

RESEARCH CALL TO DOE/NNSA FEDERAL LABORATORIES



**Design Support Tool for Remote Off-grid Microgrids
RC-ROMDST-2015**

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SECTION I – GENERAL INFORMATION

A. SUMMARY

The Department of Energy’s (DOE) National Energy Technology Laboratory (NETL), on behalf of the Office of Electricity Delivery and Energy Reliability (OE), is seeking proposals for research and development (R&D), testing, and transitioning into practice of a design support tool for remote off-grid microgrids. An overarching goal of this Research Call (Call) is that the developed tool must be capable of providing decision support analysis on AC (alternating current) and DC (direct current) microgrids to meet user-defined objectives and constraints for costs and energy system security¹. The tool developed as a result of this Call must facilitate the design of microgrids that encompass mixes of generation assets and load profiles that are typical of remote communities; and be capable of conducting such analyses as may be necessary to validate that corresponding design parameters, planned operational performance and expected benefits of microgrids can be achieved effectively and economically. The developed tool should be readily usable by designers of microgrids for off-grid applications in remote communities and should be useful for the DOE in evaluating all remote microgrid applications. A remote community, for the purposes of this Research Call, is defined as a distant, isolated, populated area (within the Contiguous United States, Alaska, Hawaii, and the territories of the United States), in which either limited (or no) accessibility to an area electric power distribution system or high costs for electricity (\$ per kilowatt hour) attributable to transporting/storing portable fossil fuels for electricity generation, or a combination of both, exists.

Projects submitted in response to this Research Call must comprise two (2) Phases of endeavor. Phase I (lasting up to 12 months) shall involve activity that results in development of the prototype design support tool. Phase II shall also last up to 12 months and consist of testing the tool (for at least 6 months) to validate performance, followed by transitioning the tool into practice (by at least one microgrid designer) for a remote community application. The entire effort (Phase I and Phase II) is expected to last up to 24 months. While the DOE anticipates selecting up to two projects for Phase I, only one of the Phase I projects will be allowed to continue into Phase II. The DOE will make this down-selection based on the performance/progress of each selected project and review of information provided in the Phase I report and the Phase I project briefing. This report must be submitted not later than 30 days after the end of Phase I, and must describe the progress and accomplishments to date and outline the planned work, objectives and expected results for Phase II. The project briefing will be scheduled soon after delivery of the Phase I report to the DOE. During the briefing, the principal investigator of the project (with or without participation of other team members) will present the Phase I progress/results and Phase II plan to the DOE.

B. BACKGROUND INFORMATION

The DOE Smart Grid R&D Program, within the OE, sponsored a scoping study for an initial comparative analysis of the benefits and drawbacks of notional DC microgrids versus their counterpart AC microgrids. This initial analysis compared generic microgrid architectures and applied a set of fundamental metrics including safety and protection; reliability; costs (capital,

¹ In the context of this Research Call, the term, energy system security, is defined in the “Performance Specifications” table under Section C titled “Research Call Description”.

operating, and engineering); energy efficiency; environmental impact; power quality; and resilience. The scoping study report² identified the potential for microgrids to serve as an efficient, low-cost platform for economic (steady-state) integration of distributed energy resources and loads. To provide more accurate estimates of the costs and benefits for microgrids as the integration platform while yielding equivalent energy system security, realistic microgrid load and generation profiles must be used, and other factors (referring to those listed in Recommendation 1 of the scoping study report) must be considered in developing the design decision analysis tool for AC vs. DC microgrids.

C. RESEARCH CALL DESCRIPTION

Proposals submitted in response to this Research Call must address development of a design support tool with economic decision analysis capabilities for remote off-grid microgrids, as a near-term target application for the tool. Many remote areas lack electricity delivery services that would typically be provided by load serving entities. While some remote communities may be supplied with electricity from a distribution (or village) utility, heavy reliance on fossil fuels for electricity generation has resulted in high costs for electricity, attributed to expenses associated with import/transport of the fuel and storage at the generation site. For such remote communities, microgrids (either with an AC network or a DC network) that integrate local renewable energy resources (such as wind or solar) to replace or supplement fossil fuel-based generation could offer viable solutions for electricity cost reduction, while maintaining or improving the reliability of electricity delivery for the region.

