UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 52-034-COL
LUMINANT GENERATION COMPANY LLC	)	52-035-COL
	)	
(Comanche Peak Nuclear Power Plant Units 3 and 4)	)	August 26, 2010

LUMINANT'S MOTION FOR SUMMARY DISPOSITION OF CONTENTION 18 AND ALTERNATIVES CONTENTION A

I. INTRODUCTION

In accordance with 10 C.F.R. § 2.1205, Luminant Generation Company LLC and Comanche Peak Nuclear Power Company LLC, Applicants in the above-captioned matter (jointly, "Luminant"), respectfully request that the Atomic Safety and Licensing Board ("Licensing Board" or "Board") grant summary disposition in favor of Luminant on Contention 18 and Alternatives Contention A (jointly, "Alternatives Contention A") concerning energy alternatives to Comanche Peak Nuclear Power Plant ("CPNPP") Units 3 and 4.[1] As discussed below, Alternatives Contention A should be dismissed because there is no genuine issue of material fact related to this contention and Luminant is entitled to judgment as a matter of law.[2]

1 This motion is supported by the accompanying "Joint Affidavit of Donald R. Woodlan, John T. Conly, Ivan Zujovic, David J. Bean, John E. Forsythe, and Kevin Flanagan" ("Joint Affidavit") and the "Statement of Material Facts on Which There is No Genuine Issue to be Heard" ("Statement of Material Facts"). Mr. Woodlan is the Manager for Nuclear Regulatory Affairs, NuBuild for Luminant; Mr. Conly is the COLA Project Manager, NuBuild for Luminant; and Messrs. Zujovic, Bean, Forsythe, and Flanagan are consultants for Enercon Services, Inc., a contractor to Luminant for CPNPP Units 3 and 4.

2 Counsel for Luminant has made a sincere effort to contact the lead counsel for the other parties to resolve the issues raised by this motion. Those efforts were unsuccessful with respect to the Intervenors. Counsel for the NRC Staff has stated that the Staff has no objection to the motion.

II. PROCEDURAL BACKGROUND

On September 19, 2008, Luminant submitted an Application to the U.S. Nuclear Regulatory Commission ("NRC") for combined licenses ("COLs") for CPNPP Units 3 and 4.[3] The Sustainable Energy and Economic Development Coalition, Public Citizen, True Cost of Nukes, J. Nile Fisher, Nita O'Neal, Don Young, and Lon Burnam ("Intervenors") filed a "Petition for Intervention and Request for Hearing" ("Petition") on April 6, 2009, alleging nineteen contentions. Contention 18 alleged that Luminant's application was deficient because its Environmental Report ("ER")[4] failed to evaluate adequately alternative sources of generating capacity.[5] The Board restated and admitted Contention 18 as:

> The Comanche Peak Environmental Report is inadequate because it fails to include consideration of alternatives to the proposed Comanche Peak Units 3 and 4, consisting of combinations of renewable energy sources such as wind and solar power, with technological advances in storage methods and supplemental use of natural gas, to create baseload power.[6]

On December 8, 2009, Luminant notified the Board of its submittal to the NRC identifying revisions to the ER ("ER Update") that created a new section, Section 9.2.2.11, augmenting the original evaluation of alternative generation sources.[7] Luminant filed a motion

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3 Luminant Generation Company, LLC; Notice of Receipt and Availability of Application for a Combined License, 73 Fed. Reg. 66,276 (Nov. 7, 2008).

4 Comanche Peak Nuclear Power Plant Units 3 and 4, COL Application Environmental Report (rev. 1, Nov. 20, 2009) ("ER Rev. 1"), *available at* http://adamswebsearch2.nrc.gov/idmws/ViewDocByAccession.asp?AccessionNumber=ML100081557 (follow links).

5 Petition at 42.

6 *Luminant Generation Co., LLC* (Comanche Peak Nuclear Power Plant Units 3 & 4), LBP-09-17, 70 NRC ___, slip op. at 82, 85 (Aug. 6, 2009).

