, and presentations. This should not contain propriety information, but should include approach, general methodology, open-source tools, and relevant publications.

4.8 Additional Terms and Conditions

See Appendix 1 for additional requirements.

COMPETITORS THAT DO NOT COMPLY WITH THE ADDITIONAL REQUIREMENTS IN APPENDIX 1 MAY BE DISQUALIFIED.

Appendix 1: Additional Terms and Conditions

A.1 Requirements

Your submission for the Digitizing Utilities Prize is subject to the following terms and conditions:

- You must post the final content of your submission or upload the submission form online by 5 p.m. EST on January 26, 2023, before the prize's Phase 1 submission period closes. Late submissions or any other form of submission may be rejected.
- All submissions that you wish to protect from public disclosure must be marked according to the instructions in Section A.10. Unmarked or improperly marked submissions will be deemed to have been provided with unlimited rights and may be used in any manner and for any purpose whatsoever.
- You must include all the required elements in your submission. The Prize Administrator may disqualify your submission after an initial screening if you fail to provide all required submission elements. Competitors may be given an opportunity to rectify submission errors due to technical challenges.
- Your submission must be in English and in a format readable by Microsoft Word or Adobe PDF. Scanned handwritten submissions will be disqualified.
- Submissions will be disqualified if they contain any matter that, in the sole discretion of the U.S. Department of Energy (DOE) or the National Renewable Energy Laboratory (NREL), is indecent, obscene, defamatory, libelous, and/or lacking in professionalism, or demonstrates a lack of respect for people or life on this planet.
- If you click "Accept" on the HeroX platform and proceed to register for any of the prizes described in this document, these rules will form a valid and binding agreement between you and DOE and are in addition to the existing HeroX Terms of Use for all purposes relating to these contests. You should print and keep a copy of these rules. These provisions only apply to the prize described here and no other prize on the HeroX platform or anywhere else.
- The Prize Administrator, when feasible, may give competitors an opportunity to fix nonsubstantive mistakes or errors in their submission packages.
- As part of your submission to this prize, you will be required to sign the following statement:

I am providing this submission package as part of my participation in this prize. I understand that I am providing this submission to the federal government. I certify under penalty of perjury that the named competitor meets the eligibility requirements for this prize competition and complies with all other rules contained in the Official Rules document. I further represent that the information contained in the submission is true and contains no misrepresentations. I understand false statements or misrepresentations to the federal government may result in civil and/or criminal penalties under 18 U.S.C. § 1001 and § 287.

A.2 Verification for Payments

The Prize Administrator will verify the identity and role of all competitors before distributing any prizes. Receiving a prize payment is contingent upon fulfilling all requirements contained herein. The Prize Administrator will notify winning competitors using provided email contact information for the individual or entity responsible for the submission. Each competitor will be required to sign and return to the Prize Administrator, within 30 days of the date on the notice, a completed NREL Request for ACH Banking Information form and a completed W9 form (<https://www.irs.gov/pub/irs-pdf/fw9.pdf>). In the sole discretion of the Prize Administrator, a winning competitor will be disqualified from the competition and receive no prize funds if: (1) the person/entity does not respond to notifications, (2) the person/entity fails to sign and return the required documentation within the required time period, (3) the notification is returned as undeliverable, or (4) the submission or person/entity is disqualified for any other reason.

In the event of a dispute as to any registration, the authorized account holder of the email address used to register will be deemed to be the competitor. The "authorized account holder" is the natural person or legal entity assigned an email address by an internet access provider, online service provider, or other organization responsible for assigning email addresses for the domain associated with the submitted address. All competitors may be required to show proof of being the authorized account holder.

A.3 Teams and Single-Entity Awards

The Prize Administrator will award a single dollar amount to the designated primary submitter, whether consisting of a single or multiple entities. The primary submitter is solely responsible for allocating any prize funds among its member competitors or teammates as they deem appropriate. The Prize Administrator will not arbitrate, intervene, advise on, or resolve any matters or disputes between team members or competitors.

