DOCKETED

Docket Number:	16-EPIC-01
Project Title:	EPIC Idea Exchange
TN #:	219823
Document Title:	LLNL Response EPIC Request for Comments Modeling Tools RFC
Description:	N/A
Filer:	System
Organization:	Lawrence Livermore National Laboratory
Submitter Role:	Applicant
Submission Date:	6/21/2017 11:23:00 AM
Docketed Date:	6/21/2017

Comment Received From: Emma Mary Stewart
Submitted On: 6/21/2017
Docket Number: 16-EPIC-01

LLNL Response EPIC Request for Comments: Modeling Tools RFC

Additional submitted attachment is included below.

Title: EPIC Request for Comments: Modeling Tools RFC
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Date: June 20th 2017

Lawrence Livermore National Laboratory is pleased to submit this response to the request for comments for the draft solicitation entitled EPIC Request for Comments: Modeling Tools RFC

Background

The mission of Lawrence Livermore National Laboratory is, advancing our nation's security by innovating science and technology solutions to improve national energy security and surety while reducing environmental impact. Laboratory scientists and engineers are working nonstop to identify key elements, opportunities and challenges in an evolving energy landscape. This landscape includes:

- Increasing mandated reductions of greenhouse gases, which are causing the mix of energy sources to change rapidly.
- Adding significant amounts of intermittent renewable energy and loads, which creates new challenges in economics and in maintaining a reliable electric grid.
- Adapting Smart Grid technologies, which can help stabilize the electric grid in this new environment but which also brings problems such as cyber threats.
- Determining if unconventional oil and gas can be exploited in an environmentally sensitive manner.

Lawrence Livermore applies high-performance computing to solve challenges like these. But it's not just big computers that solve challenges; it's the people and the ecosystem surrounding those computers. Researchers start with a detailed understanding of the basic science, develop algorithms to explain that science, and turn these algorithms into simulations that run on the Laboratory's big computers. They validate these simulations with observations and experiments using state-of-the-art tools and multidisciplinary expertise. By leveraging these capabilities the Lab is able to produce innovative solutions, including:

- Technologies that enable expanded use of renewable energy, improved efficiency, new resources, systems integration, and reduced costs.
- Science, technology, and operational protocols that increase the use of the nation's large and secure reserves of conventional and unconventional fossil fuels while safely eliminating carbon dioxide emissions through innovations in carbon capture and long-term geologic sequestration.

Lawrence Livermore's goals are to provide science and technology solutions to:

- Secure Energy--Increase security and supply of U.S. energy resources, while minimizing environmental impacts and reducing costs.

- Reliable Delivery--Ensure secure, safe, and reliable delivery of U.S. energy resources across transmission and distribution networks.
- Climate Resilience--Predict and understand climate change security challenges and develop solutions for future adaptation.

The following responses are to the specific questions outlined in the RFC.

Question 1
Funding for Groups 1, 2 & 3 is adequate, but funding for group 4 could be considered
Group 4 focuses on specific development of a GUI for Gridlab-d. There are numerous instances of commercially utilized GUI's for this product and development of this, could be considered as part of the group 1 to 3 projects which will likely also develop open GUI products for the tools and interfaces. There are also alternate open source tools which could benefit from a GUI including EPRI's OpenDSS for distribution, DOE Grid Modernization Initiative's HELICS (https://github.com/GMLC-TDC/HELICS-src) and CyDER from LBNL. The funding level specified here could be split within the projects in Group 1 to 3 to create open interfaces to a selection of tools.

Question 2
In Group 1, the projects could consider a wide range of DER and distributed technologies in these tools, as opposed to specifically microgrid deployment. Microgrid deployment would need to consider complex business practices and ownership models, versus DER deployment. Optimal mixes of these resources should consider very short time frame events and distributed mitigation strategies and potentially realistic communications requirements in the cost profile. We suggest considering optimal mixes of technology versus specific microgrid specification.

Within Group 2, conversion tools from models often require specific changes to the software agreement. It is suggested that engagement from the 2 most common distribution planning tool vendors is encouraged, despite them not being based solely in California

Within Group 3 the description seems to suggest a only need for quasi static time series analysis and techniques, similar to that being pursued by Sunshot DOE. The CA Distribution Resources Planning Integrated Capacity Analysis (ICA) working group has identified several computational challenges on performing ICA - for example, 1) computational time required for each methodology is exacerbated by the number of feeders, feeder complexity, method used, and time to be simulated; 2) the ICA long term refinement report identifies the need of integrated transmission and distribution analysis. It is suggested that this group be expanded to consider specific T & D interaction to analyze many circuits simultaneously (even the entire IOU footprint distribution system), and synchronization in a common platform, with QSTS components, rather than development of this technique in isolation.

With respect to the HPC goals, GPUs are important, but only represent a subset of the architecture innovations either developed or emerging that could be applied in the grid area. For example, the use of manycore processors and/or solid state storage could be much more important to improving total time to solution than GPUs – this all depends on the problem to be solved. As such, need to allow the computational scientists to determine the best approach to speeding up the entire modeling workflow as opposed to prescribing specific architecture solutions.

Suggested Change:

- Speed up the overall simulation process of open-source modeling by enabling high-performance computing using multicore processors and exploring parallel processing coding to take advantage of the emerging power of graphics processing unit (GPU) accelerated computing.

To:

- Speed up open-source modeling and simulation using advances in high-performance computing by developing algorithms and software to take advantage of multicore processors, accelerators (e.g. graphics processing unit (GPU) and manycore accelerators), complex memory hierarchies, or other emerging computing architectures.

Question 3

Existing complementary efforts include for each group

Group 1

1) Grid Modernization Lab Consortium Project – 1.3.5 DER Siting and Optimization Tool for California
2) Sunshot DOE project CyDER (T (GridDyn) & D (CymDist) & DER tool with common application interface and GUI)
3) ARPA-E NODES Projects

Group 2

1) ARPA-E Grid Data project: GridBright development of a research data platform

Group 3)

1) Sunshot DOE project: **Rapid QSTS Simulations for High-Resolution Comprehensive Assessment of Distributed PV Impacts**
2) Sunshot DOE Project CyDER (referenced above)
3) Grid Modernization Lab Consortium Project - Integrated Transmission, Distribution and Communication tool development

Group 4)

1) ARPA-E Grid Data: BetterGrids Foundation Project http://www.bettergrids.org/about-2/

Question 4
GitHub would be adequate

Question 5

There is significant growing interest in the industry in the confluence of the data analytics and grid modeling industries, for example CyDER has developed an interface to CymDIST (used at both SCE & PG&E) to high fidelity measured data and a novel data analytics portal to validate and calibrate the models before deploying an automated run for thousands of power flow studies to evaluate the DER integration challenges and opportunities. The team would like to encourage the CEC to consider joint sensing, analytics and modeling projects for these particular activities. Model validation is a key limiter for many of the distribution analysis projects and projects which do not consider this issue are limited by the accuracy of their model inputs.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.