

Final Technical Progress Report

Project Title: Wind Energy Science, Technology and Research Consortium: Curriculum Workforce Development and Education Plan

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Recipient: University of Massachusetts Amherst

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Contacts: James Manwell, Principal Investigator, 413-577-1249,
manwell@ecs.umass.edu
Theresa Girardi, Grant & Contract Administration, 413-545-0698,
twg@research.umass.edu

DOE Project Team: DOE HQ Program Manager – Jose Zayas
DOE Field Contract Officer – Jane Aanders
DOE Field Contract Specialist – Jane Sanders
DOE Field Project Officer – Debbie Schultheis
DOE/ CNJV Project Monitor – Martha Amador

Project Objective: Establishment of the American Academy of Wind Energy (AAWE), including development of curriculum components and solicitation of charter members.

The purpose of the project is to modify and expand the current wind energy curriculum at the University of Massachusetts Amherst and to develop plans to expand the graduate program to a national scale. The expansion plans include the foundational steps to establish the American Academy of Wind Energy (AAWE). The AAWE is intended to be a cooperative organization of wind energy research, development, and deployment institutes and universities across North America, whose mission will be to develop and execute joint RD&D projects and to organize high-level science and education in wind energy.

Background: The American Academy of Wind Energy will be a cooperative organization of wind energy research, development and deployment (RD&D) institutes and universities across North America, whose mission will be to develop and execute joint RD&D projects and to organize high-level science and education in wind energy. The AAWE was inspired by a corresponding organization in Europe, the European Academy

of Wind Energy (EAWE). The EAWE has proven to be extremely effective at promoting educational and research activities across members. The AAWE will take the best aspects of the European equivalent, and customize the activities for the U.S. The design, development, establishment, and initial maintenance of the Academy will take place over a two-year period, as campuses join the Academy and contribute to the structure.

Status: The work carried out during this the period of this contract was directed toward the following tasks:

Subtask 1.1: Development and Release of a Revised Version of the MIE 573 Wind Energy Engineering Course:

The wind energy engineering course, MIE 573 "Engineering Wind Power Systems", was reformatted to be deliverable on-line and first piloted in the summer of 2011. Evaluation of the pilot version of the course also took place in August of 2011. As a result of the favorable results from the evaluation, we undertook an investigation of how to offer the course on a more regular basis. As a result of that investigation, we arranged with the UMass Amherst Continuing and Professional Education Program to assist in offering the course on a regular basis. At the present time, we are now offering the on-line version of MIE 573 twice per year. Both for-credit and not-for-credit options are available. Altogether, the course has been offered four times so far. Information about the course as it is available this semester (spring, 2013) may be found here: <http://www.umassulearn.net/classes/spring-2013/online?view=class&cid=10588>. A typical syllabus for this course is included in an appendix to this report.

Subtask 1.2: Development and Release of a For-Credit Certificate Program in Wind Energy Engineering at the Graduate Level:

A certificate program in wind energy engineering has been developed and approved by the University of Massachusetts administration. The Wind Energy Certificate comprises 15 graduate credits corresponding to five courses which deal directly with or are relevant to wind energy. There are three required core courses. Two of them are MIE 573: "Engineering Wind Power Systems" and MIE 673: "Wind Turbine Design." The final core course can be chosen from MIE 607: "Advanced Fluid Mechanics I," MIE 597F: "Fluid-Structure Interaction," or MIE 674: "Offshore Wind Energy Engineering." The remaining courses can be any graduate level course that has a direct relevance to wind energy, including: fluid dynamics, controls, fluid structure interaction, and energy economics. The certificate was first offered in the fall semester, 2011. The 15 credits may also be applied to the 30 credit requirement for an M.S. degree in Mechanical Engineering. More details on the certificate program are available here: <http://www.umass.edu/windenergy/study.graduatecertificate.php>

Subtask 1.3: Development of a Plan for a Comprehensive Series of For-Credit Professional Short-Courses in Wind Energy Field Engineering.

Under this sub-task we developed a plan to offer a comprehensive series of short courses in the field of wind energy field engineering. The plan called for five short courses: 1) Installing Wind Data Meteorological Towers, 2) Wind Data Instrumentation, Data Collection, and Reporting, 3) Wind Data Quality Assurance Methods and Long Term Extrapolation, 4) Wind Data Collection Using Remote Data Collection: LIDAR and SODAR, 5) Wind Site Selection and Performance Estimation Processes. In accordance with this plan we arranged with the UMass Amherst Continuing and Professional Education Program to offer these five courses (see flyer which accompanies this report). There was sufficient enrollment for one of these courses (Wind Data Instrumentation, Data Collection, and Reporting) and it was taught in the fall of 2010. In addition, a detailed outline was prepared and course material was assembled for Installing Wind Data Meteorological Towers in anticipation of its being taught in the spring of 2011. Syllabi were also prepared for the other courses. Due to lack of enrollment, the Installing Wind Data Meteorological Towers course was cancelled, and work on the other courses was stopped. A review of the concept of professional level courses indicated that the structure was not as attractive as that of the regular wind energy engineering course, MIE 573, which was converted successfully into an on-line format (see Subtask 1.1 above). Accordingly, we do not intend to pursue the professional level option any further at this time. On the other hand, it does appear worthwhile to consider converting our other, regularly offered wind courses, Wind Turbine Design and Offshore Wind Energy into on-line courses. That is an option we are continuing to pursue.

Subtask 2.1: Development of the Educational Structure of the AAWE.

Subtask 2.2: Development of the Organizational Structure of the AAWE.

Subtask 2.3: Identification of Potential Members of the AAWE.

Considerable effort was dedicated to establishing the American Academy of Wind Energy. This involved developing the educational structure, the organizational structure, and identification of potential members. Since all three of these sub-tasks were highly interconnected, the following provides a summary of all those tasks together.

Over the course of the project the concept of an academy of wind energy generated a great deal of interest nationally, with the result that a number of universities and national laboratories joined in the effort. During this period, it was also decided to change the name to the North American Wind Energy Academy (NAWEA). In the following, the acronym NAWEA is used.

Some of the key events that transpired during the course of this project were: 1) a webinar of interested people in the fall of 2010, 2) establishment of connections with the European Academy of Wind Energy and participation in one of their meetings (April, 2011), 3) arranging a meeting concerning NAWEA at the AWEA University Summit in Iowa City, IA, in June, 2011, 4) participation in a meeting regarding the establishment of

NAWEA in Colorado in November, 2011, 5) hosting an inaugural meeting of NAWEA at UMass in August, 2012, and 6) joining in an effort to write a charter for NAWEA. As of the time of writing this report (March, 2013), the NAWEA charter is complete and NAWEA is being formally incorporated. The agenda for the inaugural meeting of NAWEA, the NAWEA charter and the NAWEA bylaws accompany this report.

APPENDIX

This appendix includes the following items:

- Syllabus of MIE 573 On-Line
- Flyer advertising professional level courses
- NAWEA UMass workshop agenda
- NAWEA charter
- NAWEA bylaws

Syllabus

MIE 573 Wind Energy Systems Engineering (On-line Version)

Prerequisites: Fluid mechanics, strength of materials, statics, dynamics, fundamentals of electricity

Text Book (Required): [Wind Energy Explained: Theory, Design and Application](#) (by Manwell, McGowan, and Rogers, 2nd Ed., published by Wiley). The textbook is available as an eBook in PDF format through the UMass library system. [This is a link to the book.](#) You automatically have access to the library as an enrolled student.

If you do not meet the prerequisites for the course, [Schaum's Outlines](#) may be a good option. The books are inexpensive (\$22) and provide a mixture of theory and problem solving. Each book contains hundreds of solved problems. Schaum's Outlines are available for each of the prerequisite subjects: [Fluid mechanics](#), [statics and strength of materials](#), [statics and dynamics](#), [fundamentals of electricity](#).

Course Software: The only required software for the course is Microsoft Excel. However, for grading purposes, we require homework and exam problems to be clear and well documented. Thus, homework problem solutions can be written entirely electronically and submitted. A program such as [MathCAD](#) would be suitable for this purpose. Also, scanned PDFs of handwritten work will be accepted. Scanned images can be converted to PDF using a utility such as [CutePDF](#). We can address other means of conveying homework problems on a case-by-case basis.

The course utilizes computer audio files which can be played directly within Blackboard Vista. However, the player is not sophisticated and does not allow the user to "seek" or "jump to" any portion of the MP3 file. Thus, an MP3 player such as [Windows Media Player](#) or [iTunes](#) is recommended.

Course Hardware: Audio files will be used throughout the course so speakers or headphones will be necessary. A scanner is also required if you would like to submit handwritten homework sets.