The tool developed under this Research Call should be expandable to include additional analysis capabilities for grid-connected applications, AC/DC hybrid architectures, and system transient dynamics for microgrid survivability (as described in Recommendation 2 of the previously referenced scoping study report). Although these additional capabilities are outside the scope of this Research Call, the framework of the tool must be able to accommodate their future integration as add-on modules.

At a minimum, the microgrid design decision support tool developed under this Research Call must be capable of meeting the performance specifications described in Table 1 on the following page. Each proposal must adequately describe how each performance specification will be addressed and met; and explain associated assumptions, limitations, and outcomes. Additionally, tools proposed for development under this Call should incorporate the supplemental technical characteristics and desirable features presented in Appendix A.

² DC Microgrids Scoping Study to Estimate Technical and Economic Benefits, January 29, 2015 [Online]. Available: <http://www.energy.gov/oe/downloads/dc-microgrids-scoping-study-estimate-technical-and-economic-benefits-march-2015>

Table 1. Performance Specifications for the Microgrid Design Support Tool

Microgrid architectures considered	AC and DC: Simultaneous simulation of these architectures is not required. The two architectures may be designed independently, and if so, selection options must be made between them.
Design and operations objective functions	Objective function should be user selectable with the following options: <ol style="list-style-type: none"> 1. Minimize capital cost. 2. Maximize NPV where the user specifies the investment time horizon and discount rate.
Operational constraints	Microgrid operations should ensure that: <ol style="list-style-type: none"> 1. Fuel sources (diesel, propane, etc.) for distributed generators that are part of the microgrid design will not be depleted until the next delivery. 2. Balancing reserve adequacy is maintained to account for fluctuations and changes of load and renewable energy generation at an appropriate time step to be specified in each proposal, along with justifications.
Energy system security	Energy system security, as described below, must be met: <ol style="list-style-type: none"> 1. All load is served when all microgrid power system components are functioning normally, and 2. All user-defined critical load is served, even after the loss of any single microgrid power system component (N-1 security), when the microgrid behavior is modeled as a sequence of steady states.
Approximations and relaxations	All approximations and relaxations are sufficient to understand the impacts on or limitations of the microgrid design.
Design sensitivity	The design tool will quantify the sensitivity of the objective value to any single change to generation and storage sizing in the investment design solution. Sensitivities will be computed under the same conditions and constraints as used to find the investment solution, except that the generation and storage capacities are no longer subject to optimization.
Power flow modeling	Modeling of power flow is required to properly assess the N-1 security criterion for all grid components, line congestion before or after a failure, voltage limits, and the reliability impact of power line failures.

In addition to addressing the performance specifications of Table 1 and the supplemental technical characteristics and desirable features described in Appendix A, proposals must include a preliminary test plan (up to 5 pages in length) and a transition plan (up to 3 pages in length) for Phase II. At a minimum, the test plan should contain ample discussion of the following elements:

- How the prototype tool will be tested, what combinations (number, type, capacity, etc.) of energy assets will be included in testing, and how the testing will encompass applications in a range of typical remote communities such as Arctic, High Plains, and Southwestern;

- What test data sets will be collected and how the data will be analyzed; and
- How the validity of the tool analysis outcome will be assessed.

The transition plan should encompass the following:

- Providing a user manual as a project deliverable,
- A description of planned training to instruct microgrid designers in use of the tool,
- Identification of at least one remote community for tool adoption, and
- A planned pathway to transition the tool into broader use by other remote communities.

