

The Vision and Charter for the North American Wind Energy Academy

The Inaugural Meeting
at the University of Massachusetts
Amherst, Massachusetts

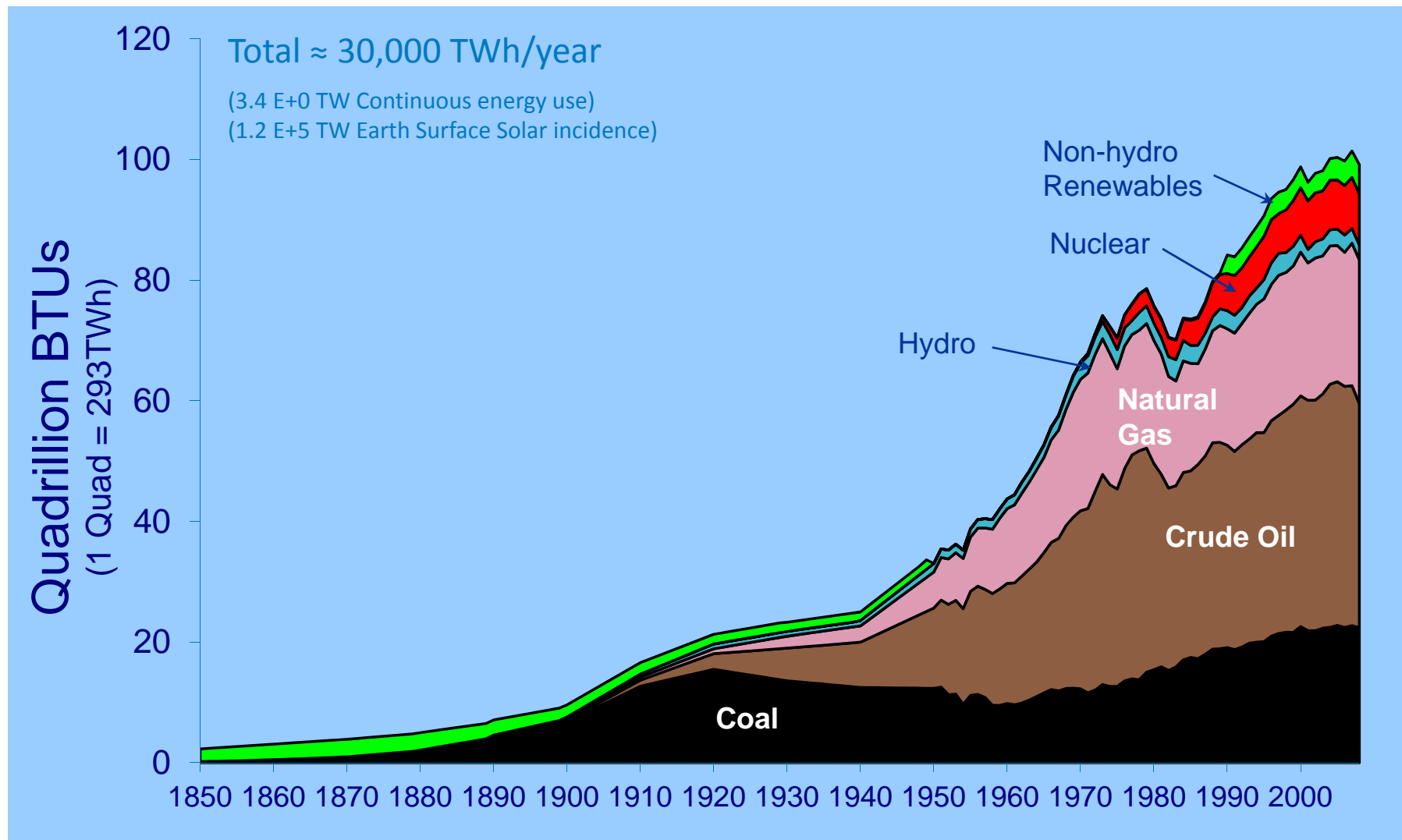
By Bob Thresher, NREL Research Fellow

August 8, 2012

NREL/PIX 19017

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

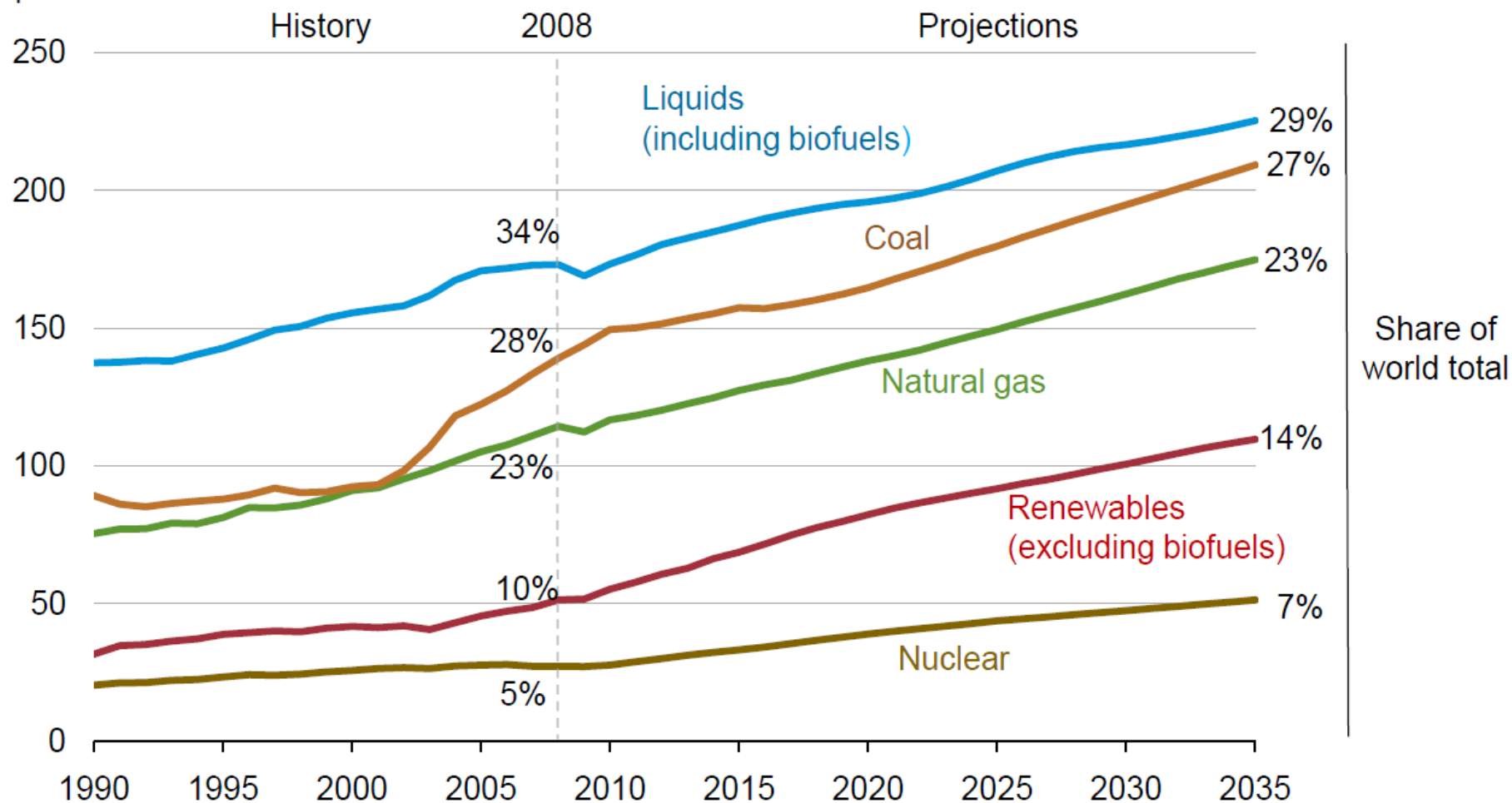
The U.S. Energy Picture 1850-2008



Source: 1850-1949, Energy Perspectives: A Presentation of Major Energy and Energy-Related Data, U.S. Department of the Interior, 1975; 1950-1996, Annual Energy Review 1996, Table 1.3. Note: Between 1950 and 1990, there was no reporting of non-utility use of renewables. 1997-2008, Annual Energy Review 2008, Table F1b.