Course Website: The website can be accessed directly using this address:

<https://learning.umassonline.net/webct/logon/6572459778131>

The requirements for using the online course shell can be found at this address:

<http://www.umassulearn.net/classes/online-class-overview/technical-requirements>

The UMass Continuing and Professional Education office provides video tutorials about Blackboard and its various tools. Access to the videos accompanies enrollment in an online course.

Instructor: Professor James Manwell

Office: Gunness Lab 8

Email: manwell@ecs.umass.edu

Teaching Assistant: Eric Morgan
Office: Gunness Lab 9
Email: Morgan.Eric.R@gmail.com

Introduction

Welcome to Wind Energy Systems Engineering. This course was developed over the last thirty years at the Renewable Energy Research Laboratory (RERL, now the Wind Energy Center) at the University of Massachusetts by several faculty members. This is the first online version of the course in which you can learn the fundamentals of energy conversion from wind energy to electricity and its use by society. The topics covered include social and historical context, meteorology, resource assessment, aerodynamics, electrical and mechanical aspects, wind turbine design, siting issues, system integration, economics and environmental considerations.

The course will consist of recorded lectures with PowerPoint slides, readings, problem sets, and two exams. Grades will be based 50% on the homework problems and 50% on the exams. Assignments will be accepted late only with the prior permission of the instructor.

The course will allow you to have an on-line interaction with the Wind Energy Center at UMass Amherst. The course does not have any predetermined meeting times and the course site can be accessed at any time. A calendar is provided within Blackboard that gives a suggested reading and lecture schedule. However, there will be strict due dates for assignments and exams so that concepts which build upon wind energy basics will be understood.

There will be 10 homework sets throughout the semester, given roughly on a weekly basis. There will also be two mid-term exams as well as a final exam at predetermined times during the semester. The exams will be “take home” in the sense that you are not required to be present at UMass – or any other test proctoring facility – to take them. However, you will be held to the [Academic Honesty Policy](#) at UMass for all of your work throughout this course. You are expected to do your own work even though you have access to the world’s knowledge on the subject.

Grading

When grading, we expect to see a step-by-step solution procedure that clearly articulates the thought process used. Handwritten work is acceptable if it is scanned, turned into a PDF and uploaded to the course site or emailed to us. MathCAD also provides an adequate platform because it forces the user to write each equation used in succession. Programs such as MatLab and Microsoft Excel do not provide adequate documentation even though they can be used to obtain the correct answers. **You should not expect the instructor to read Excel formulas or computer code to determine the process used or the answers obtained.** You will be asked to use Microsoft Excel during the course, but we will also require proper documentation of your work.

Course Framework

The online course environment is fundamentally different from a traditional lecture-based course setting: there is no direct contact between the students and the instructor and there is considerably more reading and writing. To account for these deficits, communication between the instructor and the students and between the students themselves is paramount. There are several tools that can be utilized within the course framework to better facilitate communication, and all should be employed at some time during the semester. First, email communication is encouraged with the instructor for questions and comments about the course or the material. Second, tools such as Chat and Discussion, which exist within the course site, should be used. Chat offers synchronous communications with other students or the instructor. Chat times may be scheduled depending on the availability and desire of the students. The discussion tool is asynchronous and enables authors (students or the instructor) to start a thread which can be answered by anyone else in the course. Thus, posts to either the chat or the discussion forum can enrich the learning experience of everyone involved with the course.

The instructors will strive to answer any emails or discussion threads within 48 hours. Exceptions to this may occur during holiday weekends (Memorial Day or July 4th) or during instructor travel times. **Please do not expect us to promptly answer questions about homework sets hours before they are due.**

This is the first time that any College of Engineering online course has been offered at UMass Amherst. To improve the course, we hope that you offer your comments and suggestions during the semester as well as upon completion of the course. We hope to continuously improve the course for future students and instructors.

Lecture Number	Week	Dates	Topic	Readings	Problems Due
1	1	5/16-5/22	Introduction/Context	Handouts; Chapter 1	
2	1	5/16-5/22	History		
3	2	5/23-5/29	Meteorology		Problem set #1
4	2	5/23-5/29	Meteorology/Wind Data	2.1-2.3	
5	3	5/30-6/5	Wind Data	2.4-2.5	Problem set #2
6	3	5/30-6/5	Wind Data Statistics	2.6-2.9	
7	4	6/6-6/12	Aerodynamics Intro	3.1-3.4	Problem set #3
8	4	6/6-6/12	Blade Element/Momentum Theory	3.5-3.6	
9	5	6/13-6/19	Optimum Rotor	3.7-3.10	Problem set #4
10	5	6/13-6/19	Rotor Design	3.11-3.14	
11	6	6/20-6/26	Mechanics/Dynamics	4.1-4.3	Problem set #5
12	6	6/20-6/26	Mechanics/Dynamics	4.4-4.5	
13	7	6/27-7/3	Electricity	5.1-5.3	Problem set #6
14	7	6/27-7/3	Electricity	5.4-5.7	
15	8	7/4-7/10	EXAM		
16	8	7/4-7/10	Materials & Components	Chapter 6	
17	9	7/11-7/17	Design	7.1-7.5	Problem set #7
18	9	7/11-7/17	Design	7.6-7.10	
19	10	7/18-7/24	Controls	Chapter 8	Problem set #8
20	10	7/18-7/24	Siting	9.1-9.3	
21	11	7/25-7/31	Integration	9.4-9.5 ; 10.1-10.2	Problem set #9
22	11	7/25-7/31	Offshore	10.4	
23	12	8/1-8/7	Hybrid Systems	10.3 ; 10.6- 10.7	Problem set #10
24	12	8/1-8/7	Economics	Chapter 11	
25	13	8/8-8/14	Economics/Environmental	Chapter 12	Problem set #11
26	13	8/8-8/14	Environmental		
			FINAL EXAM		

Table 1 – Suggested lecture and reading schedule and tentative homework and exam schedule



www.umassulearn.net/windenergy

Online Professional Series in Wind Energy Siting & Analysis

New! The [Wind Energy Center](#) at UMass Amherst has developed a unique series of five courses to provide wind energy development practitioners with the skills to measure the wind, interpret the results, & provide accurate estimates of wind energy potential.

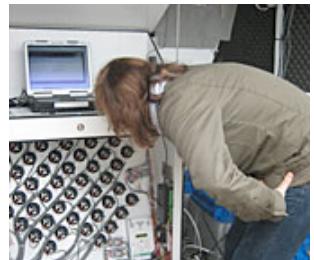
The Series Consists of the Following Courses:

1. Installing Wind Data Meteorological Towers
2. Wind Data Instrumentation, Data Collection, & Reporting
3. Wind Data Quality Assurance Methods & Long Term Extrapolation
4. Wind Data Collection Using Remote Data Collection: LIDAR & SODAR
5. Wind Site Selection & Performance Estimation Processes



Special features of this program:

- **Unique:** The material is not formally taught anywhere else as a professional series.
- **Quality:** The University of Massachusetts Wind Energy Center is a leading institution in wind energy engineering nationally & internationally. This series is developed & taught by UMass Amherst Wind Energy Center faculty & staff.
- **Practical:** This series provides you with skills you need to enter the wind energy field or differentiate yourself in that field.
- **Convenient:** These 5-week long, online courses are designed to meet the needs of working professionals.
- **Flexible:** Take a single course or the entire series; complete the entire series in as little as two semesters or spread the courses out over several years.
- **Cost-effective:** The cost is only \$550 per course with a 10% discount for those completing all 5 courses in the series.



Who should enroll:

- Technically-oriented individuals seeking to acquire skills needed to work in the wind energy measurement & feasibility assessment sector.
- Engineering students or engineering graduates interested in acquiring wind energy measurement & siting credentials.



Skills needed:

- Good mathematical skills, including algebra & geometry at the high school level
- Good computer skills, including spreadsheet creation & report writing abilities



Those who enroll may also be interested in the graduate level class [MIE573: Engineering Wind Power System](#).

For more information: Contact the UMass Wind Energy Program at: WEC@ecs.umass.edu

North American Wind Energy Academy Inaugural Meeting
University of Massachusetts Amherst
August 7 - 9, 2012
AGENDA

Tuesday, August 7th

7:30 AM **Registration opens**

8:00 - 9:00 AM **Continental Breakfast**

9:00 AM - 5:00 PM **FAST Workshop**

A wind turbine modeling workshop presented by Dr. Jason Jonkman from the National Renewable Energy Laboratory (NREL). Through US Department of Energy support, NREL has sponsored the development, verification, and validation of various computer-aided engineering (CAE) software tools for prediction of wind turbine performance, loads, and response. The workshop will focus on the coupled wind turbine aero-hydro-servo-elastic CAE tool FAST with AeroDyn and HydroDyn (<http://wind.nrel.gov/designcodes/simulators/fast/>) and will present the basic theory, structure, capabilities, and future plans of this tool. Sample simulations will be run to demonstrate its features.