7 *See* Letter from J. Rund, Counsel for Luminant, to the Board, Notification of Filing Related to Contention 18 (Dec. 8, 2009), *available at* ADAMS Accession No. ML093421445.

to dismiss Contention 18 as moot in light of the ER Update.[8] The Intervenors opposed Luminant's motion to dismiss and requested that Contention 18 advance as admitted or in a modified, narrower version.[9] The Intervenors argued that the modified Contention 18 should require Luminant to "at a minimum, actually consider combinations of wind and solar with CAES supplemented with natural gas."[10]

On January 15, 2010, the Intervenors filed six new contentions related to ER Section 9.2.2.11.[11] Luminant filed an answer opposing the Intervenors' new and modified contentions regarding alternative energy sources on February 4, 2010.[12] The NRC staff likewise opposed Intervenors' amended Contention 18 and new contentions.[13] The Intervenors replied to Luminant and the NRC staff, arguing that Contention 18, in its admitted form and as modified, and their six new contentions, should advance to hearing.[14] On April 15, 2010, the Board held oral argument on a variety of issues, including Luminant's Motion to Dismiss Contention 18 as Moot and the admissibility of Contentions ALT-1 through ALT-6.[15] Thereafter, on June 25, 2010, the Board issued a Memorandum and Order ruling, among other issues, on the mootness of

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8 Luminant's Motion to Dismiss Contention 18 as Moot (Dec. 14, 2009).

9 Intervenors' Response Opposing Applicant's Motion to Dismiss Contention 18 as Moot at 8-9 (Jan. 4, 2010).

10 *Id.* at 8.

11 Intervenors' Contentions Regarding Applicant's Revisions to Environmental Report Concerning Alternatives to Nuclear Power (Jan. 15, 2010) ("Intervenors' New Contentions").

12 Luminant's Answer Opposing New and Modified Contentions Regarding Alternative Energy Sources (Feb. 4, 2010).

13 NRC Staff Consolidated Response to Intervenors' Amended Contention 18 and Proposed Contentions Concerning Alternatives to Nuclear Power (Feb. 4, 2010).

14 Intervenors' Consolidated Response to NRC Staff's and Applicant's Answers to Alternatives Contentions (Feb. 12, 2010).

15 *See* Tr. at 733-964 (Apr. 15, 2010).

Contention 18, and the Intervenors' six new alternatives contentions.[16] A majority of the Board found Contention 18 to be moot in part based on the ER Update.[17] The Board also admitted, in part, Contentions ALT-1, ALT-2, and ALT-3.[18] The Board reformulated and consolidated the admitted portions of these contentions into one contention, designated as Alternatives Contention A:

> The Applicant has not considered the feasibility under NEPA of an alternative consisting of a combination of solar and wind energy, energy storage methods including CAES and molten salt storage, and natural gas supplementation, to produce baseload power, with specific regard to:
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> (a) the reasonable availability of the four parts of such combination for consolidation into an integrated system to produce baseload power;
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> (b) the feasibility of the use of such combination in the area of Texas served by the Comanche Peak plant;
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> (c) the extent to which there may be efficiencies arising from overlapping uses of land for each of the four parts of the combination as well as for other reasonable purposes; and
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> (d) if it is shown that such an alternative is environmentally preferable, the extent to which operation and maintenance costs of solar in such combination may be a comparative benefit.[19]

The Board emphasized that it was admitting this contention only with respect to the "four-part" combination of solar, wind, storage, and natural gas supplementation.[20] The Board also found

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16 *Luminant Generation Co., LLC* (Comanche Peak Nuclear Power Plant Units 3 & 4), LBP-10-10, 70 NRC ___, (June 25, 2010).

17 *Id.* at 4, 86.

18 *Id.* at 74-75.

19 *Id.* (citations omitted).