Renewables are the Fastest Growing Energy Source

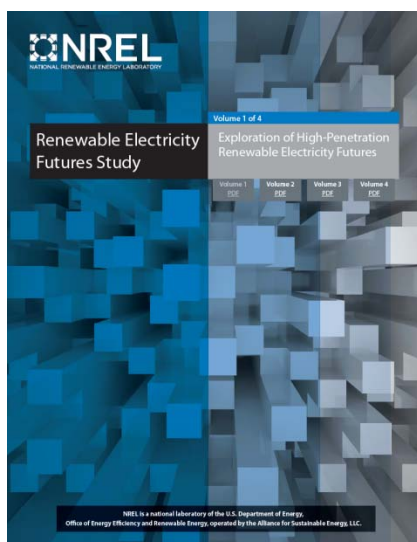
world energy consumption by fuel
quadrillion Btu



Source: EIA, International Energy Outlook 2011

The Renewable Electricity Futures Study

- RE Futures is an analysis of the U.S. electric sector focused on 2050 that explores
 - Whether the U.S. power system can supply electricity to meet customer demand with high levels of renewable electricity, including variable wind and solar
 - Grid ingeneration using models with unprecedented geographic and time resolution for the contiguous U.S.
 - Synergies, constraints, and operational issues associated with a transformation of the U.S. electric sector

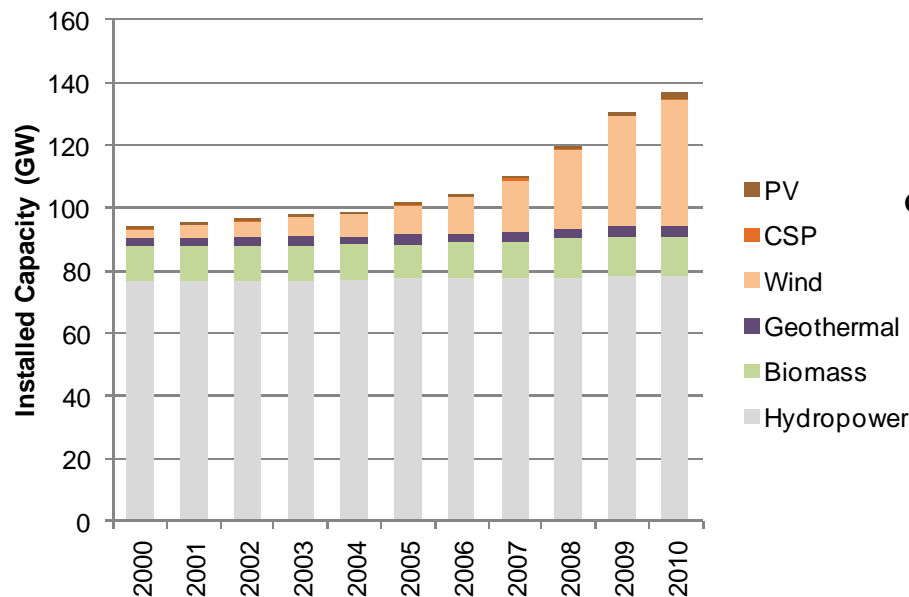


Renewable Electricity Futures Study (2012). Hand, M.M.; Baldwin, S.; DeMeo, E.; Reilly, J.M.; Mai, T.; Arent, D.; Porro, G.; Meshek, M.; Sandor, D., editors. Lead authors include Mai, T.; Sandor, D.; Wiser, R.; Heath, G.; Augustine, C.; Bain, R.; Chapman, J.; Denholm, P.; Drury, E.; Hall, D.; Lantz, E.; Margolis, R.; Thresher, R.; Hostick, D.; Belzer, D.; Hadley, S.; Markel, T.; Marnay, C.; Milligan, M.; Ela, E.; Hein, J.; Schneider, T.

- A U.S. DOE sponsored collaboration among more than 110 individuals from 35 organizations.
- Released June 2012 - http://www.nrel.gov/analysis/re_futures/

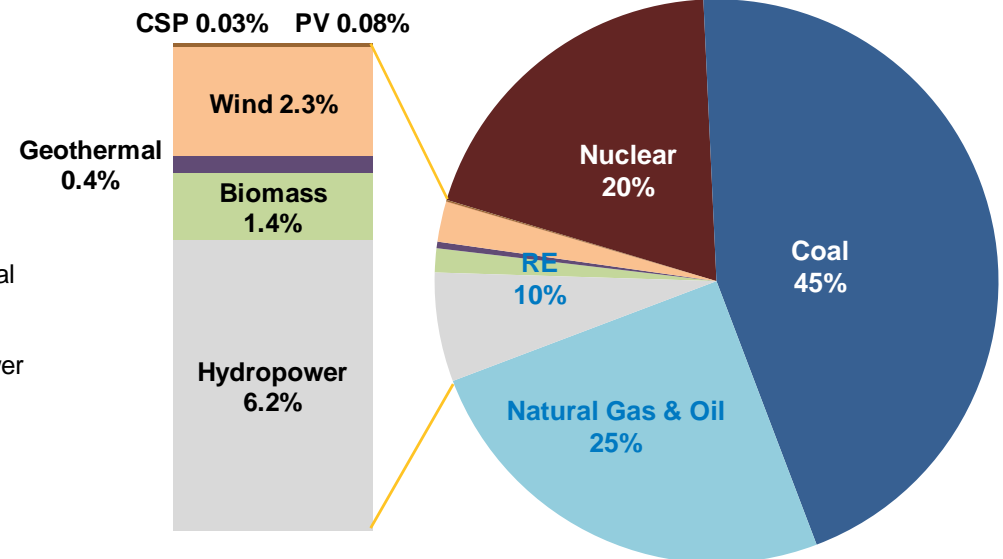
Renewable Energy Futures Study Context

RE Capacity Growth 2000-2010



Source: RE Data Book (DOE 2011)

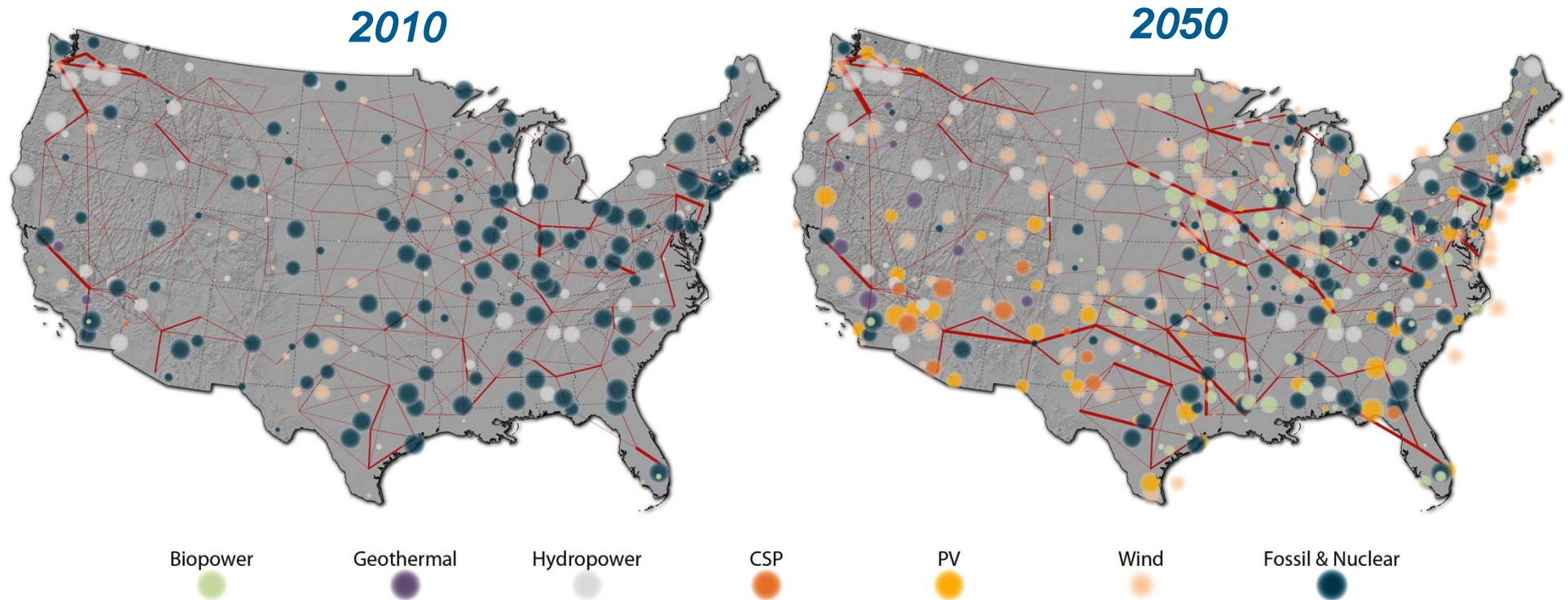
2010 Electricity Generation Mix



Source: EIA Annual Energy Review, (DOE October 2011)