For a detailed workshop agenda, [click here](#).

12:30 - 1:30 PM **Lunch**

1:30 - 4:30 PM **(Parallel session) Working Session of the North American Wind Energy Academy (NAWEA) Charter Committee (open to all conference attendees)**

Members of the NAWEA Charter Committee will meet to discuss feedback to the draft charter. The draft charter is included in this folder.

5:00 - 6:30 PM **Presentation of NAWEA Charter**

The draft of the NAWEA Charter will be presented by the NAWEA Charter Committee and discussed by interested parties. This meeting will offer an opportunity to discuss important issues with respect to establishing NAWEA and formalizing a charter.

Wednesday, August 8th

7:30 AM	Registration opens
8:00 - 9:00 AM	Continental Breakfast
9:00 AM - 12:00 PM	The Atmospheric Science Challenges Related to Large-Scale Deployment of Weather-Dependent Renewable Energy
	These talks will discuss the meteorological issues relevant to wind and solar energy. These issues have implications for wind forecasting, resource assessment, and siting, among other things.
<i>9:00-9:10</i>	Dr. Matthew Lackner, Assistant Professor, University of Massachusetts Amherst: Welcome and Introduction to the Session.
<i>9:10-10:00</i>	Dr. Chris Clack, Postdoctoral Research Associate, National Oceanic & Atmospheric Administration Earth System Research Laboratory Dr. Clack will describe a wind and solar energy plant-siting optimization study based on cost minimization conducted by NOAA's Earth System Research Laboratory. Rapid Update Cycle (RUC) assimilation model data provide the weather resource information for this study.
<i>10:00-10:15</i>	Break
<i>10:15-11:30</i>	Dr. Jim Wilczak, Team Lead, Boundary Layer Processes and Applications, National Oceanic & Atmospheric Administration Dr. Sue Haupt, Director, Weather Systems and Assessment Program, Research Applications Laboratory, National Center for Atmospheric Research Dr. Wilczak and Dr. Haupt will address relevant meteorological issues, e.g., boundary layer processes, mesoscale processes, terrain effects, upwind turbine effects, extreme wind events, turbulence, shear, spatial and temporal variability, ramp events, icing on blades, low level jet, lighting, etc. They will discuss the state of the art, recent advances, and suggested paths forward in these areas to facilitate integration of more weather-dependent renewable energy.
<i>11:30-12:00</i>	Panel Discussion and Questions
12:00 - 1:00 PM	Lunch

1:00 - 5:00 PM	NAWEA Kick-off session: "Challenges of Large Scale Deployment of Wind Power"
1:00-1:15	Dr. James Manwell, Professor of Mechanical Engineering, Director of the Wind Energy Center, University of Massachusetts Amherst: <i>Introduction to the Session</i>
1:15-1:45	Dr. Robert Thresher, NREL Research Fellow, National Wind Technology Center: <i>The Need for an Academy of Wind Energy in North America</i>
1:45-2:15	Jose Zayas, Program Manager, US DOE Wind and Water Power Program, <i>DOE's Vision for Wind Energy and the Role of R&D and Education in Fostering a Strong Wind Industry</i>
2:15-2:45	Roger Schonewald, General Electric Energy: <i>The Industry Perspective on the Future of Wind Energy in North America</i>
2:45-3:00	Break
3:00-3:30	Walt Musial, NREL Offshore Wind and Water Power Manager, National Wind Technology Center: <i>Offshore Wind Power and the Challenges of Large Scale Deployment</i>
3:30-4:00	Mark O'Malley, Professor of Electrical Engineering, University College Dublin: <i>Grid Integration Challenges and Solutions</i>
4:00-4:30	Michael Goggin, Manager, Transmission Policy, American Wind Energy Association: <i>Policy, Integration, and Transmission Solutions for the Large-Scale Deployment of Wind Power.</i>
4:30-5:00	Panel Discussion and Questions.
5:30 - 8:30 PM	Reception and Dinner
5:30-6:30	Cash Bar Reception
6:30-8:30	Dinner

Thursday, August 9th

7:30 AM **Registration opens**

8:00 - 9:00 AM **Continental Breakfast**

9:00 AM - 12:30 PM **Graduate Student Presentation and Networking Sessions**

Inspired by a similar event in Europe, the purpose of these sessions is to allow graduate students to present their research and discuss it with their peers in a more casual environment than a traditional conference. Students who only have preliminary results or are early in their theses are encouraged to present and get feedback from their peers. Time will be set aside for networking and discussion as well as presentations. Each presentation will be 15 minutes including questions.

8:30 AM - 12:30 PM **(Parallel session) General Meeting to Discuss the Strategic Direction of NAWEA and Next Steps**

Moderators: Ian Baring-Gould, National Renewable Energy Laboratory, and Mike Knotek, Renewable and Sustainable Energy Institute

This session will discuss the strategic focus of NAWEA and will allow broad discussions and brainstorming around key areas. As part of this discussion, working groups will form to further refine and elaborate on the final concepts to be included in the Charter. The major initiatives for discussion are: Educational Initiatives, Research and Development Initiatives, and Major Activities.

8:30-10:00 Brainstorming on all three initiatives (*30 minutes each*)

10:00-10:30 Coffee break and vote on priorities

10:30-11:30 Review, further discussion, and development of working groups (*20 minutes each*)

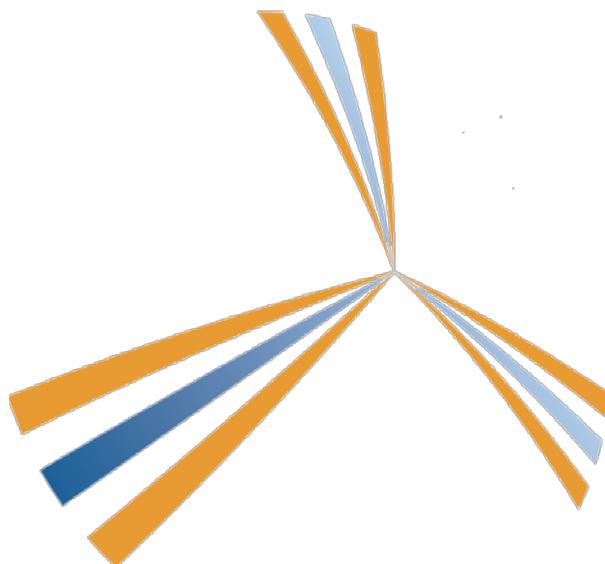
11:30-12:00 Next steps for the Academy – define a specific timeline and set next meeting

12:00-12:30 Final review of the initial charter and signing

12:30 PM - 1:30 PM **Lunch and adjourn.**

**Charter
for
NAWEA
North American Wind Energy Academy**

December 2012



www.nawea.org

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Table of Contents

Preamble	1
1.0 Vision and Mission	2
2.0 Strategic Focus	4
2.1 Educational Program	4
2.2 Research and Development Program	5
2.3 NAWEA Activities and Initiatives	6
3.0 Key Criteria for Success	7
4.0 Members and Organization	8
4.1 Members	9
4.2 Organization	9
5.0 Amending the Charter and the By-laws	9
6.0 Financial Formation and Sustainment	9
7.0 Acknowledgements	10



Preamble

Purpose

The purpose of the North American Wind Energy Academy (NAWEA or “the academy”) is to facilitate the growth of wind power into a cost-effective, high-penetration, sustainable national energy source producing at least 10 times the 2012 electricity production levels. To meet this energy goal, the academy will expedite the creation of a critical new wind energy research and development agenda that bridges education, multiple disciplines, and diverse organizations, and fosters national and international collaborations.

Strategic Importance

Achieving a tenfold increase of current capacity requires overcoming numerous barriers including reducing cost, exceeding 2012 levels of service and performance, and evolving a new vision for grid interconnection and operation wherein renewable resources are a major contributor. The academy will address these lofty goals and challenges using a comprehensive approach sharply focused on advancing research, development, and deployment that is leveraged by educational resources and creatively uses public and private business models.



1.0 Vision and Mission

Vision

The North American Wind Energy Academy will be the leading organization within regions of close proximity to North America, including but not exclusive to the United States, Canada, and Mexico, that are engaged in research, technical, education, market, and policy advancements that will enable wind energy to achieve more than a tenfold increase in 2012 capacity and thereby produce over 20 percent of each region's or nation's electrical energy.

Mission

The mission of NAWEA is to bring together North America's foremost intellectual assets and to apply their collective talents to overcome the challenges of advancing wind power technology and its applications, optimizing its role in meeting national energy needs in an environmentally sustainable manner, while nurturing the development of future generations of technical, management, and policy experts to assure the continued sustainable advancement and optimization of wind power.