D. APPLICATION EVALUATION

Applications submitted in response to this Research Call will be subject to an initial review followed by a comprehensive merit review. Initial review of applications will be conducted as specified in Section V. Applications that fail to pass the initial review will not be forwarded for merit review and will be eliminated from further consideration for funding under this Call.

The merit review involves a comprehensive evaluation of the information contained in the electronic application files submitted in response to this Research Call. Applications submitted in response to this funding opportunity will be evaluated and scored in accordance with the merit review criteria and the corresponding weighting factors listed with each criterion described in Section V.

SECTION II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

Since only DOE-sponsored National Laboratories (see below) are eligible to apply as primary recipients under this Research Call, the ensuing awards may be issued as a Field Work Proposal (FWP), an Inter Entity Work Order (IWO), Interagency Agreement (IA) or other allowable instrument deemed appropriate by the Government. All awards resulting from this Research Call will be processed through and administered by NETL.

B. ESTIMATED FUNDING

The DOE plans to provide approximately \$1.5 Million in FY 2015 for Phase I of projects selected under this announcement. An additional \$1 Million is expected to be available in FY 2016 for award of a single Phase II project. Funding for all awards and future budget periods is contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority. The Government reserves the right to fund, in whole or in part, any, all, or none of the proposals submitted in response to this Research Call and will award that number of instruments which serves the public purpose and is in the best interest of the Government.

C. EXPECTED NUMBER OF AWARDS

For Phase I, the DOE anticipates selecting up to 2 proposals for awards under this announcement. Furthermore, only one of the Phase I projects will be selected for continuation into Phase II. Down-selection of projects for Phase II will be accomplished through a competitive evaluation of the performance, progress, and results of the Phase I projects.

D. PROJECT TEAM REQUIREMENT AND ANTICIPATED AWARD SIZE

The amount of funding planned for awards resulting from this Research Call is as follows:

Phase I: up to \$750,000 per award

Phase II: up to \$1,000,000 per award

A multi-institutional project team is required, and must be documented with formal letters of commitment provided as part of the initial application for this Research Call. At a minimum, each application submitted for consideration under this Research Call must include collaboration with an additional research institution (such as another national laboratory or a university), a commercial entity (preferably energy sector stakeholders, such as but not limited to, suppliers and integrators of energy delivery control systems and components, load serving entities, or energy asset owners and operators), and a governing entity for the proposed remote community(ies).

E. PERFORMANCE PERIOD

Projects submitted for consideration under this Research Call are expected to consist of a total performance period of up to 2 years. Projects must be divided into 2 phases (budget periods) as follows:

Phase I: not to exceed 12 months.

Phase II: not to exceed 12 months; including a minimum 6-month testing period of the prototype tool followed by transitioning the tool for implementation by at least one microgrid designer for remote community(ies).

Based on progress/results during Phase I, a decision will be made by the DOE regarding continuation, redirection, or termination of the selected projects.

F. TYPE OF PROPOSAL

The DOE will accept only new applications under this announcement. Applicants should organize proposed work and associated budget estimates into two periods of performance that clearly define an R&D segment (Phase I) and a testing/transition period (Phase II) as described elsewhere in this Research Call. Refer to Section IV for discussions on the level of detail required for describing the proposed work and corresponding budget estimate.

SECTION III – ELIGIBILITY INFORMATION

Only DOE Government-Operated Government-Owned (GOGOs) and Contractor-Operated Government-Owned (COGOs) national laboratories are eligible to apply as primary recipient. Multi-institutional collaboration is required. At a minimum, each proposal must include an additional research institution (such as another national laboratory, or a university), a commercialization entity, and a governing entity for a remote community.

Non-DOE Federally Funded Research and Development Centers (FFRDCs) and non-DOE GOGOs may participate as a sub-recipient, but are not eligible to apply for funding as a primary recipient.

Federal agencies and instrumentalities (other than DOE) are also eligible to participate as a sub-recipient, but are not eligible to apply for funding as a prime recipient.

Letters of commitment (collaboration) must be provided by all prospective team members as part of the initial application.