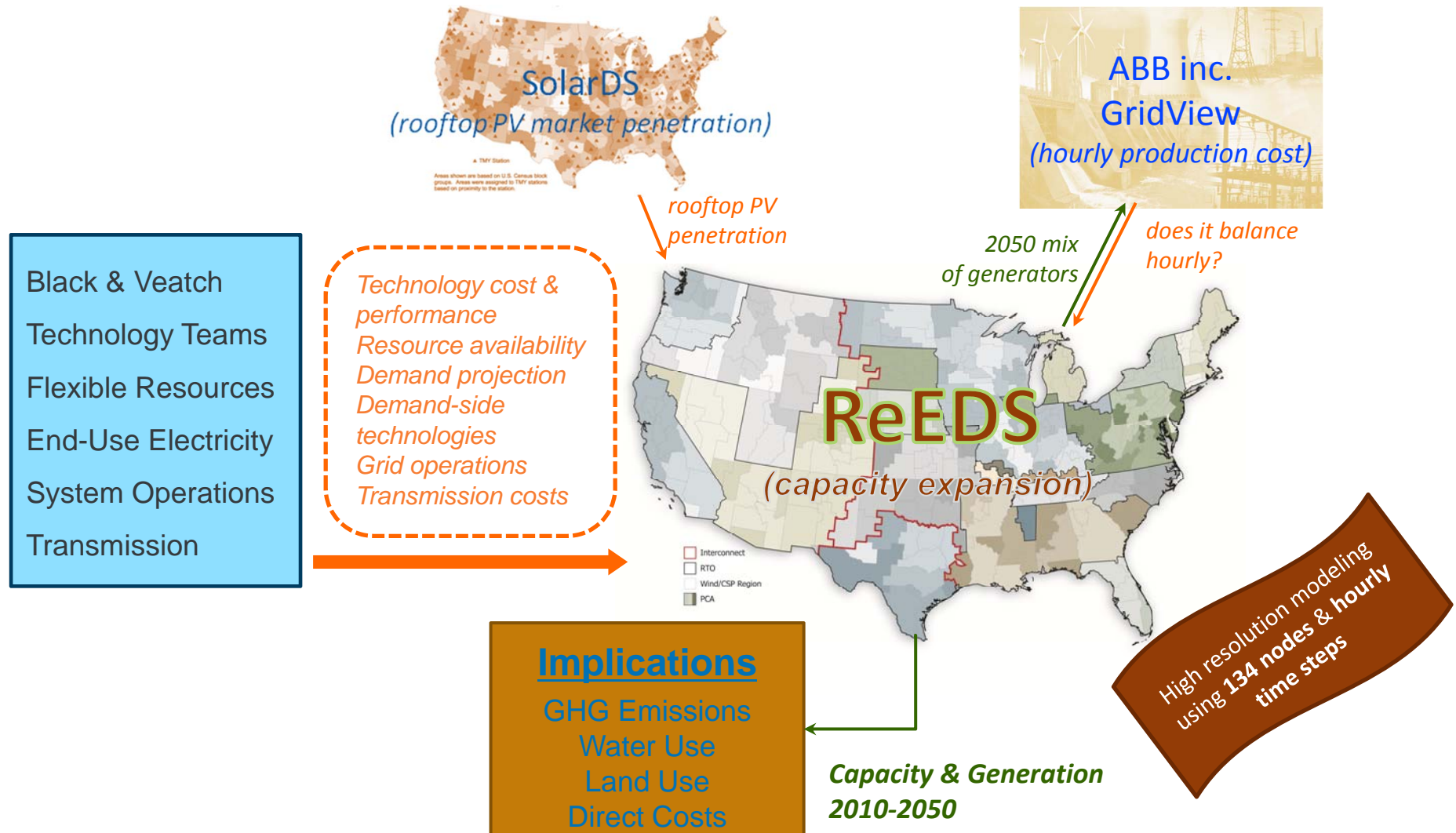
- RE is a low carbon, low air pollutant, low fuel use, low water use, domestic, sustainable electricity source.
- To what extent can renewable energy technologies commercially available today meet the U.S. electricity demand over the next several decades?