In executing its mission, NAWEA will both lead and support efforts to undertake and accomplish the following major activities:

1. Work to expand the breadth and competence of the wind energy academic and national laboratory communities to ensure the continued advancement of wind energy through:

- developing and disseminating a recommended wind energy curriculum;
- developing and sponsoring activities that enhance and supplement undergraduate and graduate educational opportunities in North America;
- developing a program that provides work experience for students to enhance their educational experience in collaboration with the wind industry; and
- establishing a collaboration agreement among North American universities and with the European Academy of Wind Energy (EAWE) that facilitates joint projects and special educational programs in addition to the exchange of information, students, faculty, and postdoctoral researchers.

2. Foster research and development collaborations that bring together the necessary disciplines, agencies, and stakeholders to address topics critical to the advancement of wind energy, such as:

- wind energy system science and engineering;
- grid integration and operations;
- atmospheric sciences;
- environmental and institutional impacts;
- business, finance, and economics;
- market barriers;
- social acceptance; and
- policy development.



- 3. Develop unbiased, accurate, and relevant scientific information on wind power's benefits and impacts and actively communicate that information to decision makers and the general public through a variety of means such as workshops, symposia, and publications.**
- 4. Promote programs and activities that:**
 - continue the responsible advancement of wind technology;
 - accelerate the development of world-class manufacturing capability and jobs creation;
 - enhance appropriate widespread deployment; and
 - facilitate the full realization of the energy, environmental, and economic benefits offered by wind power in North America.
- 5. Conduct any and all other lawful activities consistent with accomplishing the foregoing purpose.**



2.0 Strategic Focus

2.1 Educational Program

Advancing the state of wind energy technology and providing accurate information to the public and to policy makers requires a strong academic and national laboratory foundation and partnership. The overall goal of the NAWEA Educational Program is to expand the breadth and competence of the wind energy academic community throughout the region by working collaboratively to develop relevant curriculum.

NAWEA educational activities are designed to do the following:

- 1. Develop and disseminate a recommended wind energy curriculum model.** The wind curriculum model will bring together the best ideas and long-established concepts through collaborative efforts of the academy. Best practices and curriculum models established will guide the development of balanced, high-quality, wind energy instructional programs. The model curriculum will facilitate student exchange opportunities and maximize the use of online courses.
- 2. Develop and sponsor activities that enhance and supplement undergraduate and graduate educational opportunities.** University members bring a broad set of diverse skills and expertise. It is envisioned that any student from any university may benefit from the breadth of course offerings among NAWEA university members. Student exchanges among the NAWEA university members will be developed and online instruction offered with course offerings on a multitude of unique topics.
- 3. Develop an internship program to provide student work experience with the wind industry.** The wind energy industry plays an important role in NAWEA by providing students with valuable work experience through internship opportunities. Conversely, an internship program at undergraduate and graduate levels also provides the industry with insight into the skills and experience needed to address current technical challenges confronting industry.
- 4. Establish a collaboration agreement among NAWEA member universities and EAWE that facilitates joint projects and special summer educational programs and the exchange of information, students, faculty, and postdoctoral researchers.** NAWEA will provide leadership for establishing, where feasible, the following educational opportunities:
 - An academy-wide interdisciplinary graduate student summer school covering all aspects of wind energy from science and technology to siting and policy.
 - An annual summer NAWEA meeting that provides opportunities for graduate students to present their research plans and accomplishments and interact with other graduate students, industry and laboratory researchers, and faculty from other institutions.
 - An annual graduate student technical paper competition.
 - Energy graduate fellowships.
 - An exchange program within NAWEA and EAWE that facilitates research collaborations, as well as student and faculty exchanges.



2.2 Research and Development Program

For wind energy to evolve into a cost-effective, high-penetration, sustainable national energy source that generates more than 20 percent of electricity production, new agendas are essential in wind energy research and development. The research agenda must bridge multiple disciplines and diverse organizations and foster national and international collaborations in order to address the science, engineering, economic, environmental, policy, and public acceptance issues that currently are impeding growth and acceptance of wind energy. Research areas the academy will address include the following:

1. **Wind energy system science and engineering** to address the cost and reliability issues that are currently limiting wind energy's use on land and off shore.
2. **Grid integration and management** constraints that limit – and opportunities that enhance – the widespread use of variable generation sources in the North American electrical system.
3. **Atmospheric sciences** uncertainties that limit our ability to model and predict wind plant operation, performance, reliability, and dynamic behavior.
4. **Environmental science** unknowns concerning the impacts of wind plants on the environment, wildlife, and humans, as well as research on methods to mitigate any impacts.
5. **Market barriers** and institutional barriers due to misperceptions, obsolete regulations, and outdated management paradigms.
6. **Social acceptance** research to address and mitigate real and perceived issues with the widespread application of wind energy.
7. **Policy research** to explore appropriate and balanced energy policies that treat all energy generation technologies equitably.
8. **Business and financial** model research and development to improve wind plant development and planning.
9. **Interdisciplinary research** to bridge the connections between the above disciplines and facilitate solutions that are not possible within one area alone.
10. **New research** on evolving issues and barriers as they emerge over time.

NAWEA will use the following means to facilitate research collaborations and partnerships:

1. **Research collaboration among the members.** NAWEA will promote research collaboration among members via faculty and staff exchanges and sharing of experimental facilities. Faculty, research staff at government and private laboratories, and researchers in industry will be able to participate.
2. **Research Topic Working groups.** NAWEA will facilitate the formation of working groups to explore and address emerging, evolving, or critical areas in wind energy research. The objective will be to establish ad hoc virtual topical external advisory working groups that develop topical white papers or other outcome. These mechanisms are essential components for establishing an effective and accurate flow of information, thus providing the academy with the agility it needs to ebb and flow with wind research needs and impact the research agenda.
3. **Outstanding Young Researcher Award.** NAWEA will sponsor an annual “Outstanding Young Researcher Award” to encourage and recognize the importance of new researchers and the need for innovative research in the wind community. (similar to the EAWE outstanding young doctoral researcher award)



4. **Graduate student research exchanges.** NAWEA will facilitate opportunities for graduate students to work at other NAWEA member universities and at the national laboratories to enhance their research. This will help promote collaboration among the members, and enrich the graduate student experience. International exchange opportunities with EAWE members will be established.

2.3 NAWEA Activities and Initiatives

NAWEA activities will support its vision, mission, and initiatives. Examples of activities and initiatives include, but are not limited to, the following:

1. **Annual Conference and Workshop.** NAWEA will sponsor an annual conference and workshop to enable the vision and mission. This conference will include presentations and interaction with those engaged in wind energy at the levels necessary to bring wind energy up to the tenfold increase as stated in the mission.
2. **Meetings of the Board.** Meetings of the board will be held to set NAWEA's strategic agendas and activities. Representation is provided from institutional groups, academic groups, industry groups, and the NAWEA members at large. The results of these meetings will be available to the members of NAWEA.
3. **Committees.** NAWEA will enlist committees to facilitate NAWEA activities. Committees may include the following:
 - Research Topic Committees
 - Curriculum Committee
 - Conference Committee
 - Outreach and Member Management Committee

Committee areas of scope and responsibilities are further detailed in ARTICLE VI of the By-laws.



3.0 Key Criteria for Success

Academy Goals and Major Activities	Types of Outcomes for Measuring Performance
Goals	
1. Fulfill the vision and mission stated in this charter through the actions and leadership of the governing board.	<ul style="list-style-type: none">• Fulfillment of NAWEA's vision and mission
2. Collaboratively and systematically engage North America's foremost intellectual resources in wind power to enable full realization of the energy, environmental, and economic benefits offered by high penetration wind power to help meet the nation's energy goals.	<ul style="list-style-type: none">• Multi-institutional and multidisciplinary membership• Attendance and participation in NAWEA events• Industrial involvement• Governmental agency involvement
3. Advance the scientific, technological, and institutional knowledge base and capabilities to confront the challenges and realize the opportunities of strategic scale manufacturing, deployment, and operations of wind power.	<ul style="list-style-type: none">• Systems and technological activities• Multimedia presentation of research and planning results by member collaborators/impact on the community• Activities to reduce cost, streamline institutional activities, and optimize system performance
4. Sustain its intellectual foundations by developing future generations of technical, management, and policy leaders as well as a pipeline to broader qualified workforce.	<ul style="list-style-type: none">• Involvement of undergraduate, graduate students, collaborating professionals• New inter-institutional and interdisciplinary educational opportunities
Major Activities	
1. Foster research and development collaborations by convening the community to address critical issues in wind system science and engineering, grid integration, atmospheric sciences, environmental and institutional impacts, market barriers and social acceptance, and policy evolution.	<ul style="list-style-type: none">• Number of NAWEA-sponsored events• Level of participation in events• Breadth of participation in events
2. Facilitate and promote beneficial educational programs necessary to ensure intellectual progress and a strong industry.	<ul style="list-style-type: none">• Availability of a new generation of interdisciplinary education
3. Develop accurate and relevant information on wind power's capabilities and actively communicate that information to decision makers and the general public.	<ul style="list-style-type: none">• Written, web, and oral communications that educate and inform decision makers and the public
4. Encourage communication across disciplines, agencies, and stakeholder groups to affect holistic approaches to address key challenges.	<ul style="list-style-type: none">• Educational program network• Mentoring program• Convening activities



