



**ARPA-E WORKSHOP: IMPROVED WIND AND SOLAR FORECAST ACCURACY THROUGH ADVANCED SENSORS, ALGORITHMS AND COMPUTATIONAL RESOURCES**

March 30, 2012, 8:00AM – 3:30PM  
 Offices of Booz Allen Hamilton  
 3811 N Fairfax Dr, 6<sup>th</sup> Floor  
 Arlington, VA 22203

This workshop will bring together thought leaders from distinct science, engineering, and commercial communities to collectively develop new ideas and identify key needs and potentially transformational technological approaches for enabling significant improvements in the accuracy of wind and solar forecasts on both a longer (days) and shorter (hours to minutes) schedule. Of particular interest will be methods of properly forecasting ramp events, the rapid change in output from wind and solar plants. The day’s events will include the opportunity for a wide-ranging discussion among experts within the forecasting community about research activities which could be transformative but are not currently being adequately pursued and funded. There will also be discussion of specific areas of interest:

- Can a radical decrease in the cost of sensing instrumentation and larger deployment lead to better forecasting results? If so, what paths, such as low-cost long-range LIDAR, are most promising towards that end? Are mobile sensor networks, possibly mounted on UAVs, which can dynamically go where the data is most needed, a promising approach?
- Can a massively parallel ensemble forecasting approach lead to probability distribution functions that are of use to grid operators when making decisions such as dynamically deploying balancing reserves? If so, what computational resources are best suited to the task: supercomputing facilities of the kind found at national labs, or commercial cloud computing resources? What capabilities must cloud computing demonstrate for this purpose?
- To what extent can machine learning algorithms which focus more on pattern recognition than underlying dynamics serve to complement physics-based models? Has the expertise and practices gained from other fields such as finance and high-speed trading been ported over to the field of forecasting?
- Can high time-resolution data on local irradiance values feed into predictive models to better understand solar power output and cloud formations? If so, can the rapid output (on a timescale of seconds) of solar photovoltaic panels across a geographic region be aggregated and analyzed to produce useful results? Is there a feasible, low-cost way to communicate this data?

Participants are invited to submit 1 powerpoint slide on any or all of the following topics prior to the workshop by emailing [philippe.larochelle@hq.doe.gov](mailto:philippe.larochelle@hq.doe.gov). Slides can also be brought on a USB storage device on the workshop day. There is a limit of 1 slide per topic. Time permitting these can be shown during the breakout sessions, or if not will be considered by ARPA-E after the workshop.

Topic 1 (Morning Breakout)	Topic 2 (Afternoon Breakout)	Topic 3 (Afternoon Breakout)
How much room is there for forecast improvement over the state of the art? What targets must a technology achieve to be impactful? Which are ARPA-E hard problems?	What are promising sensor advances for vastly increasing the amount of data available to the models? Which are ARPA-E hard problems?	What advances are possible in better computation resources, machine learning, and dynamic optimization and placement of mobile sensors? Which are ARPA-E hard problems?



<u>Time</u>	<u>Title</u>	<u>Speaker/Breakout Lead</u>	<u>Location</u>
7:30-8:00 AM	Breakfast and Registration	--	Booz Allen Lobby 6 <sup>th</sup> floor
8:00-8:10 AM	Welcome and Introduction to ARPA-E	<b>Karma Sawyer</b> Assistant Program Director, ARPA-E	Booz Allen Room
8:10-8:20 AM	Meeting Goals and Agenda	<b>Phil Larochelle</b> ORISE Researcher, ARPA-E	Booz Allen Room
8:20-8:30 AM	Wind Forecast Programs Currently at DOE	<b>Stan Calvert</b> Wind Systems Integration Lead, DOE	Booz Allen Room
8:30-8:40 AM	SunShot Forecasting RFI and Workshop	<b>Kevin Lynn</b> Solar Systems Integration Lead, DOE	Booz Allen Room
8:40-9:00 AM	Wind and Solar Forecasts Lessons Learned and Sensor Needs	<b>Jim Wilczak</b> Team Lead, NOAA	Booz Allen Room
9:00-9:20 AM	State of the Art Forecast Accuracy and Client Needs	<b>Justin Sharp</b> Founder, Sharply Focused Forecasting	Booz Allen Room
9:20-9:45 AM	Break		Hallway
9:45-11:45 AM	<b><u>Morning Breakout Sessions</u></b> Topics covered in both breakouts: How much room is there for forecast improvement over the state of the art? What targets must a technology achieve to be impactful? Which are ARPA-E hard problems?	<b>Phil Larochelle</b> ORISE Researcher, ARPA-E  <b>Tim Heidel</b> Fellow, ARPA-E	Booz Allen Room  Hamilton Room
11:45-12:15PM	<b>Lunch</b>		Hallway
12:15-12:30 PM	Lunchtime Remote Address High Assurance Cloud Computing	<b>Ken Birman</b> Professor, Cornell University	Booz Allen Room
12:30-12:40 PM	Second Wind Sensor Technologies	<b>Niels LaWhite</b> Chief Scientist, SecondWind	Booz Allen Room
12:45-1:00 PM	WindTracer LIDAR	<b>Mike Margulis</b> Program Director, Lockheed Martin	Booz Allen Room
1:00 – 1:15 PM	Autonomous Flying Vehicles and Sensor Measurements	<b>Vijay Kumar</b> Professor, University of Pennsylvania	Booz Allen Room
1:15-3:15 PM	<b><u>Afternoon Breakout Sessions</u></b>		
	What are promising sensor advances for vastly increasing the amount of data available to the models? Which are ARPA-E hard problems?	<b>Nick Cizek</b> Fellow, ARPA-E	Booz Allen Room
	What advances are possible in better computation resources, machine learning, and dynamic optimization and placement of mobile sensors? Which are ARPA-E hard problems?	<b>Tim Heidel</b> Fellow, ARPA-E	Hamilton Room
3:15-3:30 PM	Wrap up and closing remarks	<b>Phil Larochelle</b> ORISE Researcher, ARPA-E	Booz Allen Room
3:30 -5:00 PM	No Host Bar		TBD