A Transformation of the U.S. Electricity System



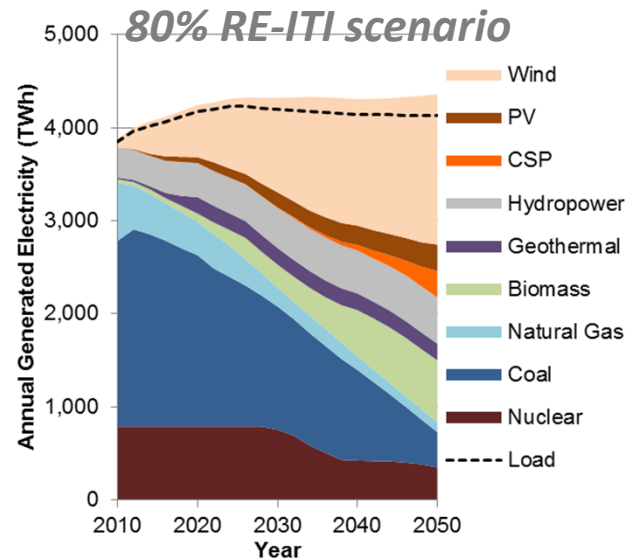
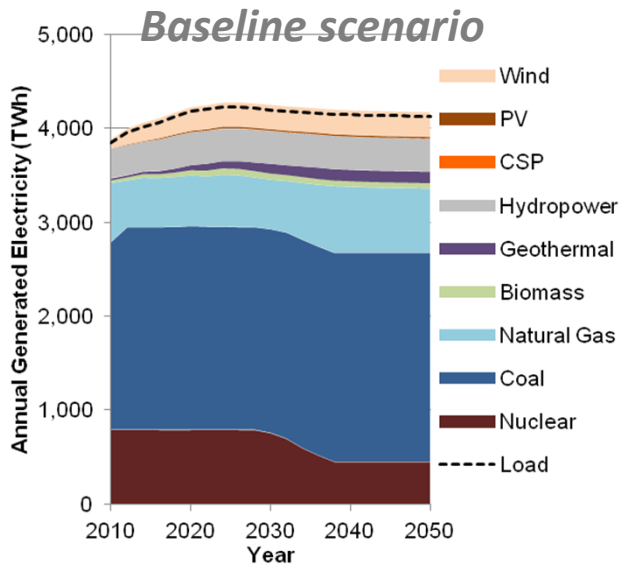
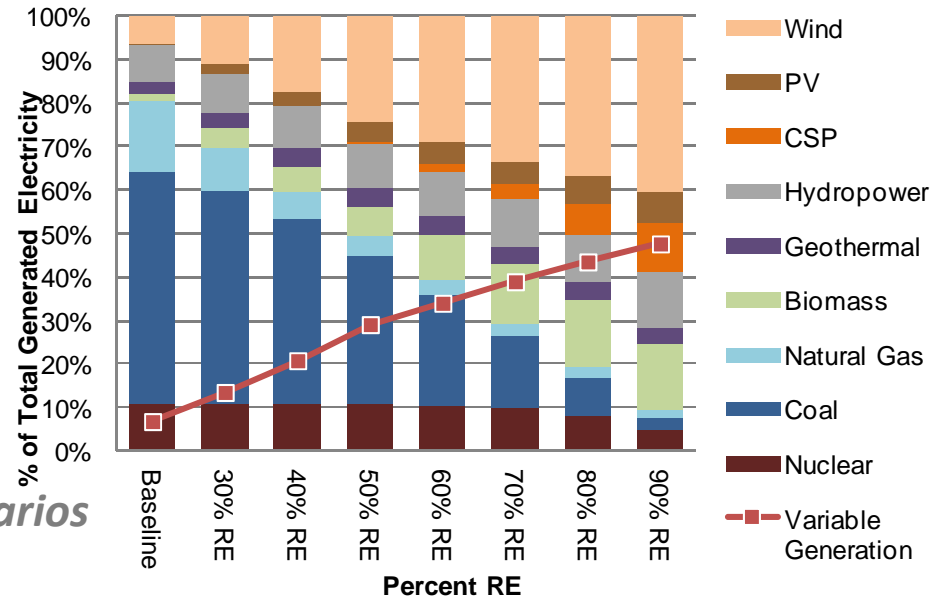
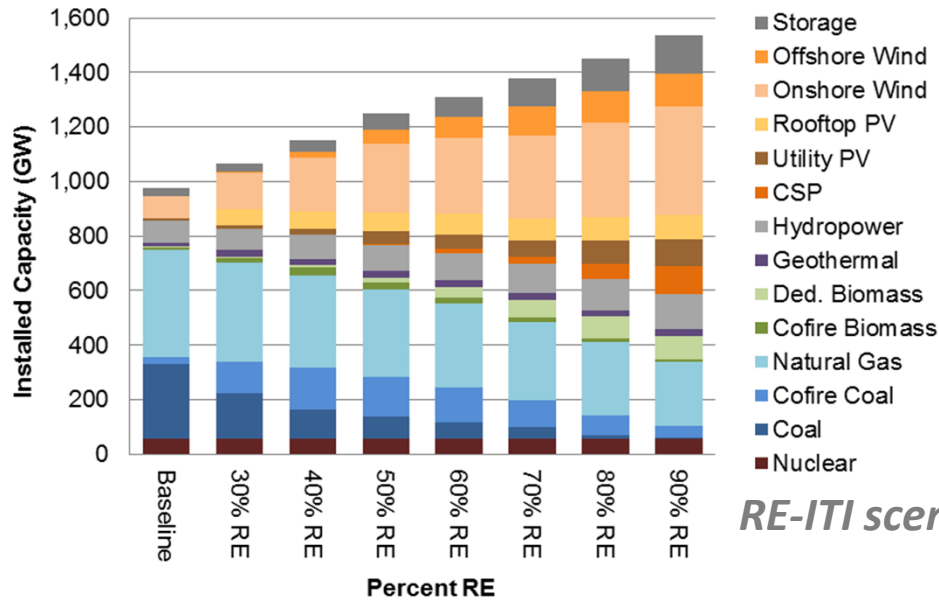
RE generation from technologies that are commercially available today, in combination with a more flexible electric system, is more than adequate to supply 80% of total U.S. electricity generation in 2050 while meeting electricity demand on an hourly basis in every region of the country

Scenario Modeling Framework

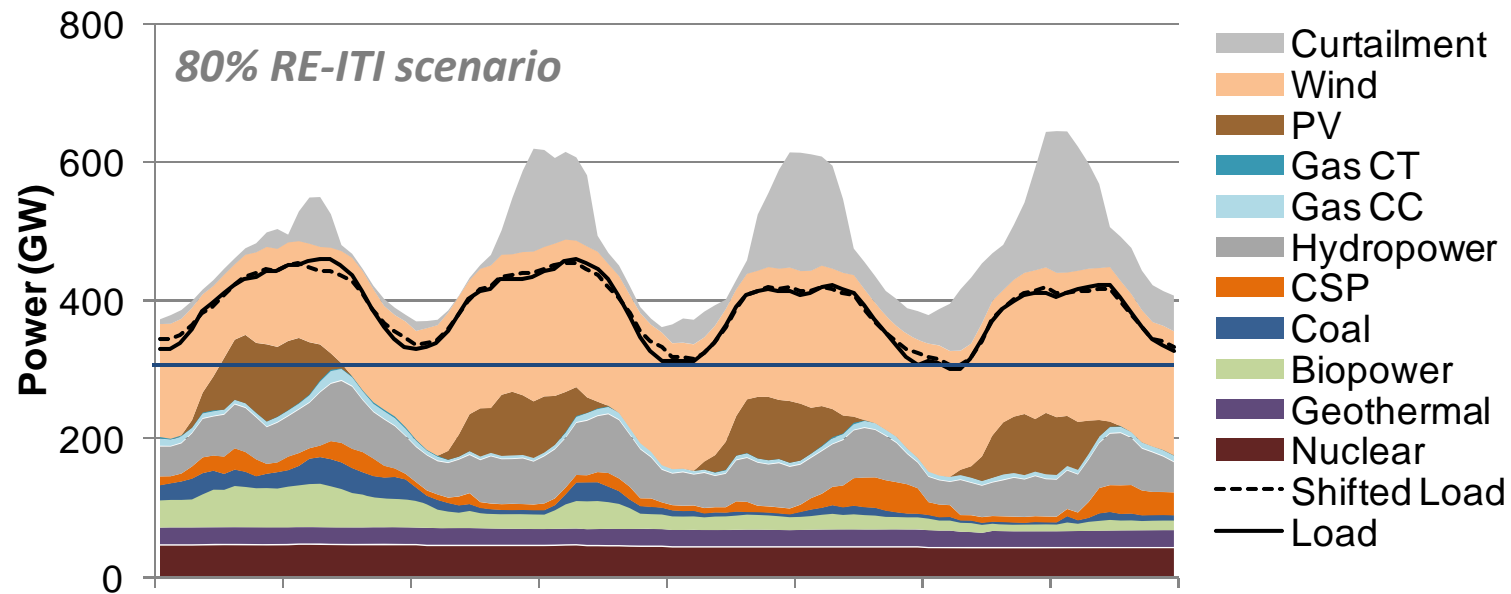


“Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful.” A quote Taken from: *Empirical Model-Building and Response Surfaces* by George E. P. Box, and Norman Richard Draper, p. 74

Renewable generation resources could adequately supply 80% of total U.S. electricity generation in 2050 while balancing hourly supply and demand



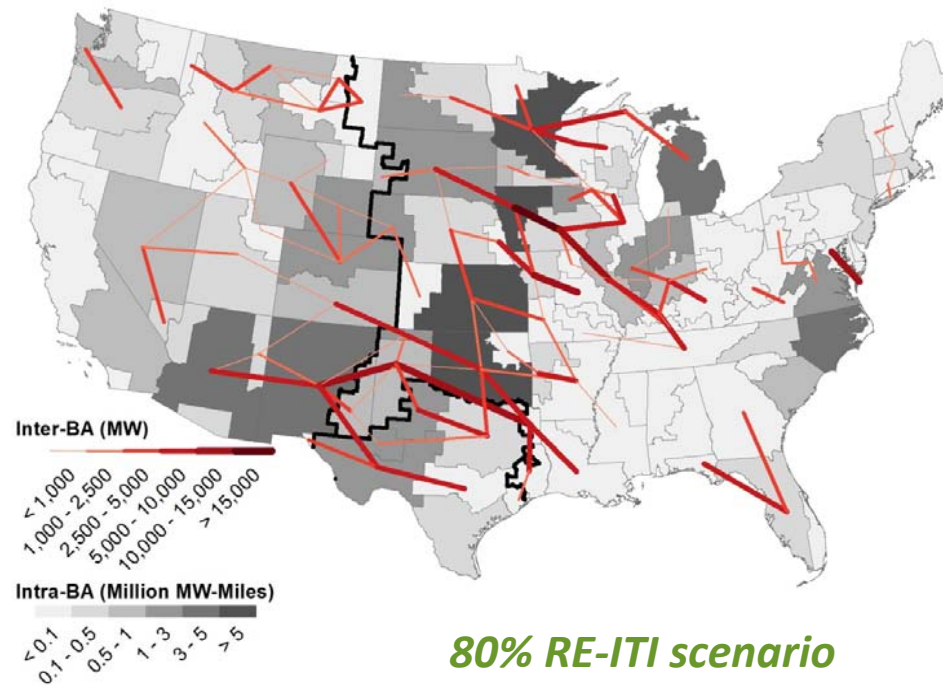
Additional planning and operational challenges include management of low-demand periods and curtailment of excess electricity



