

MOU Number: MOU-18-515

## MEMORANDUM OF UNDERSTANDING

Between

The National Renewable Energy Laboratory

And

University of Strathclyde

Glasgow, Scotland

For coordination on Research of Renewable Energy Resources with a focus on Wind Energy

### INTRODUCTION

The National Renewable Energy Laboratory (NREL), is a national laboratory managed and operated by the Alliance for Sustainable Energy, LLC for the United States Department of Energy (DOE) under Contract No. DE-AC36-08GO28308.

The University of Strathclyde (U. of Strathclyde) is a public research university and charitable body registered in Scotland with registration number SCO 15263 and having its Principal Office at 16 Richmond Street, Glasgow, G 1 1XQ, Scotland.

As part of its mission for DOE, NREL conducts research and development on energy efficiency and the production of renewable energy to bring clean, reliable and affordable energy technologies to the marketplace. NREL has active programs in solar energy, wind energy, ocean energy, biomass, geothermal energy, utility integration, transportation systems, and energy efficiency. NREL has conducted wind plant performance and operation and maintenance research in recent years. NREL has also focused on turbine reliability assessment from both physics and data domains, and analysis of gearbox component loads and stresses using multibody simulation software.

As part of its research and teaching strategy, the U. of Strathclyde has focused on wind energy research since the 1980s and has unique expertise and access to performance data on offshore wind systems. Since 2009 the Wind Energy and Control Centre at the U. of Strathclyde hosts upwards of 75 academics and researchers focusing on wind energy. The main focus has been with respect to wind energy controls, operation and maintenance, drivetrain analysis, wind and power forecasting, power networks, aerodynamic modelling and the U. of Strathclyde has become a credible hub in these areas globally.

NREL or U. of Strathclyde is each individually referred to as "Participant" and collectively as "Participants."

The U. of Strathclyde and NREL have conducted renewable energy research with a focus on wind energy for many years. They have cooperated informally by exchanging professionals and invitations to hosted events of mutual interest. In the past, the research goals of the Participants overlapped in areas such as wind turbine reliability and wind plant operation & maintenance, grid stability, economic and technical analysis. Continued research into all these areas is of mutual interest to the Participants.

The purpose of this MOU is to encourage coordination in areas of mutual interest and benefit the Participants. Based on the principles of equality and reciprocity, this MOU is intended to serve as a general framework for planned coordination between the two Participants and is intended to facilitate discussions for the development of a more specific planned program of research and development (R&D) collaboration. Any specific program of R&D collaboration or sharing of confidential information is to be implemented through an appropriate written agreement between the Participants.

### **Section 1: Areas of Coordination and Collaboration**

1. The coordination activities planned under this MOU, and the programs of collaboration contemplated in furtherance of, are focused on cooperation to maximize the benefit of each Participant's respective institutional interests, which may include an increased understanding of following selected topics:
  - Reliability data collection and analysis
  - Wind plant operations & maintenance
  - Energy meteorology and resource assessment
  - Electrical grids
  - Energy economics and system design
  - Other related topics as parties mutually agree

Specifically, for 2019, a scholar from U. of Strathclyde intends to visit NREL investigating oil and wear debris analysis-based gearbox failure prediction methodologies. In addition, a joint publication between both parties on gearbox fault diagnostics and prognostics is intended. For 2020, U. of Strathclyde intends to invite an NREL Principal Investigator as an external Ph.D. thesis examiner. Also a collaboration on gearbox fault diagnostics and prognostics is intended as a post-doc project after the defense. This collaboration is intended to provide NREL access to relevant research including gearbox failure records and SCADA data and condition monitoring system data managed by the U. of Strathclyde. Almost all of these data are from a novel gearbox configuration, i.e. double planetary stages and single helical stage, typical in offshore applications but not yet studied by DOE, NREL, or the U.S. wind industry. These activities are intended to help advance DOE and NREL's wind reliability and O&M research, enable DOE and NREL and others in the U.S. to access offshore wind assets. This leverages research experiences in Europe, avoids potential pitfalls, speeds up the development of U.S. offshore wind industry and improves its competitiveness through R&D.

### **Section 2: Forms of Coordination**

Planned coordination under this MOU may include:

1. Exchange of published scientific and technical information, publications, and reports; and explore joint publications;
2. Meetings organized to discuss specific topics identified in Section 1, including conferences, seminars, and workshops;
3. Exchange of scientists, engineers, and other specialists for participation in workshops, conferences, seminars, working sessions, and model-development activities. Each Participant should abide by the health, safety, and environmental requirements of the host Participant when on an exchange assignment at the host Participant's facility.