SECTION IV – APPLICATION CONTENT AND SUBMISSION REQUIREMENTS

A. SUBMISSION INSTRUCTIONS

Proposals shall be submitted electronically as attachments to messages sent to the following e-mail address: ROMDSTLabCall@netl.doe.gov

Questions pertaining to this announcement shall be submitted via this e-mail address.

Applications **MUST** be received by ***June 30, 2015***, not later than ***3:00:00 PM Eastern Time***. You are encouraged to transmit your application well before the deadline.

It is strongly recommended that application submission begin well in advance (at least 48 hours) of the closing of this Research Call.

APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR FUNDING UNDER THIS RESEARCH CALL.

Due to recently imposed constraints regarding the size of e-mail messages and attachments, please ensure that the total size of e-mails (including attachments) is less than 25 Megabytes. Applicants are encouraged to request a return notification to verify delivery of a proposal.

Except for the detailed budget justification (which may be submitted in .xls or .xlsx format), files that are attached to the e-mail must be in Adobe Portable Document Format (PDF). The proposal (including the abstract, project narrative, resumes and commitment letters) should be saved as a single PDF file using the following file name format: “RC-ROMDST-2015*Proposal*LabName*PIname.pdf”, for example:

“RC-ROMDST-2015*Proposal*NETL*Sciulli.pdf”.

The budget justification file should use the same naming convention, as shown by the example:

“RC-ROMDST-2015*Budget*NETL*Sciulli.xlsx”.

Note: *A spreadsheet template will be provided for use by applicants in preparing the budget justification.*

B. APPLICATION CONTENT

Proposals submitted in response to this Research Call shall not exceed 30 pages , including cover page, table of contents, charts, graphs, maps, photographs, tables, and other pictorial presentations, etc. when printed {single spaced} using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right). The font type must be legible and not smaller than 11 point. EVALUATORS WILL ONLY REVIEW THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE. Therefore, proposals exceeding the prescribed page limit will likely receive a lower overall score.

Do not include Internet addresses (URLs) to provide information necessary to review the application, because evaluators will not access the websites and the information contained therein will not be reviewed.

The preliminary test plan (up to 5 pages in length) and a transition plan (up to 3 pages in length), as previously discussed in Section I.C, are included in the total number of pages specified. The resume(s) of key personnel and letters of commitment may be excluded from the total number of allowed pages.

In order to produce a comprehensive proposal for this Research Call, applicants shall address, at a minimum, the areas discussed below.

- 1. Project Summary/Abstract** - must contain a summary of the proposed activity, and be suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project (including methods to be employed), the potential impact of the project (i.e., benefits, outcomes), and sub-recipients/major participants and/or collaborators. The abstract must not include any proprietary or business sensitive information as the DOE may make the document available (in whole or in part) to the public after proposals are selected for funding. The project summary must not exceed 1 page when printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right) {single spaced} with legible font not smaller than 11 point.
- 2. Project Narrative** - This section should include adequate technical background and details so that reviewers will be able to evaluate the application in accordance with the merit review criteria included in Section V.B of this Research Call. In addition, applicants should provide a comparison of the current state of the art to the proposed approach and, as appropriate, briefly discuss previous funding levels and what has been accomplished to date.

The project narrative is to be prepared according to the following outline (format), and (at minimum) should include the following elements:

- **Project Objectives:** This section should provide a clear, concise statement of the specific objectives/aims of the proposed project.
- **Relevance and Outcomes/Impacts:** This section should explain the relevance of the effort to the objectives in the announcement and the expected outcomes and/or impacts.
- **Merit Review Criterion Discussion:** This section should be formatted to address each of the merit review criterion and sub-criterion listed in Section V.B, including the criteria and sub-criteria of the Test and Transition plans. The discussion should provide sufficient information so that reviewers will be able to evaluate the application in accordance with these merit review criteria. The DOE WILL EVALUATE AND CONSIDER ONLY THOSE APPLICATIONS THAT ADDRESS SEPARATELY EACH OF THE MERIT REVIEW CRITERION AND SUB-CRITERION. Applications that avoid substantial discussion of the requisite criteria, and instead reference information in other publications and attachments outside the Project Narrative, will be judged nonresponsive to the criterion.
- **Preliminary Test Plan -** This section should fully describe all key elements of how the performance of the proposed microgrid design support tool will be evaluated. The plan must not exceed 5 pages, and must be included within the 30-page limit for the proposal.
- **Transition Plan -** This section should fully describe how the proposed microgrid design support tool will be transitioned (in the short term) for application by other remote communities, and subsequent deployment to other areas. The plan must not exceed 3 pages (included within the 30-page limit for the proposal).
- **Roles of Participants -** Briefly describe the roles and the work to be performed by each participant/team member and how these efforts will be integrated, coordinated and managed.
- **Project Performance Site -** Indicate the primary site where the work will be performed, and identify other sites that may be involved in the project.
- **Equipment and Other Resources -** Provide a brief summary of major equipment planned to be acquired, and other resources available for use by the proposed project. For purposes of this Research Call, “major” means having a fair market value in excess of \$5,000.
- **Field Work Proposal (FWP) / Statement of Project Objectives (SOPO) -** The FWP/SOPO is generally not more than 5 pages in total for the proposed work, and must be included within the 30-page limit for the proposal. The FWP/SOPO must contain a clear, concise description of all activities to be completed during the project and should follow the outline discussed below. **Since the SOPO may be released to the public (in whole or in part) by the DOE after award, it shall not contain proprietary, confidential or business sensitive information.**
 - **TITLE OF WORK TO BE PERFORMED**
Insert the title of work to be performed. Be concise and descriptive.
 - **OBJECTIVES**
Include a paragraph on the overall objective(s) of the proposed project. Also, include objective(s) for each major phase of planned work.

- **SCOPE OF WORK**
This section should not exceed one-half page and should summarize the effort and approach to achieve the project objective(s).
- **TASKS TO BE PERFORMED**
Tasks, concisely written, should be provided in a logical sequence and should be grouped into the phases of the project, as appropriate.
- **DELIVERABLES**
The periodic, topical, and final reports shall be submitted in accordance with the context of this announcement. During the project, Progress Reports shall be submitted to the Project Officer within 15 days of the end of a calendar Quarter. In addition, a report discussing results, progress and the “transition plan” is due within 30 days of the end of Phase I.
- **MILESTONES**
Provide a timeline and milestones for the project that include a title and planned completion date. Milestones should be quantitative and show progress toward achievement of project goals.
Note: During the course of the project, the Recipient will report the Milestone Status as part of the required quarterly Progress Report. The Milestone Status will present actual performance in comparison with the Milestone Log, and include:
 - (1) the actual status and progress of the project,
 - (2) specific progress made toward achieving the project's milestones, and
 - (3) any proposed changes in the project's schedule required to complete milestones.
- **BRIEFINGS and TECHNICAL PRESENTATIONS**
A detailed briefing shall be prepared for presentation to the Project Officer, Program Manager and other DOE stakeholders at the Project Officer’s facility located in Pittsburgh, PA or Morgantown, WV; at the DOE facility in Washington, DC, or other mutually agreeable location. This briefing will likely take place shortly following submission of the Phase I report, and should be used to explain progress and results of the technical effort to that point, and the plans for testing and transitioning the microgrid design support tool to a broader audience of remote communities. Projects selected for Phase II will also be required to submit a “final technical report” at the end of the effort.