4.0 Members and Organization

4.1 Members

Member types and privileges are fully described in the Bylaws, ARTICLE IV. NAWEA shall have the following member types:

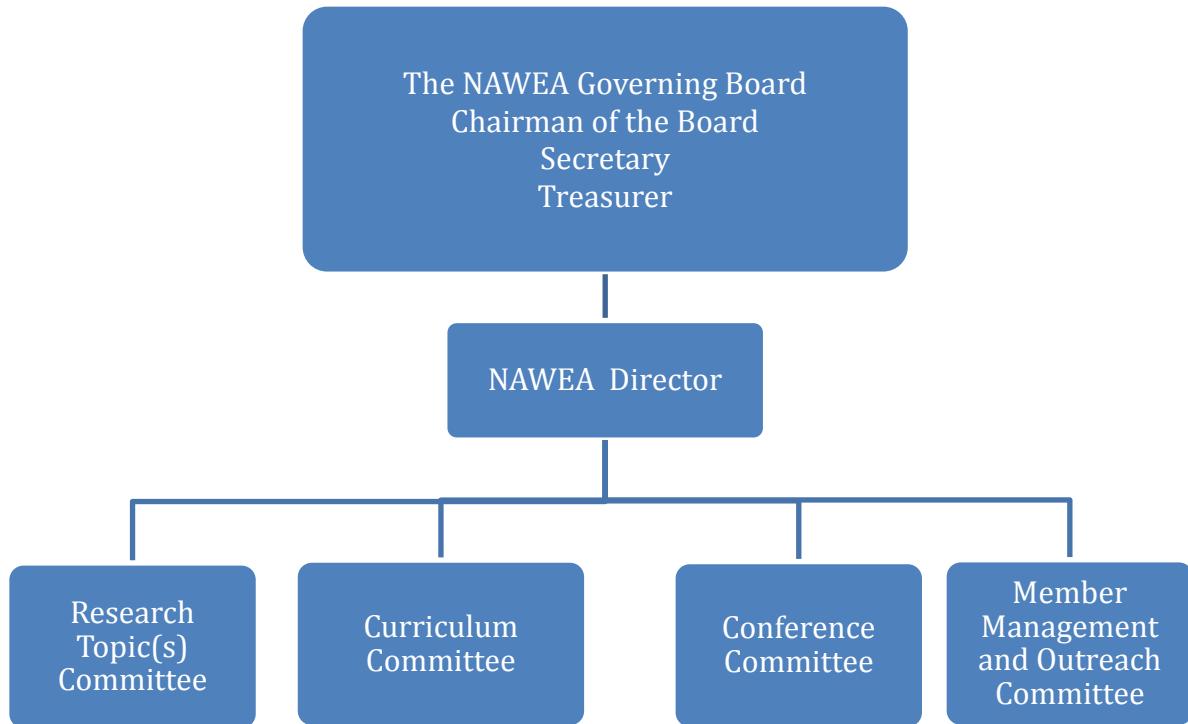
- Public Sector/Institutional Member
- Academic Member
- Individual Member
- Invited Member
- Private Sector/Industry

The following table delineates member roles and responsibilities to include governing board members.

Member Type	Role	Responsibility
Officers		
<u>Executive Committee (EC)</u>		
Director Director-Elect	Leadership and governance	Leads the academy's development of its strategic plan
Chairperson	Leadership of the executive board	Manages the board
Chairperson-Elect	Assistant to chair	Acts as chair when needed
Treasurer	Financial officer	Ensures sound financial management
Secretary	Membership records and meeting minutes	Maintains accurate and comprehensive records of membership and meetings
Board		
All Board Members	Conduct the business of the academy	Ensure the academy follows strategic direction and remains financially solvent
Public Sector/Institutional	Board member	Research, technical representation
Academic	Board member	Educational and outreach representation
Individual	Board member	Members at large, general constituency representation
Private Sector/Industry	Board member, nonvoting	Industry representation
Invited	Invited and approved by governance board, nonvoting	Specialty areas identified by the board



4.2 Organization



5.0 Amending the Charter and the By-laws

Amending the Charter and Bylaws accomplished in accordance with ARTICLE XI of the Bylaws.

6.0 Financial Formation and Sustainment

The intent of the NAWEA is to be financially self-sustaining by collecting dues and sponsorships in support of operational and administrative expense. The academy shall be a not-for-profit, U.S.-based 501c (3) organization.



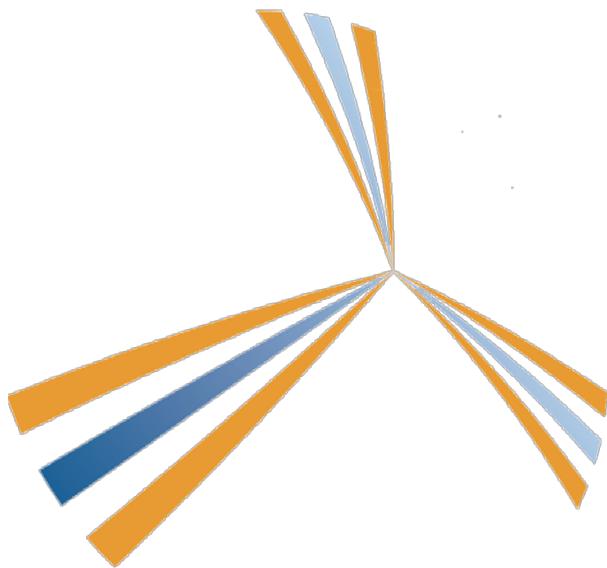
7.0 Acknowledgements

NAWEA Charter Committee Members

Name	Affiliation
Doug Cairns, Charter Committee Chair	Montana State University
Patrick Butler	University of Iowa
Ed DeMeo	Renewable Energy Consulting Services, Inc.
Michael Knotek	Renewable and Sustainable Energy Institute
James Manwell	University of Massachusetts Amherst
Pat Moriarty	National Renewable Energy Laboratory
Will Shaw	Pacific Northwest National Laboratory
Diane Stults	Renewable and Sustainable Energy Institute
Andy Swift	Texas Tech University
Bob Thresher, NAWEA Director (Interim)	National Renewable Energy Laboratory
Case van Dam	University of California Davis
Paul Veers	National Renewable Energy Laboratory

Additional Contributors

- Tom Acker, Northern Arizona University (UNC)
- Stephan Barth, ForWind, University of Oldenburg, Germany (acted as a representative of the European Academy of Wind Energy (EAWE))
- Kevin Doran, RASEI
- Rupp Carriveau , University of Windsor, Canada
- Yves Gagnon, Université de Moncton, Canada
- Sue Haupt, University Corporation for Atmospheric Research (UCAR)
- Hogan Lovells
 - Kevin Doran, Renewable and Sustainable Energy Institute (RASEI) Research Professor, enlists Hogan Lovells (www.hoganlovells.com) legal counsel to assist the charter committee in drafting the by-laws framework on a pro-bono basis. Attorneys included: Dennis Arfmann (Denver), Brandon Wilson (WDC), Christian Ulrich (WDC)
- William Mahoney, University Corporation for Atmospheric Research (UCAR)
- Mike Robinson, National Renewable Energy Laboratory (NREL)
- J. Charles (Charlie) Smith, Utility Wind Integration Group (UVIG)

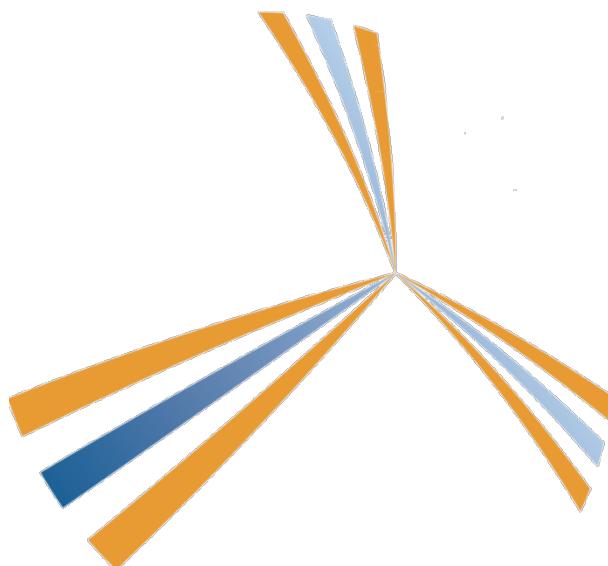


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By Laws
Of the
North American Wind Energy Academy

