

The year ahead: This time for sure?

BY E. MICHAEL BLAKE

SINCE THIS ANNUAL attempt at forecasting began in 2008, this reporter has committed a great deal of ink to predictions that have not, shall we say, achieved complete fulfillment. After the 2011 installment, there was an earthquake of historic proportions near Japan, and the resulting tsunami ravaged that country's northeastern coast, killing thousands of people and overwhelming the shutdown effort at the Fukushima Daiichi nuclear power plant. There have been repercussions worldwide, none of which was predicted here in January.

Despite this, we are now looking ahead to 2012. This time, the range of what's being examined in this article is limited to little more than a numerical ranking of the prospects for new reactor projects and small modular reactor (SMR) development in the United States. If fewer forecasts are made, the article as a whole should be less wrong this time than it has been in the past.

COLs: Approval vs. delivery

As 2011 neared its end, the biggest concern for early 2012 was when the amended design of Westinghouse's AP1000 pressurized water reactor would be certified. The Nuclear Regulatory Commission staff handed over the final rule package to the commissioners on October 18. At least three of the five commissioners had posted votes in favor of the final rule by December 6; still to be worked out was the wording of the directive to the staff on publishing the rule. Looming over this process is the prospect of federal court action by the citizen organizations that have tried (and so far failed) to use the Fukushima Daiichi accident and the NRC's Near-Term Task Force report to stop the AP1000 certification and many other major licensing actions by the NRC.

As has been reported in *Nuclear News* before, the first two sets of combined construction and operating licenses (COL)—

The Fukushima Daiichi accident has affected every nuclear energy project in the world. It may now be possible to see which ones will continue.



This shot of the Vogtle new construction site, taken on November 3, 2011, shows circulating water system pipes that will connect to Unit 3's turbine building and condenser. (Photo: Southern Company)

for Southern Nuclear Operating Company's Vogtle-3 and -4, and SCANA/Santee Cooper's Summer-2 and -3—cannot be issued until the amended AP1000 design is certified. There may also be lingering, unresolved questions from the commissioners for the applicants and the NRC staff in the wake of the mandatory hearings. Nothing can be assumed to be routine, as this is the first time that the licensing process in 10 CFR Part 52 has been taken this far.

The most recent (approximate) schedule for the first COLs has been based on AP1000 approval by the commissioners in December 2011, publication of the final rule in the *Federal Register* in January 2012, and the final rule's going into effect in February, 30 days after publication. The commissioners' approval of the Vogtle COLs was possible during December 2011,

but the NRC staff can issue the COLs only after the AP1000 design is certified. (Southern has requested that it be allowed to begin safety-related work as soon as the AP1000 final rule is published, without a 30-day wait for the rule to go into effect). On this schedule, the Summer COLs could be approved in January 2012.

As can be inferred from the previous paragraph, many important actions may have occurred between the writing of this article and the publication of this issue of *NN*. If they have, and if they took place as the applicants hoped, perhaps they should be counted as making last year's predictions look a little better.

New reactors (large LWRs)

In what follows, the lower the number, the better the prospect; numbers in paren-

theses show where the project was ranked last year. **Bold** indicates a project that the author expects to continue, *italics* is used for a project that might continue, and plain type means that the author does not expect the project to continue. Does “continue” seem too vague? Would it be better to say “produce electricity?” Remember, we’re looking only at 2012 here, and even the Tennessee Valley Authority’s Watts Bar-2 in Tennessee won’t be on line until 2013 at the earliest.

As 2011 neared its end, the biggest concern for early 2012 was when (and whether) the amended design of Westinghouse’s AP1000 pressurized water reactor would be certified.

Speaking of Watts Bar-2, that and the TVA’s other project—Bellefonte-1 in Alabama—involve the completion of unfinished “old” reactors, and it is assumed here that they will be finished, although nothing will be done at the Bellefonte site in 2012, because construction there is not to resume until fuel is loaded in Watts Bar-2, perhaps around the end of the year.

1. Vogtle-3 and -4 (1). The issuance of the COLs would trigger more than the start of safety-related construction. The terms of the loan guarantee from the Department of Energy state that the guarantee goes into effect only after the COLs have been handed over to Southern. (Recently, Southern officials have questioned whether the DOE guarantee will actually lead to financing that is usable by a regulated service-area utility seeking to build reactors.) Another way to look at this is that the longer the paperwork on the AP1000 amendment certification is delayed, the longer the wait for both money and work at Vogtle.