3. Detailed Budget Breakdown - Justify the costs proposed in each Object Class Category/Cost Classification category (e.g., identify key persons and personnel categories and the estimated costs for each person or category; provide a list of equipment and cost of each item; identify proposed subaward/consultant work and cost of each subaward/consultant; describe purpose of proposed travel, number of travelers, and number of travel days; list general categories of supplies and amount for each category; and provide any other information you wish to support your budget). Costs must be allowable, allocable, and reasonable in accordance with the applicable Federal cost principles. Applicants shall use the modified Detailed Budget Justification form (Attachment 1) provided with this announcement. Save the information in a single file as described in Section IV.A and submit with the proposal.

4. Resume(s) - Provide a resume for each key person proposed, including sub-awardees and consultants if they meet the definition of key person. A key person is any individual who contributes in a substantive, measurable way to the execution of the project. Each resume must not exceed 2 pages when printed on 8.5" by 11" paper with 1" margins (top, bottom, left, and right) with legible font not smaller than 11 point, and should include the following information, if applicable:

Education and Training: Undergraduate, graduate and postdoctoral training, including institution, major/area, degree and year.

Professional Experience: Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications: Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights and software systems developed may be provided in addition to or instead of publications.

Synergistic Activities: List no more than 5 professional and scholarly activities related to the effort proposed.

5. Letters of Commitment/Collaboration - Applicants shall provide a Commitment Letter from each entity participating in the proposed project.

SECTION V – EVALUATION AND SELECTION

A. INITIAL REVIEW CRITERIA

Prior to a comprehensive merit evaluation, DOE will perform an initial review to determine that an applicant is (1) eligible for an award; (2) the information required by the Research Call has been submitted; (3) all mandatory requirements are satisfied; and (4) the proposed project is responsive to the objectives of the Call. Proposals that do not meet the initial criteria may be excluded from further review and consideration for award.

B. MERIT REVIEW CRITERIA

Proposals submitted in response to this Research Call will be evaluated and scored in accordance with the criteria and weights listed in the following criterion descriptions:

Criterion 1: Technical Approach and Project Management (45%)

This criterion will evaluate the approach taken by the applicant and the degree to which the proposed solution meets the stated objectives of this Research Call.

- Feasibility that the proposed solution will address the defined need or problem. To what extent is the proposed approach logical and feasible to meet the stated objectives?

- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit of the proposed approach. To what extent does the proposed approach employ innovative concepts or methods?
- Is the test plan suitable to support validation of the tool performance?
- Reasonableness and completeness of the proposed FWP/SOPO to achieve planned milestones and measure success.
- Adequacy, appropriateness, and reasonableness of the budget. This includes the labor distribution, purchases, and effort by work breakdown budget structure to accomplish the stated objectives.
- Degree to which the applicant demonstrates sound management principles, and plans for project oversight so as to achieve the project objectives on time and within budget.
- Soundness and effectiveness of the plan to transition the developed tool into broad use.

Criterion 2: Significance and Impact (40%)

This criterion will evaluate the degree to which the proposed solution/approach will impact/enable future microgrid designs/deployments.

- Significance of the proposed tool compared with current practices, in terms of both anticipated cost savings and performance improvements.
- How does the proposed solution compare with other developments for the same target applications, in terms of scientific merit and originality?
- Extent to which the proposed effort meets a gap in the state-of-the art of similar solutions/approaches. Completeness and soundness of the discussion regarding related technologies or techniques already available to, or being developed by, the private sector, how the proposed activity differs, and how the proposed activity requires research appropriate to a national laboratory role.
- Degree to which the proposed tool is broadly applicable and adaptable for designing remote off-grid microgrids.

Criterion 3: Collaboration (15%)

This criterion will evaluate the suitability and effectiveness of the proposed multi-institutional collaboration.

- Reasonableness of the proposed approach to provide a viable pathway for industry acceptance and commercialization.
- Effectiveness of the strategic approach, including reasonableness and clarity of roles and responsibilities, to manage the proposed partnership. To what extent does the project team bring together the resources of several institutions in a coordinated, complementary way to accomplish the proposed research?
- Extent to which the approach optimizes use of team members' unique expertise/experience, facilities, resources and capabilities.
- Degree of collaboration on the proposed project as demonstrated by letters of commitment from proposed team members.