A.4 Submission Rights

By making a submission and consenting to the rules of the contest, a competitor is granting to DOE, the Prize Administrator, and any other third parties supporting DOE in the contest, a license to display publicly and use the parts of the submission that are designated as "public" for government purposes. This license includes posting or linking to the public portions of the submission on the Prize Administrator or HeroX applications, including the contest website, DOE websites, and partner websites, and the inclusion of the submission in any other media worldwide. The submission may be viewed by DOE, Prize Administrator, and judges and reviewers for purposes of the contests, including but not limited to screening and evaluation purposes. The Prize Administrator and any third parties acting on their behalf will also have the right to publicize competitors' names and, as applicable, the names of competitors' team members and organization who participated in the submission on the contest website indefinitely.

By entering, the competitor represents and warrants that:

1. The competitor's entire submission is an original work by the competitor and the competitor has not included third-party content (such as writing, text, graphics, artwork, logos, photographs, likeness of any third party, musical recordings, clips of videos, television programs, or motion pictures) in or in connection with the submission, unless (1) otherwise requested by the Prize Administrator and/or disclosed by the competitor in the submission, and (2) the competitor has either obtained the rights to use such third-party content or the content of the submission is considered in the public domain without any limitations on use.

2. Unless otherwise disclosed in the submission, the use thereof by the Prize Administrator, or the exercise by the Prize Administrator of any of the rights granted by competitor under these rules, does not and will not infringe or violate any rights of any third party or entity, including, without limitation, patent, copyright, trademark, trade secret, defamation, privacy, publicity, false light, misappropriation, intentional or negligent infliction of emotional distress, confidentiality, or any contractual or other rights.
3. All persons who were engaged by the competitor to work on the submission or who appear in the submission in any manner have:
 - a. Given the competitor their express written consent to submit the submission for exhibition and other exploitation in any manner and in any and all media, whether now existing or hereafter discovered, throughout the world;
 - b. Provided written permission to include their name, image, or pictures in or with the submission (or, if a minor who is not competitor's child, competitor must have the permission of the minor's parent or legal guardian) and the competitor may be asked by the prize administrator to provide permission in writing; and
 - c. Not been and are not currently under any union or guild agreement that results in any ongoing obligations resulting from the use, exhibition, or other exploitation of the submission.

A.5 Copyright

Each competitor represents and warrants that the competitor is the sole author and copyright owner of the submission; the submission is an original work of the competitor or that the competitor has acquired sufficient rights to use and to authorize others, including DOE, to use the submission, as specified throughout the rules; the submission does not infringe upon any copyright or any other third-party rights of which the competitor is aware; and the submission is free of malware.

A.6 Contest Subject to Applicable Law

All contests are subject to all applicable federal laws and regulations. Participation constitutes each participant's full and unconditional agreement to these Official Rules and administrative decisions, which are final and binding in all matters related to the contest. This notice is not an obligation of funds; the final award is contingent upon the availability of appropriations.

A.7 Resolution of Disputes

DOE is solely responsible for administrative decisions, which are final and binding in all matters related to the contest.

Neither DOE nor the Prize Administrator will arbitrate, intervene, advise on, or resolve any matters between team members or among competitors.

A.8 Publicity

The winners of these prizes (collectively, "winners") will be featured on DOE and NREL websites.

Except where prohibited, participation in the contest constitutes each winner's consent to DOE and its agents' use of each winner's name, likeness, photograph, voice, opinions, and/or hometown and state information for promotional purposes through any form of media worldwide, without further permission, payment, or consideration.

A.9 Liability

Upon registration, all participants agree to assume any and all risks of injury or loss in connection with or in any way arising from participation in this contest. Upon registration, except in the case of willful misconduct, all participants agree to and thereby do waive and release any and all claims or causes of action against the federal government and its officers, employees, and agents for any and all injury and damage of any nature whatsoever (whether existing or thereafter arising, whether direct, indirect, or consequential, and whether foreseeable or not) arising from their participation in the contest, whether the claim or cause of action arises under contract or tort.

In accordance with the delegation of authority to run this contest delegated to the judge responsible for this prize, the judge has determined that no liability insurance naming DOE as an insured will be required of competitors to compete in this competition per 15 U.S.C. § 3719(i)(2) and (3). Competitors should assess the risks associated with their proposed activities and adequately insure themselves against possible losses.

