



Photo: SCE&amp;G

An aerial view of ongoing construction of Units 2 and 3 at South Carolina Electric & Gas Company's Summer site, as of December 2014.

# Renaissance Watch: Licensing without construction

By E. Michael Blake

Substantial amounts of time and money, and the exertion of numerous skills, go into the production of a combined construction and operating license (COL) for a new power reactor under the Nuclear Regulatory Commission's regulations in 10 CFR Part 52. With all of these resources expended for this single outcome—the cash outlay is commonly estimated to be \$50 million—the most recent recipient of a COL is treating it as . . . an option. DTE Electric Company has the NRC's permission to build and operate a GE Hitachi Nuclear Energy ESBWR boiling water reactor at the Fermi site near Monroe, Mich., where DTE operates a BWR. DTE has not, however, bought reactor hardware, signed an engineering, procurement, and construction (EPC) contract, or in any way committed to operating new nuclear capacity.

Like a COL, design certification also consumes money, time, and human capital, and last November, the ESBWR emerged from the process after nine years as an asset that can be used by a COL applicant to resolve all nuclear safety issues in advance. Its status as a certified design may make the ESBWR the object of envy from Areva and

*Fermi-3 is the first licensed new reactor project to be put on the back burner, but it may not be the last.*

Mitsubishi Heavy Industries, who have put the certification efforts for the U.S. EPR and US-APWR, respectively, on hold. These companies have various reasons for their actions, but it hasn't helped that their applications are bogged down in technical reviews, with the NRC not satisfied with their responses to requests for additional information. The ESBWR is free and clear, but is still in an existence of paper and bytes, because DTE has so far declined to use its COL.

It may be that the numerous trends that have made it difficult for some operating reactors to maintain earlier levels of profitability are also affecting new reactor projects that have been generally successful in the licensing realm. Power demand growth in DTE's service area in Michigan has been essentially flat since the economic downturn in 2008. Hydraulic fracturing has made natural gas appear to be the cheapest choice for new capacity, and renewable energy sources, enhanced in some cases by production tax credits, continue to make inroads. DTE does not appear to need new generation now, and by not building an

ESBWR, it is indicating that it may not need generation in five to 10 years. If nothing else, the end of licensing and certification have allowed DTE and GE Hitachi to stop paying for billable hours at the NRC.

Fermi-3 may be an outlier, and other projects nearing the finish line in licensing reviews may be more energetic. Dominion Generation already has a term sheet with GE Hitachi for the ESBWR planned as North Anna-3 in Virginia, and the decision to go ahead could be rendered once the COL is issued, perhaps next year. A term sheet is not an EPC contract, however, and Dominion has been reluctant to declare full commitment to North Anna-3 through the entire length of the project's existence, starting with an early site permit application in 2003.

The technical reviews for South Texas-3 and -4 might be finished in about three months, and an EPC contract is in place for the Toshiba ABWRs, but it is not clear who would pay for the project, and with what money. Nuclear Innovation North America (NINA) has survived the challenge to its ownership arrangement, with the Atomic

Safety and Licensing Board denying assertions by both intervenors and the NRC staff of unacceptable foreign control based on Toshiba's payment of recent licensing costs. NINA's stated plan for actually building the reactors, however, depends on receiving a loan guarantee from the Department of Energy and using that to obtain outside financing. Even before the DOE revamped its existing guarantee authority last year to include other projects, such as second license renewals for existing reactors, loan guarantees for new reactors have been few in number (two offered, one accepted), take a great deal of time to get to approval, and then require long and sometimes contentious negotiations (in the case of the Vogtle-3 and -4 guarantee that went into effect) or carry conditions that break the deal (in the case of the credit subsidy fee for Calvert Cliffs -3, which effectively drove Constellation Energy out of the new reactor realm).

A draft term sheet for a loan guarantee was, in fact, issued by the DOE for South Texas-3 and -4. That happened four years ago.

### AP1000 roundup

Westinghouse's AP1000 pressurized water reactor is the model that has been most widely adopted in the United States. It is being built in twin-unit projects at two sites. It has already gone through the design certification process, and then an amendment process that took nearly as long. Also, it is still undergoing revisions through licensee amendments, which would seem to call into question whether a truly standardized design can be achieved.