December 2012

Version 1.0



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**Table of Contents**

ARTICLE I	Name
ARTICLE II	Purpose
ARTICLE III	Office
ARTICLE IV	Members
4.1	Membership
4.2	Membership Rights and Dues
4.3	Activity Status, Term, Termination, Resignation
ARTICLE V	The Academy Governing Board
5.1	The Academy Governing Board
5.2	Officers of the Governing Board
5.3	Vacancies
ARTICLE VI	Meetings of the Governing Board, Committees, Quorum, Organization
6.1	Scheduled Governing Board Meetings
6.2	Quorum, Proxy and Voting
6.3	Action Without a Meeting
6.4	Telephonic or Other Meetings
6.5	Committees
6.5.1	Research Topic Committees
6.5.2	Curriculum Committee
6.5.3	Conference Committee
6.5.4	Outreach and Member Management Committee
6.6	Organization
ARTICLE VII	Seal
ARTICLE VIII	Fiscal Year
ARTICLE IX	Conflicts of Interest
9.1	Conflicts Generally
9.2	Approving Transactions
9.3	Recusal
9.4	Quorum
ARTICLE X	Indemnification and Insurance
ARTICLE XI	Amending the By-Laws and Dissolution of NAWEA
11.1	Amending the By-Laws
11.2	Dissolution

**ARTICLE I - *Name***

The name of the 501c(3) is the “North American Wind Energy Academy” and may be referred to herein as “NAWEA” or the “Academy.”

ARTICLE II - *Purpose*

The Academy is formed for the purposes of facilitating the growth of wind power into a cost effective, high penetration, sustainable, national energy source through advancing the research and development of technical advances in the wind energy industry. In furtherance of these purposes, the Academy shall:

- a. Work to expand the breadth and competence of the wind energy academic and national laboratory communities to ensure the continued advancement of wind energy.
- b. Encourage communication across disciplines, agencies and stakeholder groups to address key challenges by fostering research and development collaborations that bring together the necessary disciplines to address topics necessary to the advancement of wind energy.
- c. Develop unbiased, accurate, and relevant scientific information on wind power's benefits and impacts, and actively communicate such information to decision-makers and the general public through a variety of mechanisms such as workshops, symposia, and reports and publications.
- d. Promote programs and activities that continue the responsible advancement of wind technology, accelerate the development of world-class manufacturing capability and jobs creation, enhance appropriate wide-spread deployment, and lead to the full realization of the energy, environmental, and societal, and economic benefits offered by wind power.
- e. Conduct any and all other lawful activities not inconsistent with accomplishing the foregoing purposes.

In furtherance of the above and other related purposes, the Academy shall have the power to exercise any and all power and authority granted to it under the laws of the state of its organization, or otherwise, including, but not limited to, the power to accept donations of money or property, whether real or personal, or any interest therein, wherever situated.

ARTICLE III - *Office*

The principal office of the Academy shall be located within or without the State of [TBD], at such place as the Governing Board of the Academy (the “Governing Board”) shall from time to time designate. The Academy may maintain additional offices at such other places as the Governing Board may designate. The Academy shall have and maintain within the State of [TBD] a registered office at such place as may be designated by the Governing Board.



ARTICLE IV - *Members*

4.1 - Membership. Natural persons or entities may be members. The Academy shall have five (5) classes of members (the “Members”), some of which shall be those Members whose Representatives (as defined herein) are allowed to vote (“Voting Members”) and the remainder of which shall be “Nonvoting Members.” Only Voting Members shall have all the rights and privileges of members of the Academy. Nonvoting Members shall have only such rights and privileges as are specifically set forth in these By-laws, but in no event shall Nonvoting Members or their Representatives have the right to vote. The following are the classes of Members:

4.1.1 - Public Sector / Institutional Member. Institutional Members shall be Voting Members. Any public sector institution, government research laboratory, or governmental agency that supports the Academy mission and vision and wishes to participate in and/or sponsor Academy programs and activities may be an Institutional Member. Employees of an Institutional Member may be listed under such organization’s membership; such individuals shall be represented on the Governing Board by the Representative (as hereinafter defined) of such Institutional Member.

4.1.2 - Academic Member. Academic Members shall be Voting Members. Any university, including divisions or units thereof, or any other academic body, that supports the Academy mission and vision and wishes to participate in and/or sponsor Academy programs and activities may be an Academic Member. Employees of an Academic Member may be listed under such organization’s membership; such individuals shall be represented on the Governing Board by the Representative of such Academic Member.

4.1.3 - Invited Member. Invited Members shall be Nonvoting Members. Any individual or organization invited by the Governing Board that supports the Academy mission and vision. Such individuals or organizations may be bestowed an ex-officio, non-voting membership in the Academy by majority vote of the Governing Board at a scheduled meeting. While non-voting, invited or ex-officio members may participate in meetings of the Governing Board and may sponsor Academy activities. Invited Members must demonstrate support for the vision and mission of the Academy by actively participating in Academy programs and activities.

4.1.4 - Private Sector / Industry Member. Industry Members shall be Nonvoting Members. Any private sector organization that supports the Academy mission and vision and wishes to participate in and/or sponsor Academy programs and activities may be an Industry Member. Industry Members are advisory, and their membership is subject to approval by a majority vote of the Governing Board at a scheduled meeting.

4.1.5 - Individual Member. Individual Members shall be represented via elected representatives (the “Individual At-Large Representative”). Any individual who supports the Academy mission and vision and wishes to participate in Academy programs and activities may be an Individual Member. Any individual employed by an Institutional Member or Academic Member, regardless of whether such individual is listed under such organization’s membership,



may also join as an Individual Member and enjoy all the rights and privileges of such membership class, should they wish to do so.

4.2 - Membership Dues.

4.2.1 - Dues Generally. Membership dues for all classes of membership shall be set by the Governing Board and may be reassessed by the Governing Board as required to ensure the fiscal solvency of the Academy. Additional fees, duties and obligations may be levied by the Governing Board as needed to sponsor the Academy's events and programs. Initial annual Membership dues, as amended from time to time by a majority vote of the Governing Board, are presented in the following table:

Member Type	Annual Membership Dues
Public Sector / Institutional Member	\$5,000
Academic Member	\$3,000
Individual Member	\$100
Invited Member	No Dues
Private Sector / Industry	No Dues

4.2.2 - Collection. Dues of Members shall be collected by the Treasurer and shall be paid by each Member to this Academy. Annual dues shall be paid to the Academy on or before the first day of on or before January 1. Admission fees, if any, and dues for new Members shall be paid to the Academy within thirty (30) days after admission of the new Member.

4.2.3 - Delinquency. The Governing Board may terminate the membership of any Member if dues are not paid within thirty (30) days after they are due. The Academy shall attempt to notify such Member of the termination by sending a notice of termination to such Member's address as it appears in the membership records of the Academy.

4.3 - Activity Status, Term, Termination, Resignation.

4.3.1 - Status and Term. Members shall have an unlimited term of membership, subject to payment of their yearly dues and continuing support of the Academy's mission and vision. Members are in good standing ("Active Members") when dues are paid and their membership is approved by the Governing Board, as applicable. Active Members become "Inactive Members" after dues are not paid within thirty (30) days. Inactive Members do not have membership privileges, Governing Board representation or voting rights.

4.3.2 - Membership Revocation. The Governing Board may, by a majority vote at a scheduled meeting, decline to accept, or revoke, Academy membership for any individual, organization, or institution that does not support the mission and vision of the Academy, pay dues, or which may present a real or perceived barrier to achieving the mission and vision of the Academy.



4.3.3 - Resignation. A Member may at any time resign from their membership in NAWEA by giving written notice, signed by (a) for an Institutional Member, Academic Member or Industry Member, a management level official of such Member; and (b) by the Individual Member; or alternatively such Member may allow its membership to lapse by not paying dues, with or without notification. A Member who has delivered written resignation to NAWEA shall not be liable for further dues after the delivery of such notice of resignation, and shall thereby revoke all rights and privileges of membership in the Academy, effective upon receipt by the Academy.