20 *Id.* at 4, 11-13, 58, 62, 68-72.

that the remaining portion of original Contention 18 that was not moot is identical to admitted Alternatives Contention A.[21]

The NRC issued a Draft Environmental Impact Statement ("DEIS") for CPNPP Units 3 and 4 in August 2010.[22] Section 9.2 of the DEIS includes information related to the environmental impacts of alternative energy generation sources, including wind, solar, and natural gas energy generations sources. Section 9.2.4 evaluates the environmental impacts of a combination of alternative generation sources, consisting of wind and solar, each with storage; biomass, municipal solid waste, and geothermal; and natural gas.[23] As stated in the DEIS, the NRC staff determined that given Luminant's objective of generating baseload power, a fossil energy source, most likely coal or natural gas, would need to be a significant contributor to any reasonable alternative energy combination.[24] The DEIS concludes that combinations of power generation alternatives are not environmentally preferable to CPNPP Units 3 and 4.[25] As discussed in the footnotes throughout this Motion, the conclusions and underlying factual statements in the DEIS are consistent with the material facts presented in this Motion.

III. STATEMENT OF THE LAW

A. Law Governing Summary Disposition

In LBP-09-17, the Board ordered that this proceeding be governed by 10 C.F.R. Part 2, Subparts C and L.[26] As provided by Subpart L, any party may submit a motion for summary

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21 *Id.* at 75, 87.

22 NUREG-1943, Environmental Impact Statement for the Combined Licenses (COLs) for Comanche Peak Nuclear Power Plant Units 3 and 4 – Draft Report for Comment (Aug. 2010), *available at* ADAMS Accession No. ML102170030 ("DEIS").

23 *Id.* at 9-28.

24 *Id.*

25 *Id.* at 9-32.

26 LBP-09-17, slip op. at 85.

disposition.[27] The motion must be in writing and include a written explanation of the basis of the motion, and affidavits to support statements of fact.[28]

In ruling on a motion for summary disposition, a licensing board is directed to apply the standards for summary disposition set forth in 10 C.F.R. § 2.710(d)(2).[29] Pursuant to that provision, summary disposition is warranted

> [I]f the filings in the proceeding, depositions, answers to interrogatories, and admissions on file, together with the statements of the parties and the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a decision as a matter of law.[30]

The NRC's hearing rules "long have allowed summary disposition in cases where there is no genuine issue as to any material fact and where the moving party is entitled to a decision as a matter of law."[31]

The Commission has held that motions for summary disposition are analogous to summary judgment motions under Rule 56 of the Federal Rules of Civil Procedure, and should be evaluated under the same standards.[32] The U.S. Supreme Court has stated that summary disposition is not simply a "procedural shortcut"; rather, it is designed "to secure the just, speedy and inexpensive determination of every action," and should be granted when appropriate.[33]

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27 10 C.F.R. § 2.1205(a).

28 *Id.*

29 *Id.* § 2.1205(c).

30 *Id.* § 2.710(d)(2).

31 *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 NRC 370, 384 (2001) (internal quotations omitted).

32 *Advanced Med. Sys. Inc.* (One Factory Row, Geneva, OH 44041), CLI-93-22, 38 NRC 98, 102 (1993).

33 *Celotex Corp. v. Catrett*, 477 U.S. 317, 327 (1986) *See also Tenn. Valley Auth.* (Hartsville Nuclear Plant, Units 1A, 2A, 1B & 2B), ALAB-554, 10 NRC 15, 19 (1979) (summary disposition provides a remedy for matters which have not been the subject of an evidentiary hearing, but are susceptible of final resolution on papers submitted by the parties in advance of such hearing).