2. Summer-2 and -3 (4). Although this project has long been cited by just about everyone except the DOE (which never discusses this publicly) as a loan guarantee finalist, SCANA has stated that it would build the reactors whether a guarantee comes through or not. Last year, Santee Cooper entered into agreements with some other utilities to take options to buy power from the reactors, but two municipal utilities in Florida have stated that they don’t expect to continue their options. The AP1000 certification is not as great a day-to-day concern here as it may be at Vogtle, but the goal of a 2016 startup for Unit 2 may already be a

bit of a challenge.

3. Levy-1 and -2 (5). All of the technical reviews might be completed in April, which puts this third AP1000 project into third place overall, and could lead to COL issuance later this year. Rate relief for Progress Energy from the Florida Public Service Commission also helps. There are enough uncertainties here, however, to keep this project in italics rather than bold. It is the first COL application to get this far in the licensing process that also has a contested

hearing yet to take place, and even a favorable decision by the presiding Atomic Safety and Licensing Board (ASLB) might be taken to court. That kind of delay might not matter much, because neither reactor is planned to enter operation until after 2020, but prolonged litigation would add to the project’s cost. Also, while Duke

and Progress insist that their planned merger will not automatically cause cutbacks in their new reactor work, plans for six new large light-water reactors by a single utility might be difficult to maintain.

4. Comanche Peak-3 and -4 (3). Bold last year, italic now. The deal-making a few years ago that led to the new ownership (and name) of Luminant Power has saddled the company with debt service obligations. Also, while Mitsubishi was not directly involved in the Fukushima Daiichi accident, the company’s long-delayed Tsuruga-3 and -4 reactors in Japan—which would use the original APWR, upon which the US-APWR is based—are now probably consigned to oblivion, given the changed attitudes in Japan toward nuclear power. The issuance last year of the final environmental impact statement (EIS) for Comanche Peak was a plus for the project, but the certification of the US-APWR will take until 2014 at least, and the completion of the COL safety review has been rescheduled to July 2014.

5. Lee-1 and -2 (10). This leap up the chart has to do mostly with problems in other projects that were previously ranked higher, but it also helps that much of the uncertainty in this project has either been resolved or is on the way to resolution. The addition of Makeup Pond C is now sufficiently understood to allow completion of the draft EIS (which was published on December 13), and the end of technical reviews on the AP1000 certification is now being expressed in the completion of safety evaluation report chapters (five so far). Duke has also declared, in its latest integrated resource plan, the company’s need

for both reactors. There are no admitted contentions, although intervenors continue to propose Fukushima-related ones.

With all that said, there is still not an engineering, procurement, and construction contract for this project (as there is for each of the three AP1000 projects ahead of Lee in the licensing queue—Vogtle, Summer, and Levy). As long as the merger with Progress is still pending, there is probably still some hard thinking ahead on how many reactors the two companies can or should build, separately or together.

6. Turkey Point-6 and -7 (8). We have jumped Lee ahead of Turkey Point because the latter still has plenty of work ahead, but Florida Power & Light Company has made some gains in technical reviews and, like Progress, has received some rate recovery authority from the state. The NRC reviews will, however, continue into 2014, and three intervenor contentions are in the hearing process.

7. North Anna-3 (6). Like Luminant, Dominion Generation mainly has to wait for the US-APWR reviews to be finished. The supplemental EIS is scheduled to be completed this year. Dominion is also carrying out additional seismic studies of the site in the aftermath of the earthquake that occurred near the plant last August.

8. Fermi-3 (12). Detroit Edison Company still has not announced progress toward an engineering, procurement, and construction contract, but the project still exists, and there was enough forward momentum during 2011 on several fronts to merit our promotion from plain type to italics. GE Hitachi Nuclear Energy’s ESBWR design has received final design approval from the NRC, and the final certification rule should be in effect by midyear. The draft EIS was issued in October. GE Hitachi announced some supply-chain agreements with Michigan firms. A contested hearing will probably take place, because four contentions have been admitted. Still, while three other companies have walked away from the ESBWR, Detroit Edison has not. One presumes that there is a reason for this.

9. Bell Bend (9). This is technically a subsequent COL application for the Areva U.S. EPR reactor design, but as will be noted below, the reference COL has many more problems than PPL Bell Bend does. We are keeping this project in italics because PPL continues to work on it, having committed to responding to the remaining requests for additional information on the environmental review by the end of 2011. If the responses satisfy the NRC, there ought to be at least a firmer schedule issued during 2012 for the draft and final EISs (with target dates probably in 2013 or later).