A.10 Records Retention and Freedom of Information Act

All materials submitted to DOE as part of a submission become DOE records and are subject to the Freedom of Information Act. The following applies only to portions of the submission not designated as public information in the instructions for submission. If a submission includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the Freedom of Information Act. Without assuming any liability for inadvertent disclosure, DOE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for review of the application or as otherwise authorized by law. This restriction does not limit the government's right to use the information if it is obtained from another source.

Submissions containing confidential, proprietary, or privileged information must be marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. government is not liable for the disclosure or use of unmarked information and may use or disclose such information for any purpose.

The submission must be marked as follows and identify the specific pages containing trade secrets, confidential, proprietary, or privileged information: "Notice of Restriction on Disclosure and Use of Data: Pages [list applicable pages] of this document may contain trade secrets, confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes. [End of Notice]"

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure." In addition, each line or paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets.

Competitors will be notified of any Freedom of Information Act requests for their submissions in accordance with 29 C.F.R. § 70.26. Competitors may then have the opportunity to review materials and

work with a Freedom of Information Act representative prior to the release of materials. DOE does intend to keep all submission materials private except for those materials designated as “will be made public.”

A.11 Privacy

If you choose to provide HeroX with personal information by registering or completing the submission package through the contest website, you understand that such information will be transmitted to DOE and may be kept in a system of records. Such information will be used only to respond to you in matters regarding your submission and/or the contest unless you choose to receive updates or notifications about other contests or programs from DOE on an opt-in basis. DOE and NREL are not collecting any information for commercial marketing.

A.12 General Conditions

DOE reserves the right to cancel, suspend, and/or modify the prize, or any part of it, at any time. If any fraud, technical failures, or any other factor beyond DOE's reasonable control impairs the integrity or proper functioning of the prize, as determined by DOE in its sole discretion, DOE may cancel the prize. Any performance toward prize goals is conducted entirely at the risk of the competitor, and DOE shall not compensate any competitors for any activities performed in furtherance of this prize.

Although DOE may indicate that it will select up to several winners for each prize, DOE reserves the right to only select competitors that are likely to achieve the goals of the program. If, in DOE's determination, no competitors are likely to achieve the goals of the program, DOE will select no competitors to be winners and will award no prize money.

A.13 Program Policy Factors

While the scores of the expert reviewers will be carefully considered, it is the role of the prize judge to maximize the impact of prize funds. Some factors outside the control of competitors and beyond the independent expert reviewer scope of review may need to be considered to accomplish this goal. The following is a list of such factors. In addition to the reviewers' scores, the below program policy factors may be considered in determining winners:

- Geographic diversity and potential economic impact of projects.
- Whether the use of additional DOE funds and provided resources are non-duplicative and compatible with the stated goals of this program and the DOE mission generally.
- The degree to which the submission exhibits technological or programmatic diversity when compared to the existing DOE project portfolio and other competitors.
- The degree to which the submission is likely to lead to increased employment and manufacturing in the United States or provide other economic benefits to U.S. taxpayers.
- The degree to which the submission will accelerate transformational technological, financial, or workforce advances in areas that industry by itself is not likely to undertake because of technical or financial uncertainty.
- The degree to which the submission supports complementary DOE-funded efforts or projects, which, when taken together, will best achieve the goals and objectives of DOE.
- The degree to which the submission expands DOE's funding to new competitors and recipients who have not been supported by DOE in the past.
- The degree to which the submission enables new and expanding market segments.
- Whether the project promotes increased coordination with nongovernmental entities toward enabling a just and equitable clean energy economy in their region and/or community.

A.14 National Environmental Policy Act Compliance

This prize is subject to the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321, et seq.). NEPA requires federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website at <http://nepa.energy.gov/>.

While NEPA compliance is a federal agency responsibility and the ultimate decisions remain with the federal agency, all participants in the Digitizing Utilities Prize will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their participation in the prize competition. Participants may be asked to provide DOE with information on fabrication and testing of their device such that DOE can conduct a meaningful evaluation of the potential environmental impacts.