### **Section 3: Funding**

1. The scope of coordination activities under this MOU should be mutually determined in light of time, resources and/or funds available at both institutions for the types of coordination undertaken and by such other financial assistance as may be obtained by either Participant from external sources.
2. Unless the Participants otherwise determine in a separate written agreement, each Participant is to be responsible for the costs it incurs in participating in the coordination contemplated by this MOU, including all administrative costs, overhead expenses, labor costs, insurance costs, travel expenses and similar costs.

### **Section 4: Researcher Exchanges**

1. Each Participant retains responsibility for its own personnel in relation to researcher exchanges to carry out coordination under this MOU.
2. Each Participant's personnel should abide by the regulations, policies, and procedures of the host Participant in carrying out activities under this MOU, including protection of business proprietary information, protection of intellectual property, compliance with export control laws and regulations, conditions of coordination and decorum, health, safety, and security requirements, and all other terms under which personnel are authorized to participate in researcher exchanges at the host Participant's facility. Such activities may require entry into separate written agreements.
3. Each Participant is to be solely responsible for its own personnel in relation to matters such as visa and travel formalities, appropriate insurance (medical insurance and medical evacuation and repatriation insurance), travel expenses, and suitable living accommodation and expenses.
4. To the extent possible, the host Participant should assist in facilitating travel arrangements of the other Participant's personnel in relation to researcher exchanges in accordance with its applicable procedures governing foreign national access to the host Participant's facility.

### **Section 5: Dissemination and Use of Information**

Each Participant intends to participate in the coordination in a manner that facilitates exchanges of publicly available, non-proprietary business information. Subject to applicable laws and regulations of its country, each Participant may disseminate information, data, and reports of the coordination carried out under this MOU.

Any information transmitted by one Participant to the other Participant under this MOU should be accurate to the best knowledge and belief of the transmitting Participant.

### **Section 7: Intellectual Property**

The Participants do not anticipate the transfer of rights in intellectual property or the sharing of confidential information to occur under any planned coordination activity under this MOU.

## **Section 8: Future Collaborations**

Any specific future research and development collaboration or the transfer or commitment of funds is to be implemented through an appropriate written agreement between the Participants. Any such agreement should include a work plan, staffing requirements, cost estimates, funding sources, the adequate and effective protection and allocation of intellectual property rights, and other arrangements or conditions; and is to be authorized under NREL's Management and Operating Contract.

## **Section 9: Review of Coordination**

The Participants intend to review the coordination undertaken under this MOU as a means to ascertain its effectiveness, document achievements and lessons learned, recognize technical personnel, and identify and plan areas for potential future collaboration that involves the conduct of research and development. This review should take the form of periodic meetings of representatives of each Participant to discuss ongoing coordination and to identify and plan future collaboration that involves the conduct of research and development activities.

## **Section 10: Contacts**

One or more designated representatives from each Participant should oversee, manage and facilitate implementation of this MOU in cooperation with each other on behalf of their respective institutions. All notices, communications and coordination should involve, at a minimum, the following individuals, their successors and/or designees as follows:

(a) For the National Renewable Energy Laboratory:

Shawn Sheng  
National Wind Technology Center  
15013 Denver West Parkway  
Golden, CO 80401  
Tel: 1 303 384-7106  
Shuangwen.sheng@nrel.gov

b) For U. of Strathclyde:

James Carroll, (Lecturer/Assistant Professor)  
Room 336,  
Royal College Building,  
204 George Street,  
Glasgow, G1 1XW  
j.carroll@strath.ac.uk


## **Section 11: General Considerations**

1. This MOU is not intended to create any legally binding obligations between the Participants.
2. Each Participant should conduct the coordination contemplated by this MOU in accordance with applicable laws and regulations to which it is subject and international agreements to which its government is party.

## Section 12: Commencement, Modification and Discontinuation

1. Coordination under this MOU may commence upon signature, and may continue for a period of two (2) years, unless discontinued in accordance with paragraph 3 of this section.
2. The Participants may modify this MOU at any time by mutual consent in writing.
3. The Participants may discontinue coordination under this MOU at any time by mutual consent in writing. Alternatively, a Participant that desires to discontinue its participation in this MOU should endeavor to provide the other Participant at least 90 days advance written notice.

For  
The National Renewable Energy  
Laboratory

  
Johny B. Green, Jr.  
(Printed name of signatory)


Associate Laboratory Director  
Title

18 July 2019

Date

Golden Colorado  
Place

For  
U. of Strathclyde

  
Miss M. McNamee  
(Printed name of signatory)  
Director  
Research & Knowledge  
Exchange Services

Title

Date

Place

23 May 2019

Glasgow