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What do you mean, 'modern power systems'?
By Walt Patterson

You hold in your hands a copy of *Modern Power Systems*. Reflect for a moment on that title - 'modern', 'power', 'systems'. 'Power' is clear enough; in this context it's just a shorter word for electricity. 'Systems' indicates, correctly, that generating and using electricity entails linking a variety of technologies that interact to deliver the desired service - an electricity or power system. But what about this word 'modern'? Suddenly we have a problem.

As used in the title of this periodical, 'modern' presumably means 'up-to-date', 'contemporary', in tune with today's times, at the cutting edge. What, then, do we mean by a modern power system? This is not a frivolous question. The key technical concepts that continue to dominate electricity systems all over the world - water turbines, steam turbines and synchronized alternating current - date back more than a century. To be sure, they have been much refined. Through the years and the decades, materials science and fabrication processes have dramatically improved the performance and the economics of systems based on these concepts, allowing spectacular increases in scale and reductions in cost. Advances in controls and system management have made electricity systems based on these century-old concepts robust and reliable. But can they really be called 'modern', in any meaningful sense of the word? Do they genuinely fulfil criteria that we would apply if we were beginning today with a clean sheet to establish electricity systems for the coming century?

Consider, to take but one example, fuel efficiency. Electricity systems based on steam-turbine stations - by far the majority across the world - still achieve an average fuel efficiency of not much better than 30 per cent. Even the very best coal-fired baseload stations manage perhaps 47 per cent, losing more than half the energy of the fuel even before the electricity reaches the station busbar. The consequent cost is compounded by the accompanying emissions to atmosphere. For more than a quarter-century, technical development of condensing steam-cycle plant has concentrated on extracting minuscule extra fractions of a percentage point of efficiency. Can we really call a system whose main output is useless low-temperature heat a modern power system? Just because we've taken it for granted for so long does not mean it is satisfactory.

Moreover, we can do better. Try designing on paper from first principles a truly modern power system. Use the most effective combinations of technologies, energy sources and finances now available. Remember that what people want, and will pay for, are the services that electricity provides - illumination, comfort, motive power, materials processing, information, entertainment and so on. While delivering these services, your modern power system must be not only technically and financially but also politically feasible. That constraint may all but preclude some options we used to take for granted. In most OECD countries, for instance, you will be hard pressed to get political acceptance for any new long-distance overhead transmission line. You will meet stubborn, intractable opposition, usually well-organized and often international, to any large hydro dam or coal-fired or nuclear plant.

Your main problem, however, may be not environmental but financial. A modern power system may now be neither vertically integrated nor a monopoly franchise. In this modern context, when almost every traditional ground rule is changing, large-scale long-term investments may look precariously risky, not to captive customers but to shareholders and bankers. Are you sure you want to build gigawatt-scale power stations and hundred-kilometer transmission lines?

You no longer have to. As the pages of this publication amply demonstrate, new generating technologies now offer a rapidly widening range of options for small plants located close to users - more convenient, more environmentally acceptable, and easier to finance. New network technologies likewise offer opportunities for interconnections and interactions much more elaborate and subtle than synchronized AC. If we were starting from scratch to design and install modern power systems, the results would look very different from the systems that presently surround us.

We are not, however, starting from scratch. Like it or not, all over the world people now own, operate and depend on power systems that are far from modern. We therefore find ourselves in an uncomfortable limbo. For years and possibly decades to come, power systems with very different attributes will have to co-exist, as an untidy and disconcerting transition unfolds. Commentators will have to watch their language.

In English literature, writers such as James Joyce, Virginia Woolf and T. S. Eliot were called 'modern'. But they were working in the 1920s and 1930s, more than half a century ago. Literary critics therefore invented a strange and anomalous term to describe the work of their successors. Electricity people may have to do likewise. Who's for 'Post-modern Power Systems'?