10. Calvert Cliffs-3 (5). This was the first COL application submitted to the NRC, but it now appears to us that this U.S. EPR will not be built. NRC regula-

tions, following on the Atomic Energy Act, preclude the issuance of power reactor licenses to any entity that is found to be foreign-owned, -controlled, or -dominated (FOCD). The ASLB presiding over this application has effectively given UniStar Nuclear Energy until April or May to strike a deal with a U.S.-based organization under which Electricité de France, now the sole owner, would no longer be in control of the project. Even if a deal were to be worked out, UniStar would essentially be a tenant at the Calvert Cliffs site, where majority control of the two operating reactors might pass from Constellation Energy to Exelon Generation (if the proposed Exelon-Constellation merger is completed). Exelon has flatly stated that it has no interest in a third reactor at Calvert Cliffs.

aspects of 10 CFR Part 52 licensing), and it may be that both NINA and UniStar will find ways to comply with regulations. It should be noted, however, that the NRC staff flatly rejected UniStar's negation plan and even asked the ASLB in the Calvert Cliffs-3 case to dismiss UniStar's COL application. Since then, UniStar has declared its intention to strike a deal for a majority-U.S. partner. NINA has taken a slightly different approach, intending for the COLs to go to STP Nuclear Operating Company, the U.S. based operator of the two existing reactors at South Texas—but the NRC staff has said that this is still not acceptable. If nothing else, it should be decided during 2012 whether Calvert Cliffs-3 and South Texas-3 and -4 advance or are ended.

We are no longer listing here the five other COL applications that have been suspended at the applicants' request, in some cases for three years. Also, we are not assigning numbers to projects that are not yet at the point of COL applications, but we will mention those in which activity is taking place—that is, the NRC is putting

Although the majority of the world's designs for SMRs appear to be originating in the United States, the first SMRs could be from other countries.

11. Harris-2 and -3 (11). Progress's 2010 integrated resource plan stated that the company would need no more than 25 percent of the power from these AP1000s, and that was before Duke and Progress began their merger talks. If six new reactors are too many for the merged company, the ones at Harris would almost certainly be the first to be put at least on hiatus.

12. South Texas-3 and -4 (4). There was some good news in 2011. Toshiba's amended ABWR design has been approved for certification by the NRC. The final EIS was issued on March 4. Then, a week later, the earthquake and tsunami in Japan occurred, resulting in changes no one could have anticipated.

Project financing was uncertain before the Fukushima Daiichi accident, and since then, Tokyo Electric Power Company has bowed out of its partial ownership. NRG Energy, owner of the largest share of STP Nuclear Operating Company, wrote down its investment in Units 3 and 4. Despite this, the licensing process has continued, with Nuclear Innovation North America (NINA), the joint venture of NRG and Toshiba, designated as the license applicant and Toshiba covering the costs. This relationship has raised FOCD questions in the form of a contention submitted to this proceeding's ASLB.

Granted, the FOCD issue has never been tested to this extent (as with so many other

in billable hours later charged to the organizations seeking the agency's attention. The early site permit applications for Exelon's Victoria site in Texas and PSEG's site adjacent to Salem/Hope Creek in New Jersey have continued through the review process, although with schedule slippage on Victoria into early 2014. Backers of the Blue Castle Project in Utah have continued to hold pre-application meetings with the NRC, with an early site permit application expected before midyear.

Also relevant to new reactors is Korea Electric Power Corporation's plan to apply (perhaps in the second half of 2012) to the NRC for certification of the APR-1400 PWR design. This design does not yet have any publicly declared customers in the United States, although Alternate Energy Holdings Inc. (AEHI) has mentioned it as a candidate for its proposed Idaho project. The NRC does not currently expect a COL application from AEHI, but the company has stated that it could apply during 2012.

Small modular reactors

Even the most developed and supported SMR designs in the United States are not expected to advance very far toward application submission in 2012, so the criterion used above (of a project that "continues" this year) may not be very meaningful here. This ranking will be based on chances for advancement on one or more fronts during

2012. Bold and italics were not used for SMRs last year, and they are used here very hesitantly.

It should also be noted that although the majority of the world's designs for SMRs appear to be originating in the United States (as opposed to the "small or medium" designation often used abroad), the first SMRs could be from other countries. During 2012, prototype construction might begin on South Korea's SMART and Argentina's CAREM. China's gas-cooled HTR-PM is under construction, and a deal has been announced to build two SMRs, perhaps integral PWRs (iPWR), in Fujian Province. Russia's first two "floating" power reactors have been scheduled to begin operation this year, once they have been finished, transported, and docked in Kamchatka. The following, however, is generally U.S.-centric.

1. **mPower** (1). The Babcock & Wilcox/Bechtel partnership for this iPWR has something no other SMR design listed here has: a declared "customer," or at least an organization willing to apply for licenses. The TVA has been meeting with the NRC to prepare for an application for up to six reactors at Clinch River; the NRC now expects submission for construction permits in mid- to late 2013. B&W has planned to apply for certification around the end of 2013.