Duke Energy, which has two COL applications for twin-AP1000 plants under review by the NRC, has become so annoyed by the need for further modifications (which the company bluntly referred to last December as "generic errors . . . that require Westinghouse input") that in January it requested that the NRC effectively take these issues out of the licensing process and deal with them chiefly through the AP1000 design certification, resolving them generically without adding to delays in the technical reviews of individual COL applications. In an April 15 reply, Glenn Tracy, director of the NRC's Office of New Reactors, stated that the agency could consider a rulemaking approach, but if a significant error exists in a design control document, a COL could not be issued on the basis of that document. Tracy also said that the NRC would not embark on an "ill-defined" rulemaking process for which there is not a clear path for a successful resolution of the issues.

Duke is concerned with the condensate return system and with dose calculations that support the main control room design. The environmental reviews for both Duke projects (Levy County in Florida and Lee in South Carolina) have been completed, and

to a great extent, the completion of the safety reviews is being held up by these pending issues. As much as Duke wants to avoid more delays in the COL issuance, however, it currently has not committed to building either plant. The EPC contract for Levy was canceled in August 2013 because the original COL issuance target was not met, and Lee has never been under an EPC contract.

As for the AP1000s that are being built, Westinghouse and its main contractor, CB&I, now project completion dates in mid-2019 for Vogtle-3 and Summer-2, and a year later for Vogtle-4 and Summer-3. Southern Nuclear Operating Company and SCANA/Santee Cooper are not satisfied

with these dates (which move back completion about a year and a half for each unit), or with the related cost increases, and they insist that Westinghouse and CB&I mitigate the effects on the projects. Separately from these disputes, at least, physical work has continued at both sites.

### The details

In what follows, **BOLD CAPITALS** are used for projects under (or approved for) construction; **bold** indicates a submitted application; *italics* means that an application is forthcoming. Acronyms: ACRS, Advisory Committee on Reactor Safeguards; ASLB, Atomic Safety and Licensing Board; COL,

combined construction and operating license; COLA, COL application; CS, proposed date for the start of commercial operation; EPC, engineering, procurement, and construction; ESP, early site permit; FEIS

(DEIS), final (draft) environmental impact statement; FSER (DSER), final (draft) safety evaluation report; ITAAC, inspections, tests, analyses, and acceptance criteria; MH, mandatory hearing; RAI, request for additional information; TBD, to be determined.

instead of numbers (SPA through SPD), essentially skipping SP2 and SP3. The COLA environmental review has four phases: EP1 (scoping); EP2 (DEIS); EP3 (comments on DEIS); and EP4 (FEIS).

**Under construction**

WATTS BAR-2, 1,177-MWe Westinghouse pressurized water reactor, Tennessee Valley Authority; Spring City, Tenn.; close to 100 percent complete. CS: December 2015, but a delay to mid-2016 is considered possible by TVA officials. FSER: Supplement 27 issued in December 2014, but Supplements 28 and 29 are expected before license issuance; *FEIS issued May 29, 2013*. On May 4, the NRC staff asked the commissioners to vote on authorizing the issuance of the operating license. Fuel loading is now tentatively scheduled for August. There are no admitted contentions.

Hot functional testing still had not begun as of this writing. It was scheduled to start in June, with completion around the end of July. Just about every new reactor project other than Summer and Vogtle is under the shadow of a possible court ruling against the NRC's rule on continued storage of spent fuel at reactor sites, but perhaps none more darkly than Watts Bar -2, the only one for which the time left before electricity production could be less than a single year.

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In many cases, detailed schedules for the NRC staff's technical reviews are in effect, and the following abbreviations are used for the phases of design certification: P1 (RAIs issued by the NRC); P2 (SER with open items); P3 (ACRS review of SER); P4 (advanced SER); P5 (ACRS review of advanced SER); and P6 (FSER). COLA reviews are based on the same six phases (referred to below as SP1 through SP6), but in some cases, the NRC is using a four-phase safety review with letters in-

**BELLEFONTE-1**, 1,213-MWe Babcock & Wilcox PWR, TVA; Scottsboro, Ala.; 55 percent complete. CS: 2018–2020. TVA has issued a draft integrated resource plan that projects the agency's needs out to 2033 and includes no new nuclear capacity other than Watts Bar-2 and power uprates at Browns Ferry. Because this plan is a draft, we continue to list Bellefonte-1 here, although its prospects now seem as dim as those for Units 3 and 4.