ARTICLE V - *The Academy Governing Board*

5.1 - The Academy Governing Board. All powers of the Academy shall be exercised by the Governing Board, which may delegate to its officers and to its committees such powers as it may see fit, in addition to such powers as are specified in these By-laws. The Governing Board shall be responsible for carrying out the business of and managing the Academy's activities and programs to achieve the NAWEA mission and vision as defined in its Charter. The Governing Board shall ensure that the composition of the Governing Board and the Academy's membership reflects the wind energy community as a whole in a balanced manner. The Governing Board shall be accountable for the performance measures of success for NAWEA, including:

- Fulfillment of NAWEA's vision and mission
- Multi-institutional and multi-disciplinary membership.
- Attendance and participation.
- Industrial involvement.
- Governmental agency involvement.
- Systems and technical activities.
- Multimedia presentation of research and planning results by member collaborators.
- Activities to reduce cost, streamline institutional activities, and optimize system performance.
- Enable a pipeline of students; undergraduate, graduate, collaborating professionals.
- Foster new inter-institutional and interdisciplinary educational opportunities.

5.1.1 – Governing Board Composition. The Governing Board shall be comprised of one representative for each Institutional Member and each Academic Member, as well as the Individual At-Large Representative(s) to be elected by the Academy's Individual Members. The number of Individual At-Large Representatives shall total no more than twenty percent (20%) of the number of Institutional Members plus Academic Members. One representative from each Industry Member may also sit on the Board, but in a non-voting capacity. Such representatives, including the Individual At-Large Representative(s) and those representing Institutional, Academic and Industry Members, are each referred to herein as a "Representative" and collectively the "Representatives." For the avoidance of doubt, only those Representatives representing Institutional, Academic and Individual Members shall be allowed to vote on any matters before the Governing Board.



5.1.2 – Selection of Representatives. Representatives representing Institutional, Academic and Industry Members shall be selected by the respective Members represented thereby and their term of appointment shall be at the discretion of their respective Members.

5.1.3 - Individual At-Large Representatives. Individual At-Large Representatives shall be elected for a three (3) year term by a majority of those Individual Members in attendance at an annual meeting of such Members. Such meetings shall be held every three (3) years at a meeting of Individual Members which shall coincide with one of the semiannual meetings of the Governing Board, regardless of whether a majority of the Individual Members are present at such meeting.

5.1.4 - Invited Members. Those representing Invited Members may be invited to participate in Governing Board meetings by a majority vote of the Governing Board at a scheduled meeting. Although those individuals representing Invited Members are expected to attend and participate in Governing Board meetings, they shall have no voting rights in the business of the Academy.

5.1.5 - Absent Representatives. Any Member whose Representative is absent from three (3) consecutive Governing Board meetings, whether such meetings are telephonic or in person, may have its membership on the Governing Board revoked by a simple majority vote of those present at a scheduled meeting. Any Member whose membership on the Governing Board has been revoked under this Section 5.1.5 may have its membership reinstated by a subsequent simple majority vote of the Governing Board at a regularly scheduled meeting.

5.2 - Officers of the Governing Board. The Governing Board shall elect officers (“Officers”) who shall be responsible for managing the day-to-day activities and programs approved by the Governing Board to achieve the mission and vision of the Academy as articulated in the Charter. The Officers of the Board may include the following specific positions, as well as any other assistant officers, agents and employees as shall be determined from time to time by the Governing Board:

5.2.1 - The NAWEA Director.

The Academy shall have a Director whose role shall be to execute and manage the day-to-day business affairs of the Academy and to execute the programs and activities approved by the Governing Board. The Director shall be nominated and elected by the Governing Board by a majority vote at a scheduled meeting and serve in that position for a two (2) year term, which term may be renewed yearly thereafter with no term limit by a majority vote of the Governing Board at a scheduled meeting. The Director may resign from such position by providing three (3) months’ prior written notice. The Governing Board may remove a Director by a majority vote of the Governing Board at a scheduled meeting.

The Director shall serve as the representative of NAWEA to external organizations and the public. The Director shall perform organizational outreach, strategic planning, budgeting, and any other executive management duties as approved by the Governing Board to achieve the mission and vision of the Academy. The Director shall also be a voting member of the Governing Board, and an ex-officio member of all standing and research topic committees. In the event that the Director is unable to attend a Governing Board meeting, activity or function,



he/she may designate any member of the Governing Board in good standing to serve as acting Director until he/she becomes available.

5.2.2 - The Chairperson of the Governing Board.

The Chairperson of the Board shall preside over Governing Board meetings and ensure that the Governing Board manages the affairs of the organization to achieve the mission and vision of the Charter. The Chairperson must be a member of the Governing Board in good standing. The Chairperson shall be nominated and elected by the Governing Board by a majority vote at a scheduled meeting and serve in that position for a two (2) year term, which term may be renewed yearly thereafter with no term limit by a majority vote of the Governing Board at a scheduled meeting. The Chairperson may resign from such position by providing three (3) months' prior written notice. The Governing Board may remove a Chairperson by a majority vote of the Governing Board at a scheduled meeting.

In the event that the Chairperson is unable to attend a Governing Board meeting, activity, or function, he/she may designate any member of the Governing Board in good standing to serve as acting Chairperson (the "Acting Chairperson") until he/she becomes available. If, in the judgment of the Director, the Chairperson cannot properly fulfill his/her duties as described in this Section and has not chosen an Acting Chairperson, the Director may designate the Secretary as Acting Chairperson on an interim basis to call a meeting of the Governing Board and otherwise provide continuity until appropriate action can be taken by the Governing Board.

5.2.3 - The Governing Board Secretary.

The Secretary shall maintain accurate membership records and shall record and distribute meeting minutes for all meetings as identified; in the absence of the Secretary at any meeting, a secretary pro tempore shall be appointed by the Chairperson. The Secretary shall be nominated and elected by the Governing Board by a majority vote at a scheduled meeting and serve in that position for a two (2) year term, which term may be renewed yearly thereafter with no term limit by a majority vote of the Governing Board at a scheduled meeting. The Secretary may resign from such position by providing three (3) months' prior written notice. The Governing Board may remove a Secretary by a majority vote of the Governing Board at a scheduled meeting.

5.2.4 - The Treasurer.

The Treasurer shall have charge and custody of and be responsible for all funds and securities of the Academy. The Treasurer shall be nominated and elected by the Governing Board by a majority vote at a scheduled meeting and serve in that position for a two (2) year term, which term may be renewed yearly thereafter with no term limit by a majority vote of the Governing Board at a scheduled meeting. The Treasurer may resign from such position by providing three (3) months' prior written notice. The Governing Board may remove a Treasurer by a majority vote of the Governing Board at a scheduled meeting.

5.3 - Vacancies. Vacancies in Offices, however occasioned, shall be filled through a nomination and election by the Governing Board at a special meeting or at the next regular meeting of the Governing Board for the unexpired terms of such Officers.



ARTICLE VI - *Meetings of the Governing Board, Committees, Quorum, and Organization*

6.1 - Scheduled Governing Board Meetings. The Governing Board shall have two (2) in person meetings each year. These semiannual meetings shall be scheduled and the venue established by the Governing Board one (1) year in advance of the planned meeting date. The purpose of the semiannual meetings shall be to review progress on Academy activities and discuss and approve plans, budgets, and future activities, as well as to conduct other business of the Academy as needed. Meeting agendas and logistical arrangements shall be provided to Members in a timely fashion. Furthermore, the Chairperson may request that the Director arrange additional scheduled Governing Board meetings by telephone or other electronic means when both the Director and Chairperson deem such additional meetings necessary and prudent in order to gain Governing Board approval on important issues that may arise unexpectedly. The Governing Board shall be given at least two (2) weeks' prior written notice and an agenda prior to holding a scheduled telephone or electronic meeting.

6.2 - Quorum, Proxy, and Voting. For a scheduled Governing Board meeting, a quorum shall be a majority of the Representatives representing Active Members. If a quorum is not present at a Governing Board meeting, then no official actions may be taken by the Governing Board and the meeting shall be adjourned without conducting official business. When a Representative cannot attend a Governing Board meeting, the applicable Member may appoint a proxy by providing written notice of such proxy to the Secretary. The proxy may be any Active Member, including another Representative. The act of a majority of those Representatives entitled to vote and present at a meeting at which a quorum is present shall be the act of the Governing Board, unless the act of a greater number is required by law or by these By-laws.

6.3 - Action Without A Meeting. Unless otherwise restricted by these By-laws, any action required or permitted to be taken at any meeting of the Governing Board or of any committee thereof may be taken without a meeting, if all Representatives entitled to vote, consent thereto in writing, and the writing or writings are filed with the minutes of proceedings of the Governing Board or committee.

6.4 - Telephonic or Other Meetings. Unless otherwise restricted by these By-laws, Representatives, or any committee designated by the Governing Board, may participate in a meeting of the Governing Board, or any committee, by means of conference telephone or similar communications equipment by means of which all persons participating in the meeting can hear each other, and such participation in a meeting shall constitute presence in person at the meeting.