Program Policy Factors

The following Program Policy Factors may be used by the Selection Official to assist in determining which of the ranked applications shall receive DOE funding support:

1. It may be desirable to select project(s) with to balance collaborative efforts among DOE national laboratories.
2. It may be desirable to select project(s) that demonstrate a developed solution will be made available through open source at no cost.
3. It may be desirable to select project(s) that demonstrate solutions that are scalable and cost-effective with a clear industry acceptance for commercialization.
4. It may be desirable to select project(s) that include a large community of microgrid researchers in national laboratories, universities, and industry.
5. It may be desirable to select projects that have two or more remote communities participating as team members.

C. SUBMISSIONS FROM SUCCESSFUL OFFERORS

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information;
- Other budget information;
- Name and contact information of the Applicant's Contracting Officer.
- Other supporting documentations

SECTION VI – AWARD ADMINISTRATION AND OTHER INFORMATION

A. MODIFICATIONS

Notices of any modifications to this Research Call will be sent via e-mail directly to the DOE National Laboratories. The e-mail will contain a web link to the appropriate page on the NETL and OE websites where the modified version of the Research call can be found.

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

The DOE reserves the right, without qualification, to reject any or all proposals received in response to this announcement and to select any proposal, in whole or in part, as a basis for negotiation and/or award.

C. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. Applicants, by submitting proposals, consent to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing a proposal. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

D. NOTICE REGARDING ELIGIBLE/INELIGIBLE ACTIVITIES

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

E. AWARD NOTICES

1. **Notice of Selection** - The DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance. Pre-award costs are not authorized for projects selected from this announcement.
2. **Non-selected Notification** - Organizations whose applications have not been selected will be advised as promptly as possible.
3. **Notice of Award** – For this Research Call, an FWP, IWO or other appropriate instrument issued by the contracting officer is the authorizing award document. It normally includes either as an attachment or by reference: (1) Special Terms and Conditions; (2) Applicable program regulations, if any; (3) Application as approved by the DOE; (4) applicable DOE assistance regulations; (5) National Policy Assurances To Be Incorporated As Award Terms; (6) Budget Summary; and (7) Federal Assistance Reporting Checklist, which identifies the reporting requirements.

Appendix A

AC and DC Microgrid Design Support Tool— Supplemental Technical Characteristics and Desirable Features

General Specifications	
Modeling time horizon	User selectable, but time horizons of 20 years are expected
Component resolution and/or subsystem disaggregation	<p>It is expected that resolving the differences between AC and DC architectures or resolving investment options within a given architecture will require disaggregated modeling of subsystems that are typically modeled in aggregate</p> <p>Examples: <u>AC-coupled PV</u> = (panels+MPPT) + DC-AC inverter <u>DC-coupled PV</u> = (panels+MPPT) + DC-DC converter <u>AC-coupled synch. machine</u> = synch machine + transformer <u>DC-coupled rotating machine</u> = rot. machine + AC-DC rectifier <u>AC load</u> = AC load <u>Direct-DC load</u> = DC-DC converter (if needed) + DC load <u>Internal-DC load</u> = AC-DC rectifier + DC load</p>
Power flow	Modeling of power flow is desirable to accurately assess the reliability impact of power line failures and for the inclusion of line losses (AC and DC) and transformer losses (AC)

Design/Simulation Inputs	
Delivered fuel costs	Diesel and propane are expected fuels
Renewable resource availability	PV-(W/m ²); Wind-(m/s)—desirable to have user-specified and default inputs for different regions
Generation efficiency curves	Desirable to have user-specified and default efficiency curves
Power electronics efficiency curves	DC-AC inverters, AC-DC rectifiers, and DC-DC converters; Desirable to have user-specified and default curves for high power and low power devices
Electrical network	User-specified, but network design is desirable; Use of standard power flow solver formats is preferred
Device capital costs	Desirable to include user specified and default values