A.15 Return of Funds

As a condition of receiving a prize, competitors agree that if the prize was made based on fraudulent or inaccurate information provided by the competitor to DOE, DOE has the right to demand that any prize funds or the value of other non-cash prizes be returned to the government.

ALL DECISIONS BY DOE ARE FINAL AND BINDING IN ALL MATTERS RELATED TO THE PRIZE.

Appendix 2: Track 1 – Load Modeling

Overview

Bonneville Power Administration (BPA) and Clark PUD have partnered to provide a working example on the need for load modeling. Competitors in Track 1 will propose an approach to addressing the challenge identified below in Phase 1. In Phase 2, competitors will work with guidance from BPA and Clark PUD to implement their plan and provide BPA and Clark PUD with completed load models by the end of the prize competition.

Transmission planning studies are conducted routinely to ensure the bulk electric power system can be operated reliably under anticipated conditions and events, such as the unplanned loss of a large generator or transmission line. These studies require accurate models of distribution-level substations and feeders, appropriately reflecting the types of load (e.g., air conditioning, lighting) that constitute a particular area. This “load composition” directly depends on multiple factors, including but not limited to building types, vintage, economic class, and availability of regional utilities. Dynamic system response is largely dependent on season and weather conditions, as grid behavior can vary widely based on activity of temperature-sensitive loads, particularly heating and cooling.

The variability in electrification and the corresponding temperature sensitivity have a direct impact on the accuracy of dynamic load models. This has created a great challenge in the load modeling community, at both distribution and transmission utilities, as well as the North American Electric Reliability Corporation (NERC) Load Modeling Working Group (LMWG). In order to correctly forecast future demand, it is critical to build models that accurately represent the current load composition. Unfortunately, information related to individual buildings served by a feeder is not always readily available, and mathematical methods of determining electrification have been historically inadequate. To support the efforts of the load modeling community across NERC, BPA seeks solutions from developers in the data analytic community to perform the tasks outlined below.

Track 1 Challenge

Competitors responding to BPA’s challenge should address some or all of the following four tasks:

Task 1 – Weather Sensitivity Analysis

End use loads are typically categorized by their relative sensitivity to temperature and humidity. Weather-sensitive loads, particularly heating and cooling, can be difficult to characterize, as they depend on varying weather conditions, as well as season, time of day, day of week, and human behavior. Two identical homes experiencing the same weather conditions may exhibit different heating, ventilating, and air-conditioning (HVAC) load profiles based on thermostat set points and occupancy patterns.

Figure 1 shows a sample of aggregated power consumption from 168 homes with central air conditioning (AC) or ducted heat pump, as collected by the Northwest Energy Efficiency Alliance (NEEA) Home Energy Metering Study (HEMS). This plot compares a milder summer day (81°F high) with a record-breaking heat wave (112°F high) in the Northwest, and shows power consumption roughly doubled, primarily due to air-conditioning load on the hotter day.

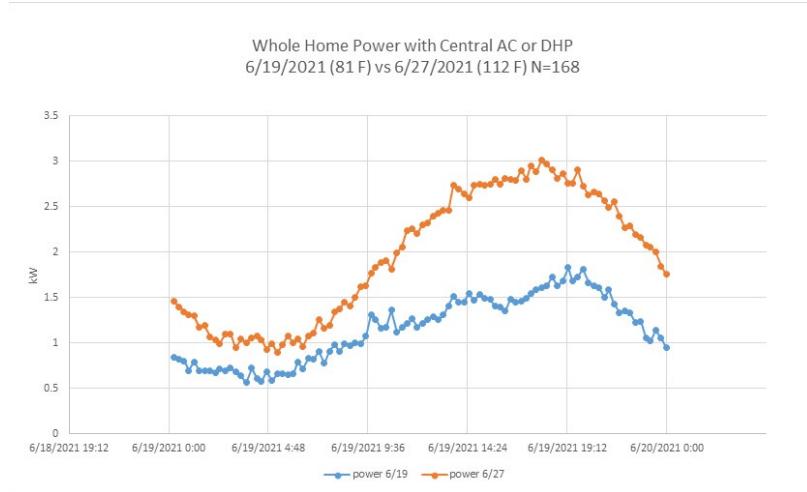


Figure 1. Residential power consumption during heat wave

At the substation level, the impact of air conditioning may be even more pronounced as commercial and multifamily buildings are introduced. Figure 2 shows total substation load for the same 2 days, exhibiting a similar trend. Peak load is roughly doubled on the day of the heat wave when compared with the milder day.