Under this standard, "substantive law will identify which facts are material. Only disputes over facts that might affect the outcome of the suit under the governing law will properly preclude the entry of summary judgment. Factual disputes that are irrelevant or unnecessary will not be counted."[34]

Moreover, the level of factual support necessary to withstand summary disposition is expected to be of a much "higher level" than at the contention filing stage.[35] Pursuant to Supreme Court and NRC case law, the party seeking summary disposition must show the absence of a genuine issue as to any material fact.[36] In response, the party opposing the motion "must set forth *specific facts* showing that there is a genuine issue of fact."[37] In this regard, "[o]nly disputes over facts *that might affect the outcome of the suit under the governing law* will properly preclude the entry of summary judgment. Factual disputes that are irrelevant or unnecessary will not be counted."[38]

To be considered a genuine issue of material fact, "the factual record, *considered in its entirety*, must be enough in doubt so that there is a reason to hold a hearing to resolve the issue."[39] Bare allegations or general denials are insufficient to oppose a motion for summary disposition,[40] as are mere "quotations from or citations to [the] published work of researchers [or

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34 *Anderson v. Liberty Lobby, Inc.*, U.S. 242, 248 (1986).

35 Final Rule, Rules of Practice for Domestic Licensing Proceedings – Procedural Changes in the Hearing Process, 54 Fed. Reg. 33,168, 33,171 (Aug. 11, 1989).

36 *Adickes v. S.H. Kress & Co*., 398 U.S. 144, 157 (1970); *Advanced Med*., CLI-93-22, 38 NRC at 102.

37 10 C.F.R. § 2.710(b) (emphasis added).

38 *Anderson*, 477 U.S. at 248 (emphasis added).

39 *Cleveland Elec. Illuminating Co.* (Perry Nuclear Power Plant, Units 1 & 2), LBP-83-46, 18 NRC 218, 223 (1983) (emphasis added). *See also Lujan v. Nat'l Wildlife Fed'n*, 497 U.S. 871, 898-99 (1990) (granting summary judgment because the plaintiff did not set forth facts specific enough to support its claim).

40 *See* 10 C.F.R. § 2.710(b) (stating that "a party opposing the motion may not rest upon the mere allegations or denials of his answer"); *Advanced Med.*, CLI-93-22, 38 NRC at 102; *Houston Lighting & Power Co.* (Allens

experts] who have apparently reached conclusions at variances with the movant's affiants."[41] Furthermore, if the party opposing the motion fails to controvert any material fact, then that fact will be deemed admitted.[42]

Submission of expert opinion by an opponent does not preclude summary disposition,[43] and parties must "clearly and thoroughly explain the basis for the expert's opinion."[44] The expert witness/affiant must be competent to testify to the matters stated in the affidavit.[45] The licensing board may look at whether the witness qualifies as an expert by "knowledge, skill, experience, training, or education."[46] The licensing board "must focus on whether the expert opinions are sufficiently grounded upon a factual basis."[47] As such, the party opposing summary disposition cannot defeat the motion by presenting "subjective belief[s] or unsupported speculation,"[48] or improperly supported expert opinion.[49] Thus, in opposing summary disposition, "expert opinion is admissible only if the affiant is competent to give an expert

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Creek Nuclear Generating Station, Unit No. 1), ALAB-629, 13 NRC 75, 78 (1981) (the opposition may not rest on mere allegations or denials).

41 *Carolina Power & Light Co.* (Shearon Harris Nuclear Plant, Units 1 & 2), LBP-84-7, 19 NRC 432, 435-36 (1984). *See also United States v. Various Slot Machines on Guam*, 658 F.2d 697, 700 (9th Cir. 1981) (holding that "in the context of a motion for summary judgment, an expert must back up his opinion with specific facts" in an affidavit).

42 10 C.F.R. § 2.710(a); *Advanced Med*., CLI-93-22, 38 NRC at 102-03.

43 *See Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-05-04, 61 NRC 71, 80-81 (2005) ("DCS") ("Conflicting expert opinions . . . do not necessarily preclude summary disposition" as "the nonmoving party cannot avoid summary judgment by presenting an unsupported opinion of an expert."). *See also Rasking v. Wyatt Co*., 125 F.3d 55, 66 (2d Cir. 1997) (holding that a mere proffer of expert testimony is not a "talisman against summary judgment").