**VOGTLE-3, -4**, 1,100-MWe Westinghouse AP1000s, Southern Nuclear Operating Company; Waynesboro, Ga.; about 50 percent complete in EPC terms. CS: perhaps 2019 and 2020, perhaps sooner. *The COLs were issued on February 10, 2012.* ITAAC status: for Unit 3, 13 closed and confirmed by the NRC; for Unit 4, 12 closed and confirmed.

There have been recent developments on several projects that help make this article more current but run the risk of redundancy with other items in this issue. Please refer to the Power section for details such as the delivery of reactor vessel internals for Unit 3.

**SUMMER-2, -3**, AP1000s, SCANA/Santee Cooper; Parr, S.C.; completion percentage not yet stated. CS: perhaps 2019 and 2020, perhaps sooner. *The COLs were issued on March 30, 2012.* ITAAC status: for Unit 2, 13 closed and 12 confirmed by the NRC; for Unit 3, eight closed and confirmed.

Like Vogtle, Summer is the site of a tussle between owners and contractors over costs and schedules, and whether they can be improved (as indicated by the “perhaps sooner” used above).

### License received

**FERMI-3**, ESBWR, DTE Energy; Monroe, Mich. CS: TBD. *The COL was issued on May 1, 2015.*

This is the debut of a new category here in the Watch, made necessary by DTE's decision to hold its license rather than use it immediately. Fermi-3 is clearly not under construction, and is not under an EPC contract, but it is no longer a license application.

### License applications

Both to save space and to keep the focus on the most active projects, the following list excludes Ameren Missouri's Callaway -2, Duke Energy's Harris-2 and -3, Entergy's Grand Gulf-3 and River Bend-3, Luminant Power's Comanche Peak-3 and -4, PPL Bell Bend's Bell Bend, TVA's Bellefonte-3 and -4, and UniStar Nuclear Energy's Calvert Cliffs-3, which have been either slowed or

suspended at the request of the applicants. In previous Renaissance Watch articles, these applications were discussed in more detail, but, frankly, they are all so tenuous now that there is almost nothing to discuss. The exception: The draft EIS for **Bell Bend** was issued on April 14.

**South Texas-3, -4**, Toshiba ABWRs, NINA; Palacios, Texas. CS: TBD. FSER: September 2015; *FEIS issued February 24, 2011.* SP5 completed, December 2014. All

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three intervenor contentions have been resolved in NINA's favor. An EPC contract was signed in February 2009.

**North Anna-3**, ESBWR, Dominion Generation; Mineral, Va. CS: TBD; FSER: March 2016; *FEIS issued March 17, 2010.* SP3 done, November 2009; SP4 due, September 2015 (four chapters completed). Dominion and GE Hitachi Nuclear Energy have stated that they have agreed on all contract terms, although Dominion has not committed to

building the reactor and so has not signed an EPC contract. The hearing record is closed, but a new contention has been submitted in connection with the August 2011 earthquake near the site.

**Lee-1, -2**, AP1000s, Duke Energy; Gaffney, S.C. CS: 2024, 2026; FSER: December 2015; *FEIS issued December 20, 2013*; MH: April 2016. SPA completed, May 2010; SPB due, May 2015 (15 chapters completed). There are no intervenor contentions.

**Levy-1, -2**, AP1000s, Duke Energy; Levy County, Fla. CS: 2024, 2025–2026. FSER: TBD; *FEIS issued April 27, 2012*. SPC completed, January 2012. The contested hearing was resolved in Duke's favor. The EPC contract was canceled on August 1, 2013.

**Turkey Point-6, -7**, AP1000s, FPL; Florida City, Fla. CS: 2022, 2023; FSER: October 2016; *FEIS*, February 2016; MH: TBD. SPA due, June 2015 (10 chapters completed). EP2 completed, February 2015. One intervenor contention is currently admitted into the hearing process.

*Eastern Idaho*, two or more NuScale reactors, Utah Associated Municipal Power Systems with Energy Northwest; on or near property of Idaho National Laboratory. Application submittal is planned for 2017.

### Early site permits

**PSEG site**, reactor TBD, PSEG; Salem, N.J. FSER: September 2015; *FEIS*: September

2015. SPA completed, September 2013; SPB due, June 2015. EP2 completed, August 2014.

*Clinch River*, reactor TBD, TVA; Clinch River, Tenn. Submittal of the application is planned for fall 2015. TVA had previously planned a construction permit application for two to six mPower reactors, but because of the slowdown in mPower development, TVA made it official in September that it will instead apply for an ESP with a plant parameter envelope based on integral pressurized water reactor design features. Pre-application meetings are still scheduled with the NRC staff, but the draft integrated resource plan mentioned earlier may affect whether TVA goes ahead with the application.