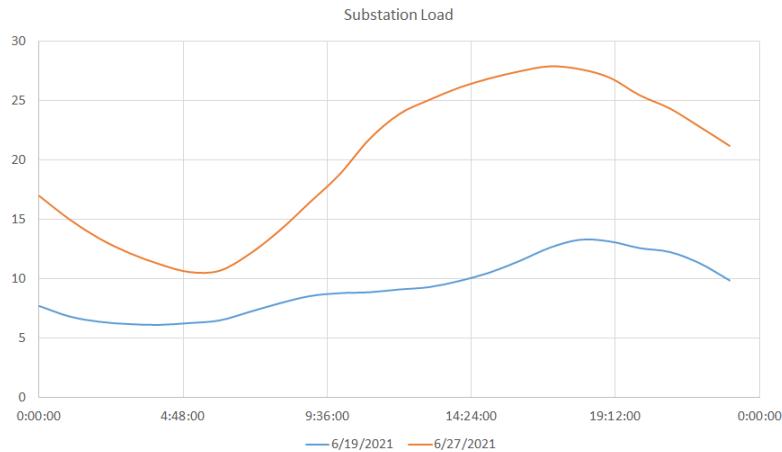


Figure 2. Substation power consumption during heat wave

For this task, BPA requests that developers address the dynamic nature of these weather-sensitive loads and generate models to characterize their behavior, both at the individual building level and feeder-level and substation-level aggregates.

Task 2 – Electrification Estimation

One of the most significant factors in generating load composition is determining the electrification of the area. A reasonable estimate of homes/buildings with electric heating, cooling, water heating, and cooking is required to understand the composition of a feeder/substation. However, this information is typically not available for utilities, and often must be estimated from metered data. Figure 3 shows how differences in electrification are observed at the substation level with hourly load data relative to observed heat index. The load at Substation 1 is significantly higher as temperatures rise when compared to milder temperatures. In comparison, the load at Substation 2 is relatively constant at higher

temperature relative to milder ones. This generally indicates less penetration of air conditioning at Substation 2 compared to Substation 1.

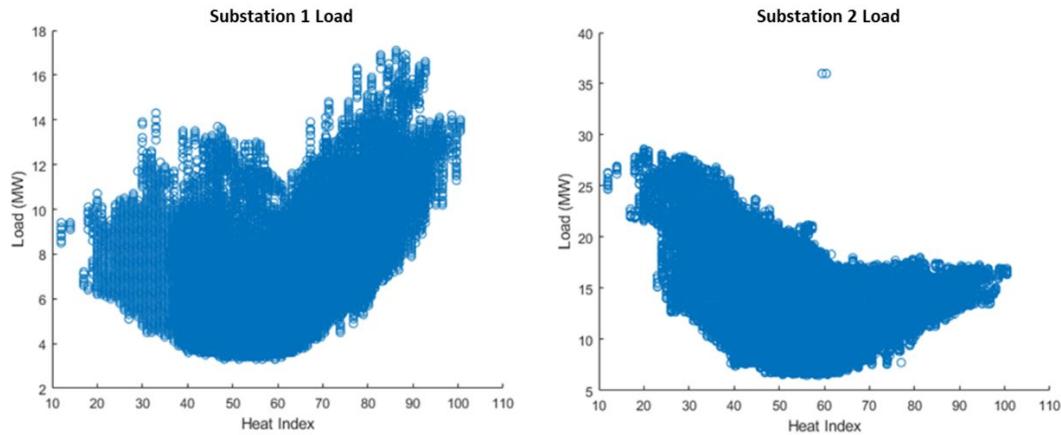


Figure 3. Hourly substation loads

However, the constitution of the substation also has a direct impact on the loads. In this example, Substation 2 contains a larger number of commercial buildings than Substation 1, which is mostly residential. This task requires that developers analyze historical load measurements, feeder/substation compositions, and weather patterns to generate a method of estimating electrification for substations with a variety of commercial/residential proportions. The expected result for each substation is the following:

- Percentage of residential homes (and/or percentage of residential building area) with electric heating, cooling, water heating, and cooking.
- Percentage of commercial buildings (and/or percentage of commercial building area) with electric heating, cooling, water heating, and cooking.