6.5 Committees. NAWEA has four types of committees. Standing committees shall have a Committee Chair approved by the Governance Board. The Governance Board shall approve all committee charters. Chairs shall report committee activities as required by the Governance Board.

6.5.1 - Research Topic Committees. The Governing Board may appoint special “Research Topic Committees” from the NAWEA membership to plan and carry out Academy activities. Research Topic Committees may be appointed to perform studies or reviews of topics important to achieving the vision or mission of NAWEA. Research Topic Committees shall be guided by a written charter with a target completion date. Both the charter and the Research Topic



Committee membership shall be approved by the Governing Board. Research Topic Committees may be formed to address any relevant topic area, but are most likely to be formed to address important research topics as they develop. These research agendas are likely to bridge multiple disciplines and diverse organizations and involve national and international collaborations in order to address the science, engineering, economic, environmental, policy, and public acceptance issues that impede growth and acceptance of wind energy.

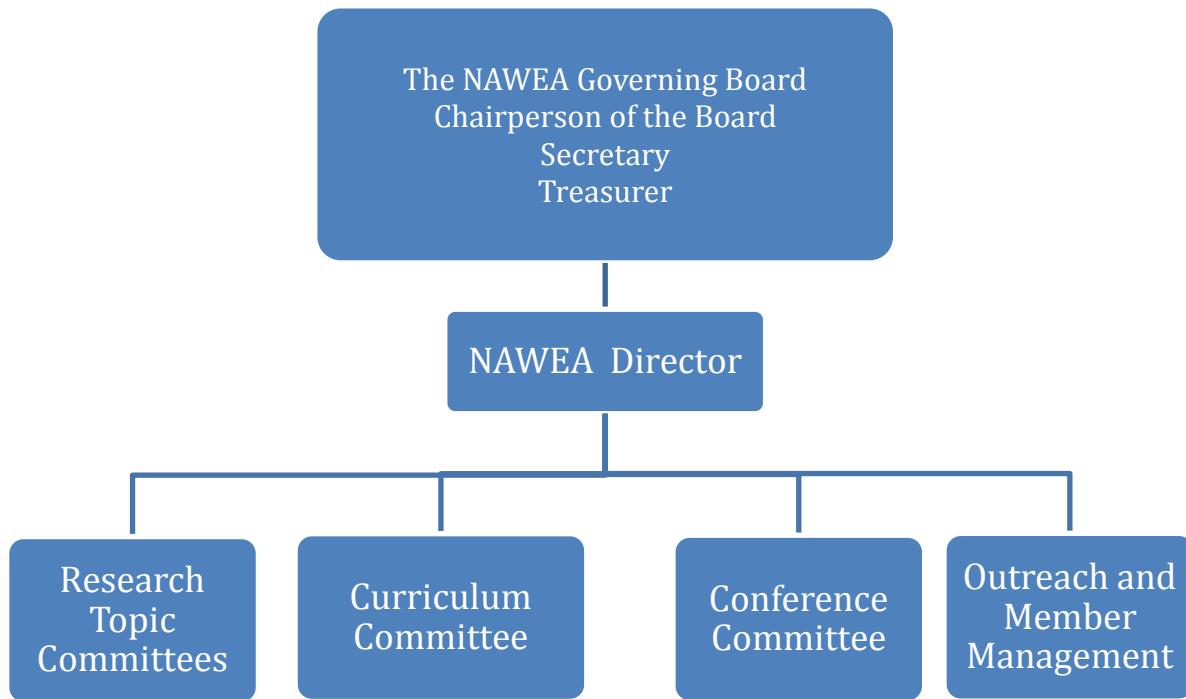
6.5.2 - Curriculum Committee. The Governing Board shall appoint a standing “Curriculum Committee” to develop and disseminate a recommended wind energy curriculum model. The Curriculum Committee shall be guided by a written charter. The wind energy curriculum model will bring together the best ideas and long established concepts through the collaborative efforts of the committee. Best practices and established curriculum models will guide the development of balanced high quality wind energy instructional programs. Both the membership of the Curriculum Committee and its charter shall be approved by the Governing Board.

6.5.3 - Conference Committee. The Governing Board shall appoint a standing “Conference Committee” to plan, manage, and hold NAWEA conferences. This committee is primarily charged with planning and managing an annual conference for the membership and the entire wind energy community. The annual conference may include presentations and interaction with the entire community engaged in wind energy to support an increase in wind deployment as described in the Charter. Furthermore, the conference may emphasize an exchange of ideas across all disciplines relevant to wind energy. The conference may also provide a special opportunity for graduate students to discuss and exchange ideas with each other, and with senior researchers, as well as industry representatives. The Conference Committee shall be guided by a written charter. Both the membership of the Conference Committee and its charter shall be approved by the Governing Board.

6.5.4 Outreach and Member Management Committee. The Governing Board shall appoint a standing Outreach and Member Management Committee. This committee will manage NAWEA’s internal and external communications and assist NAWEA’s Governing Board Secretary with member management. The committee will manage, develop, and disseminate NAWEA internal and external information that may be in the form of: internal member communications, publications or topical white papers authored by members, webinars, publicly accessible wind energy information databases, museum content and material, official NAWEA communications such as press releases, and NAWEA’s Internet presence. As the organization grows the Board may choose to split member management and outreach functions,



6.6 Organization



ARTICLE VII - *Seal*

The seal of the Academy shall be circular in form and shall bear the name of the Academy, the year of its formation, and the words “[TBD].”

ARTICLE VIII - *Fiscal Year*

The fiscal year of the Academy shall end on December 31 each year.

Article IX - *Conflicts of Interest*

9.1 - Conflicts Generally. In all instances, Members and their Representatives, as well as Officers and staff of the Academy, should avoid all actions involving material conflicts of interest with the Academy. From time to time, as necessary, the Governing Board may develop policy guidelines to avoid any such material conflicts of interest.



9.2 - Approving Transactions. No contract or transaction which may result in a direct or indirect financial or personal benefit to one or more of the Academy's Members, their Representatives, or the Academy's officers or staff shall be void or voidable solely for this reason, or solely because the Representative, officer, or staff member is present at or participates in the meeting of the Governing Board or committee thereof which authorizes the contract or transaction, or solely because an interested individual's vote is counted or such purpose, if:

- a. The material facts of the individual's or individuals' relationship or interest to the contract or transaction are disclosed or are known to the Governing Board or the committee, and the Governing Board or committee explicitly reviews the matter with the concerned individual or individuals absent while that matter is being discussed; and
- b. The Governing Board or committee in good faith authorizes the contract or transaction by the affirmative vote of a majority of the disinterested directors or committee members, even though the disinterested directors or committee members be less than a quorum; and
- c. the contract or transaction is fair to the Academy as of the time it is authorized, approved, or ratified by the Governing Board or a committee thereof.

9.3 - Recusal. Members, Representatives or other personnel with a conflict of interest shall recuse themselves from Governing Board or committee meetings during both discussion and votes on possible conflict of interest situations.

9.4 – Quorum – Interested Representatives. Representatives or committee members with a conflict of interest may be counted in determining the presence of a quorum at a meeting of the Governing Board or of a committee which authorizes the contract or transaction.

ARTICLE X - *Indemnification and Insurance*

A Representative or Officer of the Academy shall not be liable to the Academy or its Members for monetary damages for breach of fiduciary duty as a Representative or Officer, except to the extent such exemption from liability or limitation thereof is not permitted by law as currently in effect or as the same may hereafter be amended. No amendment, modification or repeal of this section shall adversely affect any right or protection of a Representative or Officer that exists at the time of such amendment, modification or repeal.

The Academy shall indemnify its officers, directors, employees, and agents to the maximum extent permitted by the laws of the State of [TBD].

The Academy may purchase and maintain insurance on behalf of itself or any person who is or was a director, officer, advisor, employee, or agent of the Academy against any liability asserted against him or her and incurred by him or her in any such capacity or arising out of his or her status as such.



ARTICLE XI - Amending the By-laws and Dissolution of NAWEA

11.1 - Amending the By-laws. These By-laws may be altered, amended or repealed at any regular or special meeting of the Governing Board at which a quorum is present, duly called and held, by a majority of the present Representatives entitled to vote. Vote may also occur by mail-in, e-mail, or by proxy.

11.2 - Dissolution. Dissolution of NAWEA may be accomplished by a two-thirds (2/3) majority vote of the Governing Board at any regular or special meeting of the Governing Board at which a quorum is present, duly called and held, by a majority of the present Representatives entitled to vote. Votes regarding dissolution may also occur by mail-in, e-mail, or by proxy. In the event of dissolution, the Governing Board shall, after paying and making provisions for the payments of all liabilities of the Academy, distribute all the Academy's assets to an organization dedicated to charitable and/or educational purposes consistent with the Charter.