*Blue Castle Project*, two AP1000s, Blue Castle Holdings; Green River, Utah. The application is currently planned for submittal in late 2016.

### Design certification

**ABWR**, 1,350-MWe boiling water reactor, GE Hitachi or Toshiba. The original General Electric design was certified in 1997. **The final certification rule for Toshiba's version, for South Texas-3 and -4, was published on December 16, 2011, and became effective on January 17, 2012.** GE Hitachi and Toshiba have both applied for the renewal of the ABWR certification, which expired in 2012. The NRC has docketed both applications, with no review schedules

issued as of this writing.

**AP1000**, 1,100-MWe pressurized water reactor, Westinghouse. This design was certified in 2006. In 2007, Westinghouse applied to amend the design. **The final certification rule was published on December 30, 2011, and became effective immediately.**

**ESBWR**, 1,520-MWe BWR, GE Hitachi. **The final certification rule was published on October 15, 2014, with an effective date of November 14.**

**U.S. EPR**, 1,600-MWe PWR, Areva. The certification target date is TBD because of the NRC's continued dissatisfaction with the digital instrumentation and control system. Areva has requested that the NRC suspend the review by March 27 and planned its own suspension for March 31. P3 completed, May 2012; P4 due, TBD (six chapters completed, and part of one other).

**US-APWR**, 1,700-MWe PWR, Mitsubishi Heavy Industries. At the applicant's request, a work slowdown went into effect in April 2014; all target dates are now TBD. P1 completed, January 2009; P2 due, TBD (17 chapters finished).

**APR1400**, 1,400-MWe PWR, consortium led by Korea Electric Power Corporation. The NRC accepted the application for docketing on March 4. At this writing, the schedule for technical reviews had not yet been issued.

*Westinghouse SMR*, 225-MWe integral PWR, Westinghouse. The application submittal date is TBD, and Westinghouse has reduced work on the design.

*mPower*, 180-MWe integral PWR, Generation mPower (Babcock & Wilcox/Bechtel). The application submittal date is TBD. A draft set of design-specific review standards was issued in May 2013.

*NuScale*, 45-MWe integral PWR, NuScale Power. The application is expected in the second half of 2016.

*SMR-160*, 160-MWe integral PWR, Holtec International. The application submittal date is TBD.

*XE-100*, 100-MWt (electrical rating not yet specified) pebble-bed fueled gas-cooled reactor, X-Energy Inc. This startup company has told the NRC that it intends to apply for certification. The NRC does not currently specify an expected submittal date.

There are no other declared certification candidates at this time, but many other designs have been proposed, among them Gen4 Energy's liquid metal-cooled *Gen4 Module*; TerraPower's project, still known as the *Traveling Wave Reactor* despite design changes that would make the "wave" stationary; General Atomics' gas-cooled *Energy Multiplier Module*; and Areva Inc.'s gas-cooled *SC-HTGR*, named the preferred design of the NGNP Industry Alliance, which may apply for a construction permit in the period 2016–2018. The Department of Energy is not pursuing licensing for the NGNP, which was established by Congress to be built by the DOE, and no public-private partnership has been established.

### And in closing . . .

The astute reader will have observed by now that very little has been said about small modular reactors, which had been so heavily touted in recent years as what would truly bring to the United States nuclear power that would be not only new but different. There has, in fact, been fairly little to say about SMRs recently, but what there is can be said now. Alone among the integral PWR developers, NuScale Power has continued to pursue its model. Soon the company may finally see the NRC issue the draft design-specific review standards that would eventually allow the agency to review the company's design certification application, which may be submitted next year. Utah Associated Municipal Power Systems has stated that it may submit a COL application in 2017 for a NuScale plant in the vicinity of Idaho National Laboratory.

It should be noted that the other iPWR developers (Babcock & Wilcox, Holtec, and Westinghouse) have other lines of business. NuScale Power does not, so its only mission is to bring its reactor to reality. Component testing is now in progress. The Watch has fewer things to watch now than it had years ago, but NuScale remains among them. ■