



## Wind in power systems: bringing it to book

By Walt Patterson

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Wind power is no longer 'alternative'. From being a token marginal afterthought, wind power has become a significant mainstream generating technology for electricity systems all over the world. As yet, nevertheless, practical experience of designing, planning, integrating and operating wind technology in electricity systems is still concentrated in comparatively few countries and companies. Now, however, an impressive roster of wind experts has come together to pool know-how and present it between two covers, in *Wind Power in Power Systems*, just published by Wiley. This 691-page volume constitutes the first comprehensive guide to the subject in all its aspects, an invaluable compendium for anyone anywhere who takes wind power seriously.

The editor, Thomas Ackermann, has been for nearly a decade an organizer and coordinator of international endeavours in innovative electricity. Now based in the Electrical Engineering Department at the Royal Institute of Technology (KTH) in Sweden, Ackermann has put together a long-running and expanding series of conferences, seminars, workshops and other gatherings on distributed generation, particularly wind. He also moderates an online discussion group on distributed generation that has been running since 1999, linking over 1300 participants from around the world; see <http://groups.yahoo.com/group/distributed-generation/>. Ackermann circulated his ambitious doctoral thesis on line for several years in draft, amending and updating it continually, before it was finally published by KTH in 2004 as *Distributed Resources in a Re-Regulated Market Environment*. The thesis is a masterly study in its own right. It also undoubtedly prepared Ackermann to tackle the even more ambitious *Wind Power* volume, and elicit contributions from leading experts in Sweden, Denmark, Finland, Germany, Switzerland, the Netherlands, the UK, the US and elsewhere.

*Wind Power in Power Systems* is divided into four parts. After a short introduction by Ackermann, Part A describes 'Theoretical Background and Technical Regulations', nine chapters covering history, generators, power electronics, power quality, interconnection, power system requirements and calculations of value. Part B describes 'Power System Integration Experience' from Denmark, Germany, the US, small and isolated systems and those with weak networks, drawing technical and economic lessons. Part C describes 'Future Concepts', including voltage control, transmission support, active network management, offshore activities and hydrogen production. Part D describes 'Dynamic Modelling of Wind Turbines for Power System Studies', and analyses system consequences. Each chapter includes its own references, copious and varied.

As the list of topics indicates, the volume devotes little space to wind turbines themselves. Ackermann notes regretfully that only one turbine manufacturer took part, and that others considered the study 'too academic'. The complaint seems ill-judged; on the contrary, after a great deal of less academic – sometimes much less academic – commentary on wind, pro and con, a thorough academic treatment is overdue, and welcome. Here, as the title indicates, the focus is emphatically on the system dimension, as wind generation increases its role in system portfolios.

Chapter 3 identifies perhaps the key issue for the entire study: 'The integration of high penetration levels of wind power (>30%) into large existing interconnected power systems may require a step-by-step redesign of the existing power system and operation approaches'. In other words, not only must wind power adapt to the system, the system must adapt to wind power. This indeed is going to be a fundamental requirement for the entire expanding catalogue of innovative smaller-scale generation. The prevailing expectation, that innovative generation must fit into the existing system, its configuration and operation, is no longer tenable. In that respect wind power is a harbinger of progressive and eventually dramatic changes in electricity systems.

In the meantime, however, wind power is being added to existing systems of many different sizes, with differing portfolios of other generation and loads. The book spells out in reassuringly elaborate detail the distinctive attributes of wind power as a system contributor, both the advantageous and the disadvantageous, and how these attributes may interact with other parts of the system, however it is operated and managed. If 'academic' was intended as a pejorative, it is nevertheless accurate; the book includes a great deal of specific material requiring an extensive familiarity with electrical and electronic engineering. But it also includes a great deal of material of importance to the accountants, lawyers and economists now often making key decisions in electricity companies.

Whether the material is intensely technical or not, the writing is anything but conventionally 'academic'. It is clear and often indeed vivid, a tribute not only to Ackermann as editor, whose first language is not English, but also, as he acknowledges, to Doerte Mueller of the intriguingly-named 'Powerwording.com' for 'language editing'. I cannot imagine anyone sitting down and reading the book cover to cover, even as a text book; it is at once too concentrated and too wide-ranging. But individual chapters are carefully and lucidly structured, and convey coherent understanding of each particular topic. Although I am not by any stretch of the imagination a wind specialist, I found myself returning again and again, to different chapters, for further elucidation, and because I enjoy reading first-rate expository writing. I expect to have the book on a nearby shelf, within reach, as these topics come to concern me in my own work.

One final observation should be added. Although much of the content of the book is quite specific to wind power as a component of electricity systems, a significant proportion is relevant also to other smaller-scale generation that may not be conveniently dispatchable. As system characteristics evolve, the tradition of independent loads and dependent generation may yield to much more reciprocity between loads and generators. Wind may be both a primary beneficiary and a primary stimulus to this desirable end.

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