44 *DCS*, LBP-05-4, 61 NRC at 81.

45 10 C.F.R. § 2.710(b).

46 *DCS*, LBP-05-04, 61 NRC at 80 (*citing* Fed. R. Evid. 702).

47 *Id*. at 81.

48 *Id*. at 80 (*quoting Daubert v. Merrell Dow Pharms., Inc*., 509 U.S. 579, 589-90 (1993)). *See also Brown v. City of Houston*, 337 F.3d 539 (5th Cir. 2003) ("Unsubstantiated assertions, improbable inferences, and unsupported speculation are not sufficient to defeat a motion for summary judgment.").

49 *Id*. at 81.

opinion and only if the factual basis for that opinion is adequately stated and explained in the affidavit."[50]

If the moving party makes a proper showing, and the opposing party does not show that a genuine issue of material fact exists, then the licensing board may summarily dispose of the contention on the basis of the pleadings.[51]

B. Law Governing Consideration of Alternative Energy Generation Sources

The Intervenors' energy alternative contentions raise issues related to the NRC's compliance with the National Environmental Policy Act of 1969 ("NEPA"),[52] and the implementing NRC regulations in 10 C.F.R. Part 51.[53] NEPA requires federal agencies, such as the NRC, to prepare an Environmental Impact Statement ("EIS") in conjunction with "major Federal actions significantly affecting the quality of the human environment."[54] An EIS must include a detailed statement on "alternatives to the proposed action."[55] NEPA "does not mandate particular results, but simply prescribes the necessary process."[56] As the Commission has explained:

> NEPA's twin goals are to inform the agency and the public about the environmental effects of a project. At NRC licensing hearings, petitioners may raise contentions seeking correction of significant inaccuracies and omissions in the ER. Our boards do not sit to

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50 *Id*.

51 *N. States Power Co.* (Prairie Island Nuclear Generating Plants, Units 1 & 2), CLI-73-12, 6 AEC 241, 242 (1973), *aff'd sub nom. BPI v. AEC*, 502 F.2d 424 (D.C. Cir. 1974) ("It remains for [the intervenor] to establish, to the satisfaction of the Board which has been convened to conduct the hearing, that a genuine issue actually exists. If the Board is not so satisfied, it may summarily dispose of the contention on the basis of the pleadings.").

52 42 U.S.C. §§ 4321-4370 (2006).

53 *See* 10 C.F.R. § 51.71 n.4.

54 42 U.S.C. § 4332(2)(C).

55 *Id.* § 4332(2)(C)(iii).

56 *Nuclear Info. and Res. Serv. v. NRC*, 509 F.3d 562, 569 (D.C. Cir. 2007) (*quoting Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989)).

> "flyspeck" environmental documents or to add details or nuances. If the ER (or the EIS) on its face "comes to grips with all important considerations" nothing more need be done.[57]

NEPA requires agencies to take a "hard look" at alternatives to a proposed action, subject to a "rule of reason."[58] "[T]he law is clear that not every possible hypothesis must be considered."[59] The NRC need not look at every possible alternative to the proposed licensing action, but only *reasonable* alternatives.[60] As the Licensing Board has ruled in this proceeding, the standard in NUREG-1555 that an alternative be "developed, proven, and available in the relevant region" is relevant to the question of reasonableness.[61] These terms are not defined in NUREG-1555. Based upon a dictionary definition of these terms, a "developed" alternative is one that is advanced in industrial capacity and technological sophistication,[62] while a "proven" alternative is one that has actually been successfully demonstrated,[63] and an "available"

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57 *Sys. Energy Res., Inc.* (Early Site Permit for Grand Gulf ESP Site), CLI-05-4, 61 NRC 10, 13 (2005) (citations omitted). *See also Duke Energy Corp.* (McGuire Nuclear Station, Units 1 & 2; Catawba Nuclear Station, Units 1 & 2), CLI-03-17, 58 NRC 419, 431 (2003) ("NRC adjudicatory hearings are not EIS editing sessions. Our busy boards do not sit to parse and fine-tune EISs.")