Source: Renewable Electricity Futures (2012)

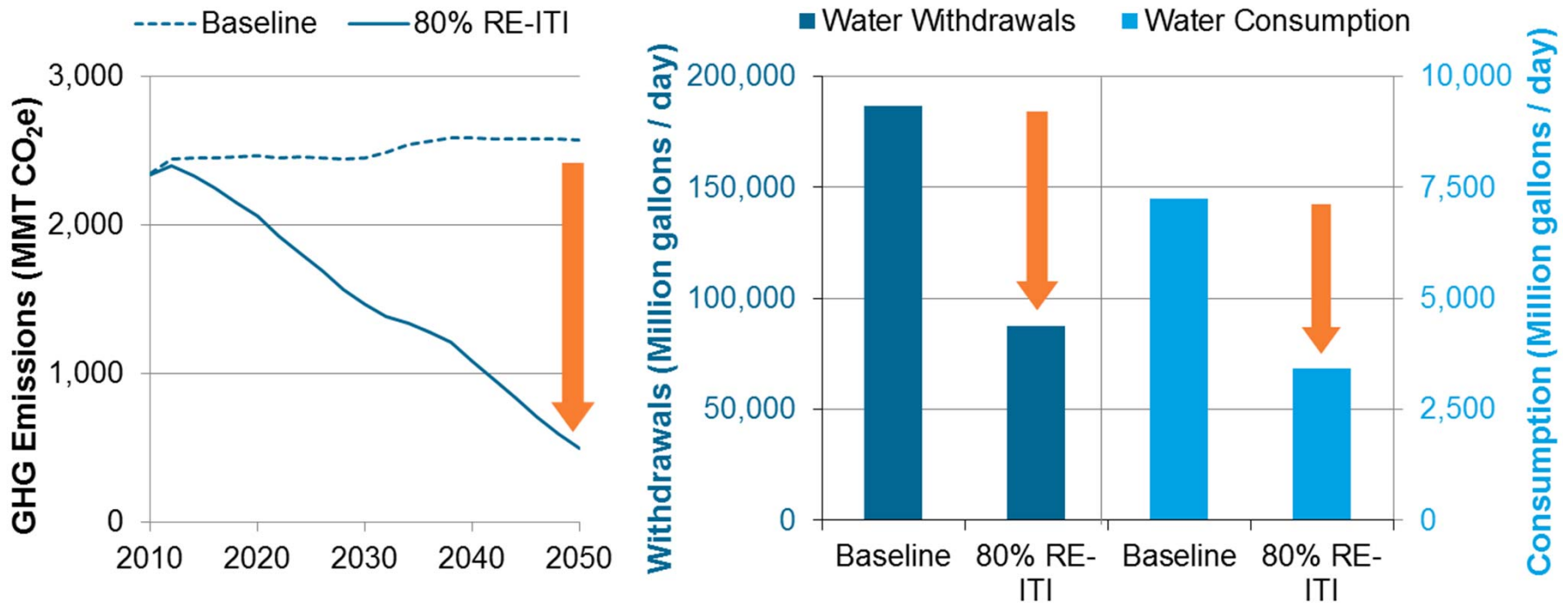
- Operational challenges for high renewable scenarios are most acute during low-demand periods (e.g., spring)
- Greater thermal power plant ramping and cycling
- Increased curtailment of excess renewable generation (8-10% of wind, solar, and hydropower curtailed in 2050)
- Storage and demand-side options (e.g. PHEV charging) can help shift loads to mitigate these challenges, e.g. 100-150 GW of storage and 28-48 GW of interruptible load deployed in 2050 for the (low demand) 80%-by-2050 RE scenarios.

As renewable electricity deployment increases, additional transmission infrastructure is required



- In most 80%-by-2050 RE scenarios, 110-190 million MW-miles of new transmission lines are added
- AC-DC-AC interties are expanded to allow greater power transfer between asynchronous interconnects
- However, 80% RE is achievable even when transmission is severely constrained (30 million MW-miles)—greater reliance on local resources (e.g. PV, offshore wind)
- Annual transmission and interconnection investments in the 80%-by-2050 RE scenarios range from B5.7-8.4/\$year, which is within the range of recent total investor-owned utility transmission expenditures
- High RE scenarios lead to greater transmission congestion, line usage, and transmission & distribution losses

High RE Reduces Emissions and Water Use

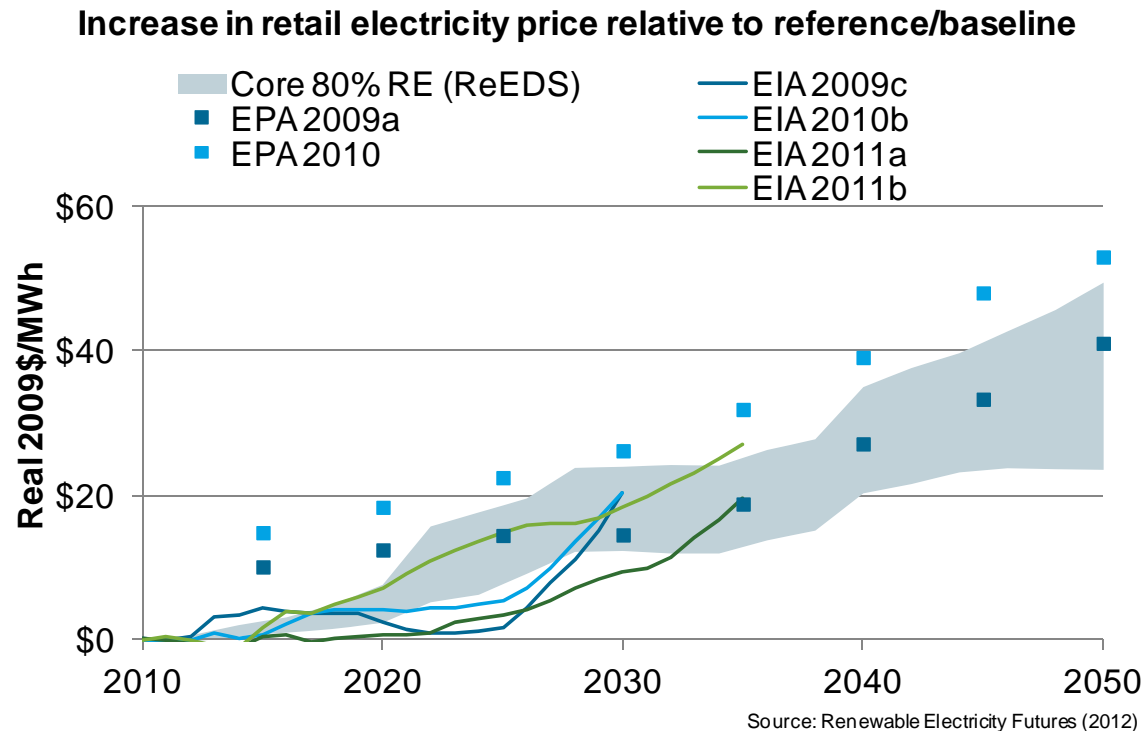


Source: Renewable Electricity Futures (2012)

80% renewable electricity in 2050 could lead to:

- ~ 80% reduction in GHG emissions (combustion-only and full life-cycle)
- ~ 50% reduction in electric sector water use (withdrawals and consumption)

Incremental cost associated with the High RE Generation is Comparable to published cost estimates of other clean energy scenarios



