



John Bosche

*President and Principal Engineer
Bellingham, WA, United States*

Summary

John Bosche has more than 35 years of experience in the wind industry with involvement in a broad range of projects. He has worked on basic engineering research, wind turbine design and analysis, component manufacturing, structural and performance field testing, root cause analysis, turbine verification, due diligence investigations, project planning and construction, commissioning testing, operations and maintenance, and design of retrofits. Mr. Bosche also has experience with procuring land leases, collecting and analyzing wind resource data, and calculating project performance projections. Past clients include turbine manufacturers, component vendors, project developers, electrical utilities, insurance companies, government laboratories, and law firms. He is a registered U.S. Patent Agent with experience obtaining patent protection on inventions representing a variety of technologies.

Professional Experience

2017 to present

Bureau Veritas Renewables Technical Advisory (previously ArcVera Renewables and before that Chinook Wind) - Golden, CO, United States

President and Principal Engineer

- Developed and grew a business providing technical and engineering consulting services to the wind and solar industries.
- Services provided included wind turbine design evaluation, testing, and analysis, independent engineering, owner engineering, performance testing and evaluation, wind data collection and analysis, site selection, due diligence, and project management.
- Provided Independent Engineering services for structured project financing on more than 250 wind farms.
- Provided due diligence related to M&A transactions for more than 60 wind farms.
- Provided wind turbine technology reviews for over 50 models of wind turbines.
- Reviewed insurance claims for approximately 300 component failures and provided root cause analysis on dozens of non-insurance investigations involving .
- Acted as expert witness in nine litigation or arbitration cases involving cases including component failures, project underperformance, construction delays, and wrongful death. Deposed on three occasions and testified in an arbitration once.
- Performed power curve testing on approximately 90 wind turbines.

2001 to 2017

Chinook Wind - Everson, WA, United States

Principal Engineer

- Developed and grew a business providing technical and engineering consulting services to the wind and solar industries. Services provided included wind turbine design, testing, and analysis, owner engineering, performance monitoring and evaluation, wind data collection and analysis, site selection, due diligence, and project management.
- Provided contract development and engineering support to clients such as enXco (now EDF), PPM Energy (now Avangrid), Ridgeline Energy, Energy Northwest, and Avista.
- Provided wind resource assessment and energy yield assessments for over 3 GW of wind farms.
- Provided power performance testing for six wind farms.

1991 to present

US Patent Agent

- Built and ran a small but profitable business as a registered US Patent Agent. Clients are from industry and academia and represent a wide variety of technologies.

1998 to 2001

Global Energy Concepts - Kirkland, WA, United States

Project Engineer

- Worked with clients in the wind industry on a variety of projects providing technical advice regarding power curve measurements, turbine commissioning, SCADA system planning, design, and installation, evaluation of wind turbine retrofit options, investigation of lightning damage and icing effects, and development of operation and maintenance strategies.
- Provided contract review and due diligence services to utilities and wind plant developers.
- Also served as Principal Investigator in a research project investigating methods for self-erection of wind turbines.

1996 to 1998

Dynamic Design - Tehachapi, CA, United States

Senior Engineer

- Provided engineering consulting services to the wind energy industry in California and to the National Renewable Energy Laboratory.
- A major focus of the work was field testing of wind turbines. Performed loads and dynamics tests on six turbines ranging in size from 100 kW to 500 kW.
- Contributed conceptual ideas and practical field experience to the design team working on the Wind Eagle, an innovative highly flexible wind turbine.

1994 to 1996

University of Texas at El Paso – El Paso, TX, United States

Research Assistant

- Assisted with research projects in the area of wind energy, including meteorology and site characterization and development of a variable speed wind turbine rotor.



1991 to 1993

Wind Harvest Company – Banning, CA, United States and Llwydcoed, South Wales, United Kingdom

Project Engineer

- Built, tested and analyzed prototypes of three different models of the Windstar, a ducted vertical axis wind turbine. Set up a fabrication facility and installed a wind farm in South Wales, UK.