58 *La. Energy Servs., L.P.* (National Enrichment Facility), LBP-06-8, 63 NRC 241, 258-59 (2006).

59 *Private Fuel Storage, LLC* (Indep. Spent Fuel Storage Installation), LBP-03-30, 58 NRC 454, 474 (2003) ("PFS").

60 *Id.* at 463.

61 LBP-10-10, slip op. at 66, 69 (*citing* NUREG-1555, Standard Review Plans for Environmental Reviews for Nuclear Power Plants 9.2.2-4 (Oct. 1999) (noting that to be considered a competitive (*i.e.*, reasonable) alternative, an "energy conversion technology should be developed, proven, and available in the relevant region")). The Licensing Board has an extensive discussion of this standard in LBP-10-10, slip op. at 60-67. *See also Kelley v. Selin*, 42 F.3d 1501, 1521 (6th Cir. 1995) (upholding NRC decision not to consider additional alternative spent fuel storage technologies that were "neither sufficiently demonstrated nor practicable for use."); *Comtys., Inc. v. Busey*, 956 F.2d 619, 627 (6th Cir. 1992) (upholding EIS that considered only two alternatives and rejecting the need to consider alternatives that "presented severe engineering requirements" or were "imprudent for reasons including their high cost, safety hazards, [and] operational difficulties"); Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18,026, 18,027 (Mar. 23, 1981) ("Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense . . . .").

62 *See* American Heritage College Dictionary 380 (3d ed. 2000) (defining "developed" as "[a]dvanced in industrial capacity, technological sophistication, and economic productivity").

63 *See id.* at 1101 (defining "proven" as "[h]aving been demonstrated or verified without doubt").

alternative is one that is present and ready for use in the relevant region.[64] For the purposes of this motion, an alternative is conservatively considered "available" if the elements necessary for its development and implementation are present and ready for use, but that does not imply financial viability or a time frame for development or implementation. On the other hand, an alternative is "feasible" if it is capable of being developed or if there is a possibility of the alternative being developed.[65]

Additionally, where a federal agency is not the sponsor of a project, the NRC may accord substantial weight to an applicant's goals for the proposed project.[66] An applicant's goals delimit the universe of reasonable alternatives. "Congress did not expect agencies to determine for the applicant what the goals of the applicant's proposal should be."[67]

Here, Luminant's stated goal is to produce baseload power. Accordingly, the NRC need only evaluate energy generation alternatives that are reasonable options for producing baseload power.[68] In that regard, the Licensing Board has limited the admitted contention to combinations of alternatives that can produce baseload power.[69]

NEPA also does not require the consideration of alternatives that are not significantly distinguishable from alternatives actually considered. Instead, an agency's evaluation of

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64 *See id.* at 94 (defining "available" as "[p]resent and ready for use").

65 *See id.* at 499 (defining "feasible" as "[c]apable of being accomplished or brought about; possible").

66 *See City of Grapevine v. Dep't of Transp.*, 17 F.3d 1502, 1506 (D.C. Cir. 1994) (*citing Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 197-98 (D.C. Cir. 1991)).

67 *Citizens Against Burlington*, 938 F.2d at 199.

68 *See Exelon Generation Co.* (Early Site Permit for Clinton ESP Site), CLI-05-29, 62 NRC 801, 810 (2005), *aff'd sub nom.*, *Envtl. Law & Policy Ctr. v. NRC*, 470 F.3d 676 (7th Cir. 2006).

69 LBP-10-10, slip op. at 11, 14, 49, 70-72.

alternatives is sufficient if it considers an appropriate range of alternatives, even if it does not consider every available alternative.[70]

In categorizing and comparing the environmental impacts of alternatives, NRC assigns each impact a "significance level":

- SMALL – For the issue, environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE – Environmental impacts are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- LARGE – Environmental impacts are clearly noticeable and are sufficient to destabilize important attributes of the resource.