Task 3 – Impact of Future Electrification

Generating accurate load composition becomes increasingly complex when projecting changes in building electrification over time. Long-term load forecasting must account for shifts toward newer technologies such as heat pumps, LED lighting, electric vehicles, and distributed solar generation. Incentive programs can accelerate future electrification, particularly in regions where these programs have government support.

For this task, developers will construct reasonable future electrification scenarios, ranging from modest to aggressive, and estimate future peak demand under extreme weather conditions.

Task 4 – Projection for Region-Specific Results

The previously described tasks will be primarily focused on the BPA footprint, specifically the Portland, Oregon, and Vancouver, Washington, areas. However, there is a growing interest in these topics nationwide, requiring that results can be projected to other areas of the country. The developers will be tasked with creating models that have applicability in varying climate areas and building compositions (e.g., densely populated downtown areas and lightly populated rural areas).

Track 1 Goals

During Phase 1, successful competitors in Track 1 will provide a plan on how they will achieve the following goals. During Phase 2, successful competitors will demonstrate that their solution has achieved the following goals.

When considering the evaluation criteria in Sections 3.6.3 and 4.6.3, reviewers will consider the evaluation criteria in the context of the following:

Task 1: BPA will use the delivered models to synthesize load shapes for substations within its footprint. These load shapes will be compared with actual historical measurements to determine the applicability of the models.

Task 2: BPA currently uses estimated electrification values to generate load composition factors for its dynamic load model. The new electrification values will be used to create replacement load compositions and a new “load model under test.” This new model will be evaluated by running studies using historical events and determining the applicability of these electrification factors.

Task 3: Transmission planners will evaluate the reasonability of the results and run system studies incorporating the established impact of the electrification scenarios.

Task 4: To be determined, based on deliverables. Depending on the success of Tasks 1–3, other utilities may be interested in performing similar evaluations using their regional data. Ideally, BPA will also generate new load composition factors for every feeder in the Western Interconnection and perform full-scale studies using historical events from other regions of the West.

Available Data Sets

Multiple projects have provided end-use metering to the public for a variety of residential and commercial building types (e.g., NEEA’s Home Energy Metering Study, HEMS). NREL’s End Use Load Profile (EULP) project aims to estimate regional load shapes based on their RESstock and COMstock models and using metering studies for validation. As these are publicly available data sets, the software development team would have access to these resources.

Developers will likely require historical weather measurements observed at multiple reliable stations. BPA has traditionally relied upon NOAA’s Local Climatological Dataset (LCD) for hourly temperature and humidity measurements. This is also publicly available information and can be supplied by BPA or retrieved from NOAA’s website.

In addition, developers will be provided with **anonymized** building stock information, including the source substation and feeder, building description, building type, and building area, for approximately 50 substations in the Vancouver, Washington, area. Table 1 shows a sample of this information; similar data will be provided for over 160,000 buildings. If necessary, similar information may be collected from other distribution utilities within the BPA footprint, pending permission from the information owner.

Table 1. Sample of Anonymized Building Data

Substation ID	Feeder ID	Building ID	Description	Area (FT ²)	Building Type
Station A	Feeder A1	000001	SINGLE-FAMILY RESIDENTIAL	1,130	CONVENTIONAL
Station A	Feeder A1	000002	SMALL RETAIL BUILDING (<10,000 FT ²)	4,144	RETAIL STORE
Station B	Feeder B1	000003	MULTIFAMILY 100 OR MORE UNITS	156,520	APARTMENTS
Station B	Feeder B2	000004	RESTAURANTS, CAFES	1,398	RESTAURANT

BPA will also provide historic measurements of substation-level loads, in 5-minute intervals, for the same 50 substations described above, in megawatts. A sample of this data set is shown in Table 2.