2. **WSMR** (8). Westinghouse has tried to get support funding from the DOE for this iPWR, but in this era of federal austerity, that cupboard is pretty nearly bare. Westinghouse and its parent, Toshiba, have the deepest pockets of all the SMR proponents, and the NRC expects this to be the first SMR certification application, perhaps around the end of 2012.

3. **PRISM** (2). This GE Hitachi design is not an iPWR, which means that the NRC is not willing to devote many of its limited SMR resources to giving it serious consideration. Recently, however, GE has spoken of marketing the liquid metal-cooled reactor overseas. If anything has developed from the Savannah River Site's 2010 memorandums of understanding with GE and the designer of another non-iPWR—Hyperion's HPM—it has not been announced publicly.

4. **NuScale** (3). Fluor Corporation has ridden to the rescue of NuScale Power, but for several months last year, work slowed sharply because of federal court action against the previous principal investor. NuScale has resumed pre-application meetings with the NRC, but the slowdown means that certification will not be sought until 2013 or later. MidAmerican Energy is on NuScale's advisory board, and MidAmerican officials have been quoted in NuScale press releases, but MidAmerican has not declared itself to be a potential license applicant.

5. **GT-MHR** (10). Exactly what the DOE's Next Generation Nuclear Plant (NGNP)

would be (other than a very-high-temperature gas-cooled reactor) is not clear, but General Atomics is currently the only candidate to provide the hardware, perhaps with something resembling the Gas Turbine-Modular Helium Reactor. Despite federal legislation calling for the NGNP to enter service in 2021, the entire project seems uncertain, with federal funding in doubt, no public-private partnership in place, and some companies that would be on the private side seeking to relocate the project from the Idaho National Laboratory to someplace where neighboring facilities could make use of process heat from the reactor. If nothing else, however, the prospect of an NGNP license application (perhaps in late 2013) has required the NRC to try to gain some expertise on gas-cooled reactors, perhaps a first step toward the agency's ending its exclusive focus on LWRs and entering more exotic realms of coolants, fuels, and operating schemes.

6. 4S (6). The fact that this is not in italics should not be taken to mean that it will never amount to anything. Toshiba has made it clear that it still seeks some kind of review, perhaps a certification application, for this liquid metal-cooled reactor that would be sealed at the factory and delivered to its end user fueled for many years of nonstop operation. In this ranking, however, everything from this point on is taken as

either too new for prospects to be assessed or lacking in sufficient outside interest. In 2011, Toshiba's many years of courting the town of Galena, Alaska, as a possible 4S site ended when the town decided to get a new fossil-fired power plant instead.

7. Traveling Wave Reactor (5). While this may turn out to be neither small nor modular, developer TerraPower participates in the American Nuclear Society's effort to develop licensing principles for SMRs in general, so this reactor concept is still listed here (as a "fellow traveler," if you will). Despite the financial backing of former top Microsoft executives, this concept still appears to be more in the realm of research and development than of near-term deployment.

8. HI-SMUR 140 (new). Holtec International, whose involvement in the nuclear industry is mainly as a supplier of fuel storage and transport casks, unveiled this concept in 2011 and signed up big-name advisors and potential industrial partners. There is said to be a potential license applicant, not yet disclosed publicly.

9. HPM (4). Hyperion Power's president and cofounder, John "Grizz" Deal, left the company in 2011 to start yet another company. Hyperion Power is still seeking to develop and deploy its design, perhaps outside the United States.

10. ARC-100 (9). The reactor and fuel

cycle concepts derived from what used to be the Integral Fast Reactor program at Idaho National Laboratory are central to this liquid metal-cooled reactor from a startup company called Advanced Reactor Concepts. There is some potential for confusion here, because another organization calling itself by the same name has set up a Web site (currently with no content), and the name has also been used for a DOE program. There has been little stated publicly about the ARC-100 since the initial announcement in June 2010.

The Pebble-Bed Modular Reactor (PBMR) is no longer listed here because there has been no clear statement that anyone has adopted the design after the South African government ended its support, although there have been indications that Areva, a onetime partner in the project, may still be interested in pursuing the concept. Also no longer listed is General Atomics' EM2, which despite the presentation of a few papers at conferences on this gas-cooled reactor concept, does not seem to be on a developmental fast track.

As noted above, the most noticeable activity during 2012 may be outside the United States. Perhaps for the January 2013 issue of *NN*, there will be enough clarity worldwide to allow this ranking to be expanded to include every candidate design. ■