- **Comparable to incremental cost for clean energy and low carbon scenarios evaluated by EIA and EPA**
- **Reflects replacement of existing generation plants with new generators and additional balancing requirements (combustion turbines, storage, and transmission) compared to baseline scenario (continued evolution of today's conventional generation system)**
- **Assumptions reflect incremental or evolutionary improvements to currently commercial RE technologies and do not reflect U.S. DOE activities to further lower these costs**

Wind Energy's Past Evolution

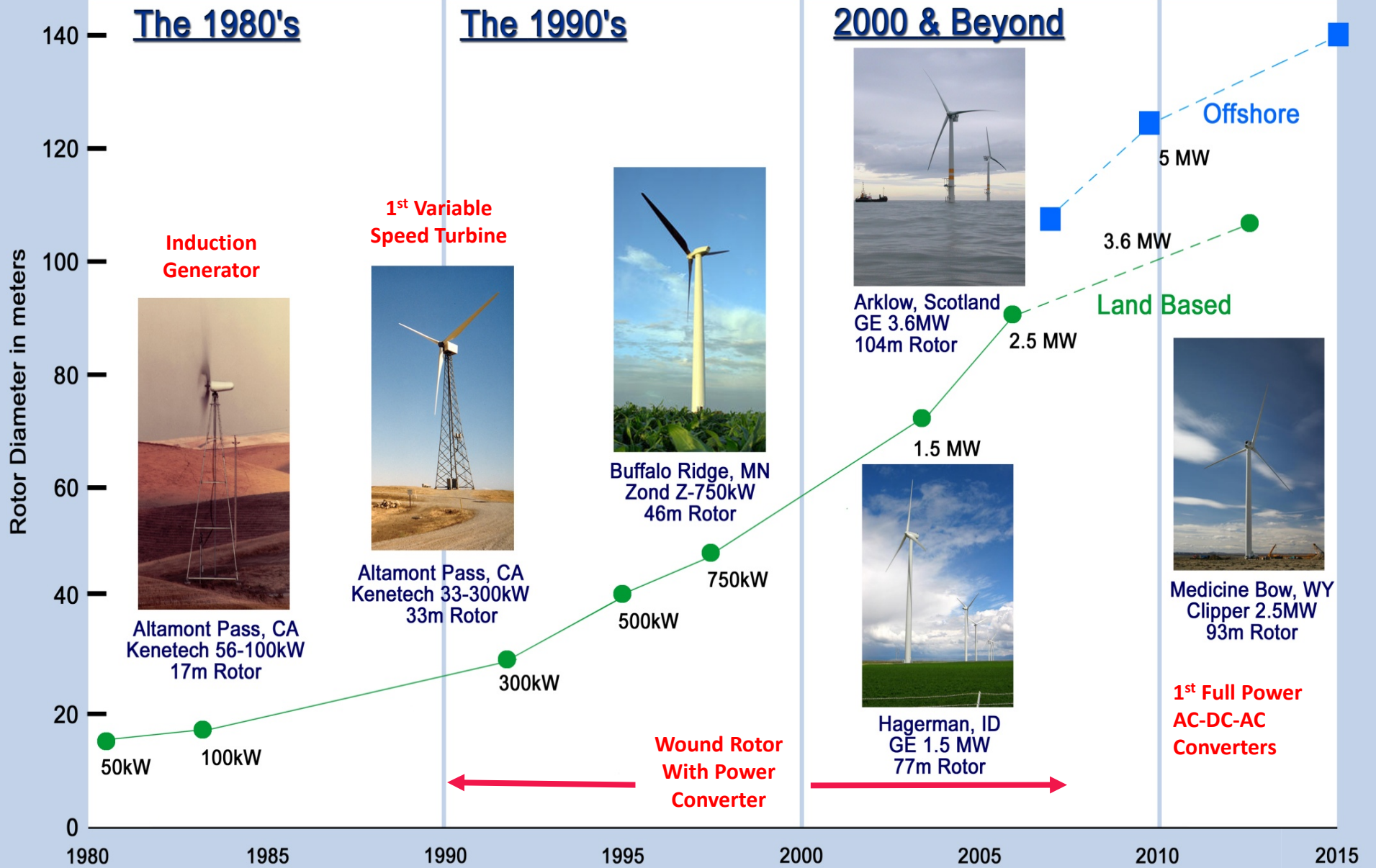


Photo credits left to right: Photo from Bob Thresher, Photo from Bob Thresher, NREL/PIX 6325, 14337, 13044, 13886

Institutions That Play A Role in Wind Energy

Federal Institutions

The U.S. Congress

Research Agencies:

- DOE
- USGS
- NSF
- NASA
- NOAA
- FFRDCs

Regulatory Agencies:

- FERC
- NERC
- BOEMRE
- USFWS
- BLM
- NOAA
- EPA

Application Agencies:

- DOD
- Coast Guard
- DHS
- USDA

U.S. Industry Groups

- Manufacturers (OEMs)
- Developers
- Consulting Companies
- Equipment Suppliers
- O & M Companies
- Financial Institutions
- Installation Companies
- **AWEA**
- EPRI

State Agencies

- Economic Development
- Public Utility Commissions
- Departments of Wildlife
- Permitting Authorities
- Energy Siting Authorities

Collaborative Wind Research Organizations

- **NWCC**
- **UWIG**
- **BWEC**
- **AWWI**
- **GLWC**

University Institutions

- Engineering Schools
- Business Schools
- Economics Schools
- Oceanography Schools
- Political Science Schools
- Biology/Environmental Science
- Technical Community Colleges

Non-Government

Organizations

- Union of Concerned Scientists
- Defenders of Wildlife
- The Nature Conservancy
- Clean Energy States Alliance
- Audubon
- The Wildlife Society
- AFWA
- Sierra Club
- Greenpeace

go

HOME

ABOUT NWCC

NEWS & EVENTS

WORKGROUPS

PUBLICATIONS

RESOURCES

JOIN NWCC



Transmission

The NWCC Transmission Workgroup advances the national dialogue on current transmission issues, increasing stakeholder... > read more



Wildlife

The NWCC Wildlife Workgroup identifies, defines, discusses, and through collaboration addresses wind-wildlife and wind-habitat interaction issues... > read more



Siting

Significantly increasing the production of renewable energy requires a sound understanding of the considerations involved in siting wind energy... > read more

Welcome to NWCC

The National Wind Coordinating Collaborative (NWCC) provides a neutral forum for a wide range of stakeholders to pursue the shared objective of developing environmentally, economically, and politically sustainable commercial markets for wind power in the United States. Formed in 1994, this partnership of experts and interested parties identifies issues that affect the use of wind power. By establishing dialogue on key and current topics and catalyzing activities that build consensus among its stakeholders, the NWCC has successfully addressed critical challenges in the areas of transmission, wildlife and habitat impacts, siting, power markets, and other aspects of wind development.

Facilitation and administrative support for the NWCC is provided by RESOLVE, a non-profit collaboration organization, in partnership with Keams and West's specialists in collaborative facilitation and communication. The NWCC is funded by the U.S. Department of Energy's Wind and Water Technologies Program.



Sign Up to Receive Monthly Updates

submit

Source: <http://www.nationalwind.org/>



Our Mission

The mission of the Utility Wind Integration Group (UWIG) is to accelerate the development and application of good engineering and operational practices supporting the appropriate integration of wind power into the electric system. This will be accomplished through the coordinated efforts and actions of its members in collaboration with wind industry stakeholders, including federal agencies, trade associations, and industry research organizations.

Membership is open to utilities and other entities that have an interest in wind generation.

Our Objectives

- Provide a forum for the critical analysis of wind technology for utility applications. Through this forum, provide current credible information on the status of wind technology and deployment worldwide
- Continue to create and deliver products and services that meet the individual and collective needs of our members
- Articulate the needs and requirements of electric utilities for wind power to be considered as a viable generating option
- Enhance the credibility of and identify opportunities for wind power application in the electric utility sector
- Provide guidance to the industry, state, and national wind development programs, including those of the U.S. Department of Energy and EPRI
- Encourage member involvement in the national wind program activities

Source: <http://www.uwig.org>



As concerns about climate change and increasing costs and long-term environmental impacts from the use of fossil fuels have heightened, wind has become an increasingly important sector of the energy industry. Wind-generated electricity is renewable and generally considered environmentally clean. However, the direct and indirect local impacts of wind facilities on wildlife continue to be an issue and widespread instances of fatality of birds and bats have been reported.