Table 2. Sample of Substation Load Data

Time	Station 1	Station 2	...	Station 50
1/1/2018 0:00	10.6	6		7.8
1/1/2018 0:05	10.5	6.2		7.9
1/1/2018 0:10	10.5	6.1		7.9
1/1/2018 0:15	10.4	6		7.8
1/1/2018 0:20	10.6	5.9		7.9
1/1/2018 0:25	10.6	6		7.9
1/1/2018 0:30	10.3	6		7.8
1/1/2018 0:35	10.3	6		7.8
1/1/2018 0:40	10.3	6		7.8
1/1/2018 0:45	10.1	6.1		7.6
1/1/2018 0:50	10.2	5.9		7.7
1/1/2018 0:55	10.1	5.8		7.5
1/1/2018 1:00	10.3	5.7		7.5

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BPA will work with selected participants to determine any additional data sets that may be required. Data can be delivered over physical or secure electronic media, and collaborative agreements and/or nondisclosure agreements (NDAs) will be provided based on the requirements of the project team.

Appendix 3: Track 2 – Data Analysis Automation

Overview

Dominion has been a leader among utilities in collecting grid sensor data. Through Track 2, competitors are invited to develop automated processes (e.g., machine learning, algorithms) to process Dominion's data with a focus on using the data to meet reliability and resiliency goals at Dominion. In Phase 1, competitors should propose a creative solution to automate the data processing of one or more of Dominion's data sets. In Phase 2, competitors will work closely with Dominion to create an application that successfully automates the data processing.

Electric utility companies are at one of the most significant transitions in their operating history. Over the last century, the country has invested in developing one of the world's most reliable and resilient transmission systems. This system, designed to power homes, businesses, industries, and services, has gradually evolved to absorb emerging technology and customer needs. Inverter-based generation, staggering localized loads (e.g., data centers), regulatory demands, and sustainability objectives are changing significant components of how the grid operates. In turn, these changes introduce new variables and volatilities that challenge the standard operating model; these are welcome challenges, but they pose a risk to the reliability of a traditional high-inertia system.

The first step in addressing this challenge is to generate an objective evaluation mechanism to understand the nature and magnitude of newly discovered data trends in performance indicators and engineering metrics. Dominion has decades' worth of supervisory control and data acquisition (SCADA) data and, more recently, deployed one of the most substantial high-frequency sensor arrays of any transmission system in North America, including phasor measurement units and waveform sensing capabilities. While decades old, synchrophasor data have seen a revolutionized capability due to big-data capabilities garnered by database technology, broadband streaming, improved data processing, and new data science techniques. With petabytes of grid sensor data, working at this scale requires thoughtful development of capabilities to synthesize, model, and surface the necessary insights to help our engineers scrutinize and evaluate a data-driven approach to resolving nuanced complexities across the system.

Individual utilities and rising task forces, including the North American Synchrophasor Initiative (NASPI), are surfacing new data types, analyses, and trends when evaluating grid events. Furthermore, bleeding edge techniques, impossible through low-frequency data, are helping experts identify oscillations, harmonics, and precursor tendencies that will play an instrumental role in preventing outages and major cascading events.

Track 2 Challenge

Analyzing synchrophasor data requires unique skills to process and render insight. One of the most limiting factors faced by the industry is the ability to collect skills that join power systems, signal processing, data science, and data analysis techniques into a joint investigative force. Competitors responding to Dominion's challenge should provide solutions that aid in producing automated data processing capabilities to support investigative capabilities.

System state data from the grid are collected in three time-series categories:

- **Low-Resolution Data:** SCADA system to take snapshots of the grid from our system state sensors, including, but not limited to, asset history, fault recording, GPS location, time, and point state.
- **High-Resolution Data:** Synchrophasor data: data collected from digital fault recorders (DFRs), phasor measurement units (PMUs), and substation relays, capturing voltage and current phasor data at varying frequencies (conventionally 30/60 Hz in transmission or 120/240 Hz for distribution).
- **Ultra-High-Resolution Data:** Waveform data: bursts of minutes of three-phase voltage and current waveforms from DFRs or continuous streams of waveform data; these include both events and steady-state conditions.