Design/Simulation Outputs	
Generation type and sizing	Number and size of each type of generation and storage
Electrical network design	In the absence of a user-specified network, network design is desirable, including topology, line impedance, line capacities, and switch locations; Issues such as protection, detailed line configuration, etc. are beyond the scope of this tool

Fossil Generation		
Generation types	Internal combustion	Fuel types: Diesel and propane
	Micro-turbine	Fuel types: Propane
	Fuel cell	Fuel types: Propane
Suggested generator technical characteristics considered in the design	<ol style="list-style-type: none"> 1. Design by total capacity and unit size 2. Part load efficiency 3. Real power limits (max/min) 4. Reactive/Apparent power limits 5. Ramping limitations 6. Disaggregated modeling to capture power electronics (if used) part-load efficiency 	
Additional fuel characteristics	Desirable to account for fuel storage and delivery schedule	

Combined Heat and Power (CHP)	
CHP types	Same as Fossil Generation
Suggested generator technical characteristics considered in the design	Same as Fossil Generation + Heat recovery efficiency
Additional fuel characteristics	Same as Fossil Generation

Intermittent Renewable Generation	
Generation types	Photovoltaic, Wind
Suggested generator technical characteristics considered in the design	<ol style="list-style-type: none"> 1. Use realistic conversion curves (PV: $W/m^2 \rightarrow W_e$; Wind m/s at hub height $\rightarrow W_e$) 2. Ability to reduce/control real power output 3. Reactive power control 4. Apparent power limits 5. Ramping limits—when controlled 6. Disaggregated modeling to capture power electronics part-load efficiency

Other Generation	
Generation types	Geothermal steam plants, Small hydro
Suggested generator technical characteristics considered in the design	<ol style="list-style-type: none"> 1. Design by total capacity 2. Use of realistic conversion curves 3. Real power limits (max/min) 4. Reactive/Apparent power limits 5. Ramping limitations 6. Power electronics (if used) part-load efficiency 7. Monthly/seasonal availability

Energy Storage		
Storage types	Batteries and capacitors	
Suggested storage technical characteristics considered in the design	<ol style="list-style-type: none"> Usable energy storage Max charge rate Max discharge rate Cycles/lifetime Charge/Discharge efficiency Parasitic losses (e.g., heaters for Na-S, climate control for Li-ion, Pb-acid) Disaggregated modeling to capture power electronics part-load efficiency 	It is desirable for the design tool to distinguish between different available battery chemistries and capacitor types, i.e., costs and operational characteristics

Electrical Loads		
Types	AC loads	
	Direct-DC loads	Disaggregate to DC-DC converter (as needed) + DC load
	Internal-DC load	Disaggregate to AC-DC rectifier + DC load
Load curves	Desirable to allow user-specified and include default curves for common systems, e.g., residential homes, small/large commercial, etc.	

Thermal Loads	
Load curves	Desirable to allow user-specified and include default curves for common systems, e.g., residential homes, small/large commercial, etc.

Additional Desirable Microgrid Operational Constraints	
Forecast error	<ol style="list-style-type: none"> Short-term renewable generation Short-term load
Dynamic security	<ol style="list-style-type: none"> Small signal stability Transient stability

Additional Desirable Microgrid Planning Requirements	
Load growth	Capable to design for load growth/decline
Component replacement	Capable of planning for replacement by tracking use-dependent or time-dependent component lifetime
Technology changes	Replacement strategy should account for technology improvements

Suggested Documentation	
The mathematical formulation of the entire design/optimization formulation should be documented with plain English descriptions of all equations. The formulation may be simplified by various means, and these should be documented. For example:	
Quasi-steady security	Simplifications or operational assumptions should be documented via mathematical formulation
Statistical methods to replace direct simulation	Methods should be documented via mathematical formulation
Nonlinearities	Approximations and/or relaxations should be documented via mathematical formulation