<http://www.batsandwind.org/index.php>

Unexpectedly high numbers of bat fatalities reported at wind energy sites, especially those on ridge tops in the eastern United States, have heightened the urgency to understand problems and find solutions.

The Bats and Wind Energy Cooperative (BWEC) was formed in 2003 by Bat Conservation International (BCI), the US Fish and Wildlife Service, the American Wind Energy Association (AWEA), and the National Renewable Energy Laboratory of the US Department of Energy (NREL). In addition to the founding organizations, BWEC also is funded by a diversity of partners.



BCI Founder and President Merlin Tuttle and Jessica Kerns, University of Maryland, inspect bats killed at wind turbines (Photo from Merlin Tuttle, BCI.)



HOME ABOUT AWWI INITIATIVES PARTNERS

SUPPORT AWWI NEWS RESOURCES CONTACT



AWWI's Mission and Methods

The American Wind Wildlife Institute has a two-part mission: *To facilitate timely and responsible development of wind energy, while protecting wildlife and wildlife habitat.*

AWWI was created and is sustained by a unique collaboration of environmentalists, conservationists, state wildlife agencies, and wind industry leaders. Our purpose is to help lay the scientific groundwork and best practices for wind farm siting and operations, through [targeted initiatives](#): wind-wildlife research, landscape assessment, mitigation, and education.

AWWI partner organizations are committed to these principles:

Partner Login:

Username

.....

Go

Remember Me | [Forgot Password?](#)

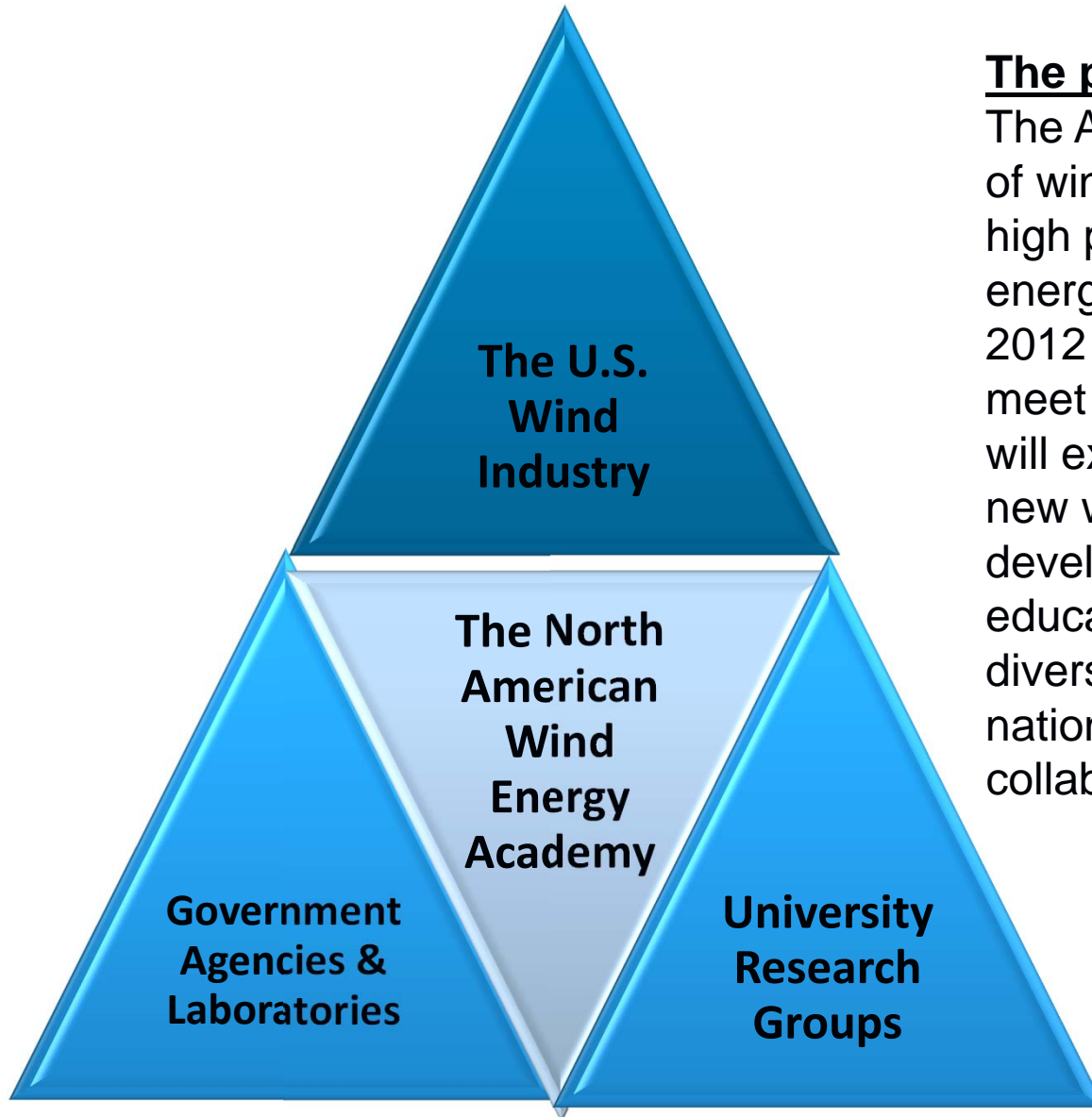
[Landscape Assessment Tool \(LAT\)](#)

AWWI announces software upgrade to Landscape Assessment Tool. Test drive our new look and faster speeds by clicking the button above.

Source: <http://www.awwi.org>

The North American Wind Energy Academy Charter

“The Academy Bridges Institutions to Facilitate Research and Education in Wind Energy”



The purpose

The Academy will facilitate the growth of wind power into a cost effective high penetration sustainable national energy source producing ten times 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.

Vision and Mission

Vision

The North American Wind Energy Academy will be the leading organization in North America – including the United States, Canada, and Mexico - that advises and facilitates research, education, development, and technical advancements necessary for wind energy to achieve more than a tenfold increase in capacity, producing over 20% of each nation's electrical energy.

Mission

North America's foremost intellectual assets are brought together and their collective talents are applied 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

The NAWEA Approach

1. Work to expand the breadth and competence of the wind energy academic community to ensure the continued advancement of wind energy through:
 - **Developing and disseminating a recommended wind energy curriculum**
 - **Developing and sponsoring activities that enhance and augment 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**
 - **Establishing a collaboration agreement among North American Universities and with the European Academy of Wind Energy (EAWE) that facilitates joint projects and special summer educational programs, in addition to, the exchange of information, students, faculty, and postdoctoral researchers**

The NAWEA Approach (Continued)

2. Encourage communication across disciplines, agencies and stakeholder groups to address key challenges by fostering research and development collaborations that brings together necessary disciplines to address topics critical to the advancement of wind energy, such as:

- **Wind system science and engineering**
- **Grid integration and operation**
- **Business, finance and economics**
- **Atmospheric sciences**
- **Environmental and institutional impacts**
- **Market barriers**
- **Social acceptance**
- **Policy evolution**

The NAWEA Approach (Continued)

3. Facilitate and sponsor the creation of unbiased working groups, programs and activities that develop accurate and relevant scientific information on wind power's benefits and impacts, and actively communicate that information to decision makers and the general public, for example promote programs that:
- **Continue the responsible advancement of wind technology**
 - **Accelerate the development of world-class manufacturing capability and jobs creation**
 - **Enhance appropriate wide-spread deployment**
 - **Foster activities that can lead to the full realization of the energy, environmental, social, and economic benefits offered by wind power**

Educational Program

- 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 augment 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 across all NAWEA university members. Student exchanges within 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 community 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 industry with insight into the skills and experience needed to address current technical challenges confronting industry.