These data in raw form are collected in two time-series data platforms, with modeling and application programming interface (API) capabilities. Our technology stack is powerful, and we encourage creative modeling solutions, libraries, and data sets using techniques that fit the defined research opportunity.

Competitors are encouraged to provide creative solutions based on similar or parallel research and industry contributions. While the methodologies adopted by Dominion provide a forefront capability, we encourage outside-the-box thinking with how to support the effort around frequency analysis and grid resiliency using a mature sensory data repository.

Sample projects could include:

- Automated, long-term spectral analysis to extract interesting dynamic performance features and scale the bandwidth of capabilities.
- Automated visualization toolkit for dynamic performance (oscillation) analysis.
- Understanding causal relationships between operating conditions and engineering metrics such as oscillation frequency and energy, Thevenin equivalents, short-circuit strength, network imbalance, etc.
- Development and integration of complementary engineering KPIs (“features” in data parlance) to support the above-mentioned investigative analysis and diagnostics.
- Development of any necessary capabilities to handle surfaced data quality issues.

Below are sample research publications to demonstrate features and capabilities driven by analyzing and researching grid sensor data to meet numerous electric transmission use cases. Competitors are reminded that **these examples are not meant to be prescriptive**, but rather represent the forms of research and capabilities that jointly serve the function of improving electric system monitoring with the ultimate mission of driving improved reliability and resiliency.

#	Publication	Year	Link
1	Power System Frequency Domain Characteristics for Inertia Estimation from Ambient PMU Data	2021	IEEE
2	Analysis of STATCOM Oscillations using Ambient Synchrophasor Data in Dominion Energy	2022	IEEE
3	Identifying Oscillations Injected by Inverter-Based Solar Energy Sources	2022	ARXIV
4	Experiences with Dynamical Mode Decomposition for Wide-Area Mode Estimation	2022	IEEE
5	Fast Oscillation Detection and Labeling via Coarse Grained Time Series Data for ML Applications	2022	IEEE

Limitations

Information Security: Data from this project are NERC CIP (North American Electric Reliability Commission, Critical Infrastructure Protection), regulated and considered Critical Energy Infrastructure Information (CEII) by the Federal Electric Regulatory Commission (FERC). Competitors must be willing to sign a standard CEII NDA with Dominion, and all project contributors are required to be U.S. citizens or legal foreign nationals.

Data & Environment Security: Competitors will be required to work within the Dominion-provided environment, including VPN access and associated credentials to work inside proprietary cloud-based PaaS data science resources. Competitors will be granted access to the environment on an “as-is” basis, meaning that they will not have the ability to modify the structure of the cloud resources or PaaS capabilities and will not, under any circumstances, be able to egress data from the environment. Competitors may be granted access to the company network and related systems via temporarily issued company IDs and laptops, subject to a successful background check and the needs of the project. Under no circumstances can a participant access the company network with their own devices. These are nonnegotiable criteria for a successful collaboration.

Track 2 Goals

During Phase 1, successful competitors in Track 1 will provide a clear plan for delivering a capability that creatively addresses the gaps and limitations of Dominion’s existing process. During Phase 2, successful competitors will demonstrate that their solution has achieved the following goals.

When considering the evaluation criteria in Sections 3.6.3 and 4.6.3, reviewers will consider the evaluation criteria in the context of Dominion’s review of the following:

- How well the developed capability addresses gaps and limitations of their existing process.
- How seamlessly the capability can be integrated.
- The degree to which the solution reduces the workload of engineers.
- The level of insight provided by the capability and its impact on Dominion’s ability to reliably operate the grid.

Available Data Sets

During Phase 2, competitors will be provided with access to Dominion’s database of synchronized phasor and waveform measurements as described in the Data & Environment Security section above. This data set contains years of synchrophasor measurements and many examples of synchronized waveform measurements.