



Voltage and Reactive Power for Planning and Operation

Self-published book by Harrison Clark

My daughter suggested that “Pro-active Power for Planning and Operation” would be a better title for this book. But, inspiring or not, “reactive” power is a problem that not only is not going away any time soon, but will become ever more challenging.

My experience with reactive power goes back to 1972. I was working for Power Technologies and doing planning studies for the Sao Paulo area in Brazil. The demand was growing at 15% per year and new generation (all hydro) was hundreds of miles from the city. Worse, in 1976 the last in-city generating plant was to be retired leaving 6,000 MW of load with no local dynamic reactive support. Lack of local generation was a significant problem, but was compounded by long heavily loaded lines and a lot of industrial load. The stability criteria for the remote generators was a single line to ground fault making high-response excitation a very effective angular stability aid and allowing normal line loadings to reach several times surge impedance loading. The result was a very difficult voltage stability problem. Out of this work came VQ curves, field tests to define load characteristics, undervoltage load shedding, long-term simulations, and other tools and study methods to define reactive equipment needs.

At about the same time demand growth was a substantial 7.5% per year in the US. The average loading of US power grid lines rose and by the 80's we were seeing increasing reactive problems. The rest is history, but it's not over. As we fix weak links in the grid between points B and C and thereby ship more power from point A to point D, we create ever higher average line loadings and higher reactive demands and an ever more delicate balance between reactive demand and reactive supply. Combine this with weaknesses in modeling such as missing industrial plant capacitors and it becomes clear why the reactive problem remains one step ahead of us and drives us up a wall with difficult questions such as how much new reactive supply should be in the form of an SVC rather than switched shunt capacitor banks.

The book offered herein is the result of my 45 years in the electric power industry, with most of those years dominated by planning studies and blackout investigations with emphasis on the reactive problem. In 1986 I wrote PTI's reactive power course notes and taught the PTI “Voltage Course” until shortly after I retired from PTI in 1996 (at age 55). More than 1000 students attended that course over the years I presented it. In 2003, following the blackout, I created a completely new and updated course at the request of some clients affected by the blackout. I've since presented that course to more than 600 engineers, with each receiving a copy and the book being updated after each presentation. The text now stands at 204 pages with 404 images and 100,000 words. It's more a reference book than a “text book” but a very complete table of contents allows easy access to the material associated with any specific problem. The book is spiral bound for lay-flat convenience. Please see the table of contents and some sample pages [here](#).

I guarantee this book. If it does not meet your expectations, I will refund your money. If you need help with a bulk system reactive power planning or operating problem that the book does not cover, or does not cover clearly and adequately, email or call me and I will assist you with that problem. Of course, I will also update the book to cover or better cover that issue in future printings.

Options and pricing:

PDF file (color, printing and copying disabled): \$100

Book (spiral bound, black & white, 8.5x11): \$100

Book and PDF file: \$150

Sales tax is 8.25% for shipments to California addresses.

The PDF is taxable only if combined with a book purchase.

Book shipping within the US is by Priority Mail at \$9.00.

Payment options are Paypal and check. To order or inquire, please send an email to hkc@hkclark.com.