Educational Program (Continued)

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, and energy graduate fellowships.
 - An exchange program within NAWEA and EAWE that facilitates research collaborations, as well as student and faculty exchanges.

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 all be able to participate.
- 2. Research collaboration facilitation** - NAWEA will facilitate the formation of voluntary working groups that explore and address research topics in emerging, evolving, or critical areas in wind energy research with the objective of developing topical white papers or to establish ad hoc virtual Dynamic External Advisory Initiatives (DEAI). 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 “Outstanding Young Researcher Award” each year to encourage and recognize the importance of new researchers to the community and the need for innovative research in the wind community. (This award is 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 across the members, and enrich the graduate student experience. International exchange opportunities with EAWE members will be established.

NAWEA Annual Activities

- 1. Annual Conference and Workshop** - NAWEA will sponsor an annual conference with workshops 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 the strategic agendas and activities for NAWEA.** Representation is provided from Institutional groups, Academic groups, Industry groups, and the NAWEA Members at Large. The results of these meetings will be made available to the members of NAWEA
- 3. Working Groups Working Groups will be established by NAWEA.** These working groups have the responsibility to establish the NAWEA Strategic Focus.

NAWEA Other Activities

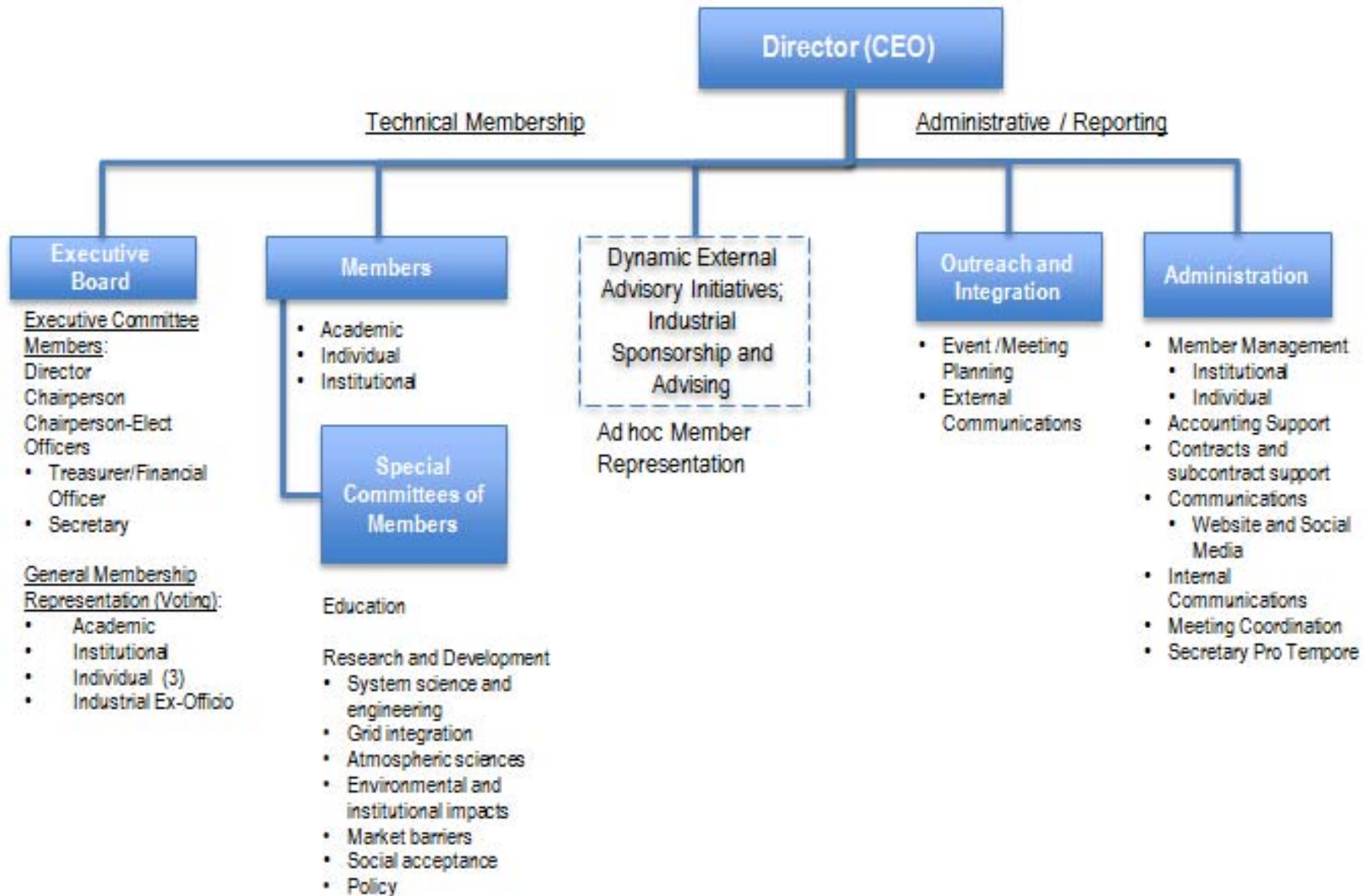
- 1. Dynamic External Advisory Initiatives (DESI) with Ad Hoc Members** This is an advisory function with members which have an interest in NAWEA, but are not core to the action and implementation. This activity is intended to keep NAWEA apprised of current and temporal needs such that NAWEA is cognizant of near-term issues, while focusing on long term goals; A self-governing and independent Industrial Advisory Group is expected to NAWEA as a mechanism for providing critical industrial perspective and guidance.
- 2. Outreach** - The outreach action is intended to help NAWEA's major activities find the relevant venue(s) for implementation and will focus on the development and dissemination of objective information regarding topics that may of interest to the public and policy makers. These could include, but are not limited to:
 1. Topical white papers
 2. Webinars
 3. Publically accessible wind energy information databases
 4. Development of museums content and material

NAWEA Memberships

Member Type	Description
Institutional Member	Nonprofit organizations, research laboratories, and governmental entities
Academic Member	Universities including divisions or units, and other academic bodies
Individual Member	An individual who supports the Vision, Mission, and Initiatives of NAWEA may be a Member

Member Type	Annual Membership Dues
Institutional Member	\$5,000
Academic Member	\$3,000
Individual Member	\$100

NAWEA Organization



NAWEA Organizational Roles

Position	Role	Responsibility	Voting
Officers			
<u>Executive Committee (EC):</u> With the exception of the Director, selected from the Executive Board (EB)			
Director	Leadership and Governance	Ensure effective and efficient operations and maintains focus on Academy strategic direction	No, as an EC/EB member; Yes, for votes put forth to individual members
Chairperson	Leadership of the EB	Manage the Executive Board	Yes
Chairperson-Elect	Assistant to Chair	Act for the Chair in emergency or extended absence	Yes
Treasurer	Financial Officer	Insure sound financial management and record keeping	Yes
Secretary	Membership records and meeting minutes	Maintain accurate and comprehensive records of membership and meetings	Yes
The Board: The Members at Large are selected from the Individual Membership			
All Board Members: Academic Institutional Member at Large	Conduct the business of the Academy	Ensure the Academy follows strategic direction and remains financially solvent	Yes
Institutional	Board	Research and Broad Technical and Representation	Yes
Academic	Board	Educational and Outreach Representation	Yes
Member at Large (3)	Board	General Constituency Representation	Yes
Ex-officio Member	Advisory - Invited to serve by the Board	Industry and other organizations	Non voting - does not pay dues

NAWEA Charter Drafting Committee

Chairman: Doug Cairns, Montana State University

Members:

- Barry Butler, University of Iowa
- Edgar DeMeo, Renewable Energy Consulting Services
- Mike Knotek, RASEI University of Colorado
- James Manwell, University of Massachusetts, Amherst
- Pat Moriarty, National Renewable Energy Laboratory
- Will Shaw, Pacific Northwest Laboratory
- Diane Stolts, RASEI University of Colorado
- Andy Swift, Texas Tech University
- Bob Thresher, National Renewable Energy Laboratory
- Case Van Dam, University of California, Davis
- Paul Veers, National Renewable Energy Laboratory