Education

1996

- M.S. in Mechanical Engineering – University of Texas at El Paso, El Paso, TX, United States.

1989

- B.S. in Mechanical Engineering – West Virginia University, Morgantown, WV, United States.

Professional Affiliations & Activities; Certifications

Partial List of Past Consulting Clients:

Developers/Owners/Operators

AES
Algonquin
Apex Clean Energy
Auren
BayWa
Berhshire Hathaway Energy
BP Alternative Energy
Competitive Power Ventures
ConnectGen
CPFL
CTG - Brazil
Duke Energy / Deriva
EDF
Edison Mission Energy
EDPR
Enel
Engie
Everpower
Exelon
Edison Mission Energy
First Wind

Iberdrola / Avangrid
Infigen
Invenergy
InterGen
LS Power
Leeward Renewable Energy
Mulilo
Northland Power
Origin
PEC Energia
Red Rocket
RES-USA
Ridgeline Energy
Rio Energy
RWE
Sun Cable
Scout Clean Energy
SeaWest
Serena
Squadron Energy
Vena Energy



Partial List of Past Consulting Clients (cont.):

Wind Turbine and Component Vendors

GE Wind
Vestas America
Clipper Windpower
TPI Composites
Southwest Windpower
Suzlon Windpower
Valmont Industries
Nordex Acciona

Banks and Investors

BBVA
Bank of America – Merrill Lynch Banorte
Brookfield
BTMU
CoBank
Credit Agricole
DE Shaw
Dexia
Diamond Generation
First Reserve
HSBC
Inter-American Development Bank
JP Morgan
KeyBank
Mizuho
Prudential Capital Group
Santander
Societe Generale
State Street Corp.
Trust Company of the West UniCredit

Utilities

Sempra Generation
AECI
Bonneville Power Administration
Electric Power Research Institute
Wisconsin Public Service
Basin Electric
Constellation Energy
Energy Northwest
Avista Utilities
Southern Power
Alliant

Other

AIG Insurance
Leidos
Sargent & Lundy
ICF
CH2M Hill
Luminate
Congressman Jerry McNerney
Town of Laurel, NE
National Renewable Energy Laboratory

Wind Turbines Worked On:

Acciona AW125/3000
 AOC 15/50
 Clipper C96
 DeWind D8.2
 Enron Z-50
 Fuhrlander 2.5
 Gamesa G87
 Gamesa G97
 Gamesa G114
 GE 1.5 se
 GE 1.5 sle
 GE 1.6 xle
 GE 1.6 100
 GE 1.7 100
 GE 2.3-107
 GE 2.3-116
 GE 2.5-100
 GE 2.7-128
 GE 5.3-158
 Goldwind GW 155-4.5
 Goldwind GWH182
 Kenetech MVS 33
 Kenetech KVS 46
 MHI-250
 MHI-600
 MHI 1000a
 MHI 2.4/102
 Micon 108
 Ming Yang MYSE156-4.0
 Ming Yang MYSE172-6.25
 Nedwind N40

Nordex N80
 Nordex N100
 Nordex N163
 Nordtank 65
 Repower MM92
 Suzlon S88
 Suzlon S97
 Tacke 600e
 Vestas V15
 Vestas V27
 Vestas V39
 Vestas V47
 Vestas V66
 Vestas V90
 Vestas V100
 Vestas V110
 Vestas V117
 Vestas V120
 Vestas V126
 Vestas V136
 Vestas V150
 Vestas V162
 Bonus 65 kW
 Bonus 1.3 MW
 SGRE G126
 SGRE G132
 SGRE SG 6.2-170
 Siemens 2.3 MW
 Siemens 3.0 MW
 WEG AGW 147/4/2
 WEG MS4
 Zond Z-40
 Zond Z-50



Wind Industry Professional Service:

Board of Directors for ARESA
Standards Development Board of ARESA
Board of Directors for Northwest SEED
Member of IEC Power Performance Testing Standard Committee MT12
Member of IEC Nacelle Lidar Wind Measurement Standard Committee PT50-3
Chair of Green Power – Optimizing Wind Power O&M 2011
Session Chair for Windpower 2006
Session Chair for Windpower 2007
Member of Technical Committee for 2002 Global Windpower Conference
Wind resource assessment subcommittee of the Idaho State Wind Working Group

Publications:

ArcVera Wind Energy Resource Assessment Benchmark White Paper: Published by ArcVera Renewables, May 2018

Wind Farm Operation and Maintenance Costs – Real Life Experiences and Summary of Projected Costs: WindAc, Cape Town, South Africa, November 2017

Wind Farm Operations and Maintenance: RECAM, Panama City, Panama, March 2017

SODAR to Met Tower Comparisons in a Variety of Terrain Types: American Wind Energy Association Conference Proceedings, June 2012

Discussion on Updated IEC Standard for Power Performance Testing: American Wind Energy Association Conference Proceedings, June 2012

Wind Turbine Performance Issues In Wind Resource Assessment: American Wind Energy Association Wind Resource Assessment Proceedings, September 2010

Wind Flow Modeling Software Comparison: American Wind Energy Association Wind Resource Assessment Proceedings, September 2009

Data: What We Need, Why We Need It, and How We Measure It: American Wind Energy Association Wind Resource Assessment Proceedings, September 2007

Wind Modeling Software Comparison: American Wind Energy Association Conference Proceedings, May 2007

Comparison of Methodologies for Power Performance Testing: American Wind Energy Association Conference Proceedings, May 2005.

GIS Mapping Tools to Promote Policies and Community-Scale Projects: American Wind Energy Association Conference Proceedings, May 2005.



Low Wind Speed Turbine Project Conceptual Design Study: Advanced Independent Pitch Control: May 2004.

Simple Arrays of Wind Turbines as a Practical Alternative to the Single Large Rotor Machines, American Wind Energy Association Conference Proceedings, May 2003.

Development of a Renewable Energy Resource Atlas of the West, American Wind Energy Association Conference Proceedings, June 2002.

TVP News Bulletin and Quarterly Stats Page, U.S. Department of Energy-Electric Power Research Institute Wind Turbine Verification Program, 1999-2001.

Wisconsin Low Wind Speed Turbine Project Third-Year Operating Experience: 2000-2001, U.S. Department of Energy - Electric Power Research Institute Wind Turbine Verification Program, EPRI TR-1004041, December 2001.

Iowa / Nebraska Distributed Wind Generation Projects First and Second-Year Operating Experience: 1999-2001, U.S. Department of Energy - Electric Power Research Institute Wind Turbine Verification Program, EPRI TR-1004039, December 2001.

WindPACT Turbine Design Scaling Studies Tehnical Area 3 -- Self-Erecting Tower and Nacelle Feasibility: March 2000 - March 2001. (2001). 72 pp.; NICH Report No. SR-500-29493.

Project Performance in the DOE-EPRI Wind Turbine Verification Program, America Wind Energy Association Conference Proceedings, June 2001.

Baseline Power Performance Test for the Z-50 Wind Turbine in Algona, Iowa, U.S. Department of Energy-Electric Power Research Institute Wind Turbine Verification Program, December 2001.

Baseline Power Performance Test for the Z-50 Wind Turbine in Springview, Nebraska, U.S. Department of Energy-Electric Power Research Institute Wind Turbine Verification Program, December 2001.

Baseline Power Performance Test for the AOC 15/50 Wind Turbine in Kotzebue, Alaska, U.S. Department of Energy-Electric Power Research Institute Wind Turbine Verification Program, December 2001.

Power Performance Testing Progress in the DOE/EPRI Turbine Verification Program. 15 pp.; NICH Report No. CP-500-30667.

Power Quality of Distributed Wind Projects in the Turbine Verification Program. 13 pp.; NICH Report No. CP-500-30407.

Power Performance Testing Activities in the DOE-EPRI Turbine Verification Program. 15 pp.; NICH Report No. CP-500-28589.



Review of Operation and Maintenance Experience in the DOE-EPRI Wind Turbine Verification Program. 13 pp.; NICH Report No. CP-500-28620.

Comparison of Projections to Actual Performance in the DOE-EPRI Wind Turbine Verification Program. 14 pp.; NICH Report No. CP-500-28608.

Wisconsin Low Wind Speed Turbine Project First- and Second-Year Operating Experience: 1998-2000, U.S. DOE - EPRI Wind Turbine Verification Program, EPRI TR-1000959, 2000.

Wind Turbine Verification Project Experience: 1999, U.S. Department of Energy - Electric Power Research Institute Wind Turbine Verification Program, EPRI TR-1000961, June 2000.

Baseline Power Performance Test for the Tacke 600e Wind Turbine in Glenmore, Wisconsin, U.S. Department of Energy-Electric Power Research Institute Wind Turbine Verification Program, December 1999.

Project Development Experience at the Iowa and Nebraska Distributed Wind Generation Projects, U.S. Department of Energy-Electric Power Research Institute Wind Turbine Verification Program, EPRI TR-112835, December 1999.

Baseline Power Performance Test for the Z-40FS Wind Turbine in Searsburg, Vermont, U.S. Department of Energy-Electric Power Research Institute Wind Turbine Verification Program, September 1999.

Wisconsin Low Wind Speed Turbine Project Development, U.S. Department of Energy-Electric Power Research Institute Wind Turbine Verification Program, EPRI TR-111438, December 1998.

Balancing Energy Capture and Structural Loads on Variable Speed Wind Turbines. Collection of the 1997 ASME Wind Energy Symposium Technical Papers Presented at the 35th AIAA Aerospace Sciences Meeting and Exhibit, 6-9 January 1997, Reno, Nevada. Washington, DC: American Institute of Aeronautics and Astronautics; pp. 309-318; NICH Report No. 23291.

Control Strategy Options for Variable Speed Wind Turbines, The University of Texas at El Paso, Master's Thesis, July 1996.

Control System Design for a Variable Speed Yaw Controlled Wind Turbine. Windpower '95: Proceedings of the Annual Conference and Exhibition of the American Wind Energy Association, 26-30 March 1995, Washington, DC. Washington, DC: American Wind Energy Association; pp. 187-193; NICH Report No. 21805.

Presentations:

Wind Turbine Aerodynamics – West Virginia University, October 1996.

Patent Law – University of Texas at El Paso Mechanical Engineering graduate seminar, February 1995.

Patent Law – University of Texas at El Paso Electrical Engineering graduate seminar, April 1995.

Cold Weather Operation Concerns – Utility Wind Interest Group Workshop Anchorage, AK, June 2000.



Self-Erecting Wind Turbine Workshop, National Renewable Energy Laboratory, September 2000.

Fundamentals of Onshore and Offshore Wind Energy, Gerson Lehrman Group, New York, June 2006

Fundamentals of Onshore and Offshore Wind Energy, Gerson Lehrman Group, San Francisco, June 2006

Fundamentals of Wind Energy, Gerson Lehrman Group, Boston, February 2007

Estimation of Annual Net Energy Yield at a Prospective Wind Farm, Presented to Various Banks, New York, June 2009

Wind Turbines 101, Presented to Chartis Insurance, July 2012

Power Performance Testing for Wind Farm Operations, Optimizing Wind Power O&M, Chicago, IL, Oct 2012

Optimizing Turbines and Components, Optimizing Wind Power O&M, Chicago, IL, Sept 2013

Opportunities In the US Wind Power Operations & Maintenance Service Sector, Gerson Lehrman Group, May 2016

Uncertainty in As Built Versus Design Specifications of Wind Turbine Components, NREL, July 2016

Technology and Wind Resource Risks in the Modern Turbine Era, Infocast, San Diego, CA, February 2017