These significance levels are embodied in NRC's environmental regulations in 10 C.F.R. Part 51, Table B-1, pertaining to license renewal of nuclear power plants. Although this regulation applies to license renewal proceedings, licensing boards have relied on these definitions in COL proceedings.[71] Similarly, this method of classification is a useful tool for comparing the environmental impacts of energy alternatives relative to CPNPP Units 3 and 4 and is used in Section 9.2 of both the DEIS and the ER.

IV. THERE IS NO GENUINE ISSUE OF MATERIAL FACT, AND LUMINANT IS ENTITLED TO JUDGMENT AS A MATTER OF LAW

The following sections demonstrate that no genuine issue of material fact exists regarding (1) the feasibility and availability of the four-part combination of solar, wind, energy storage,

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70 *PFS*, LBP-03-30, 58 NRC at 479 (*quoting Headwaters, Inc. v. BLM*, 914 F.2d 1174, 1181 (9th Cir. 1990), *reh'g and reh'g en banc denied*, 940 F.2d 435 (1991)); Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. at 18,027 (acknowledging that certain projects could involve an infinite number of alternatives, but indicating that an agency need only discuss a "reasonable number of examples, covering the *full spectrum* of alternatives").

71 *See*, *e.g*., *Tenn. Valley Auth.* (Bellefonte Nuclear Power Plant Units 3 & 4), LBP-08-16, 68 NRC 361, 425 (2008).

and natural gas supplementation to generate baseload power;[72] and (2) the environmental impacts of the four-part combination, accounting for the possibility of overlapping land uses.

As discussed below, the undisputed material facts show that:

(1) Because natural gas is developed, proven, and available for producing baseload power, combinations involving natural gas (including the four-part combination that is the subject of Alternatives Contention A) are also developed, proven, and available for producing baseload power, provided that natural gas supplies the majority of the electricity. Furthermore, because wind, solar, energy storage, and natural gas are each proven and available means for generating electricity, a four-part combination involving wind, solar, energy storage, and natural gas is a feasible and available method for producing baseload power in Texas, even if natural gas does not supply the majority of the electricity. However, such a combination does not exist and has not been proven for producing baseload power.

(2) Combinations of wind and solar power with storage, supplemented with natural gas are not environmentally preferable to CPNPP Units 3 and 4, even assuming overlapping land uses.

Based upon these undisputed facts, Luminant is entitled to judgment as a matter of law. In that regard, Issue (d) in Alternatives Contention A regarding the costs of solar power is not relevant or material, given that the four-part combination is not environmentally preferable to CPNPP Units 3 and 4.

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72 As noted above, Alternatives Contention A claims that Luminant "has not considered the *feasibility* under NEPA of an alternative consisting of a combination of solar and wind energy, energy storage methods including CAES and molten salt storage, and natural gas supplementation" and "the *reasonable availability* of the four parts of such combination for consolidation into an integrated system to produce baseload power." LBP-10-10, slip op. at 74-75 (emphasis added). *See also id.* at 71 ("[W]e do find . . . admissible, the issue of the feasibility and reasonable availability of the four-part wind/solar/storage/natural gas supplementation combination to produce baseload power . . . .").

A. Uncontested Facts Regarding Proposed CPNPP Units 3 and 4

The Intervenors have not contested the location, purpose, capacity, or the significance level of the environmental impacts of CPNPP Units 3 and 4 as described in the ER:

- Location – CPNPP Units 3 and 4 will be located at Luminant's CPNPP 7950-acre site in rural Somervell and Hood counties, in north central Texas.[73] Approximately 3300 acres of the site are devoted to Squaw Creek Reservoir ("SCR"), which is used for cooling water for CPNPP Units 1 and 2, but will not be used for cooling water for CPNPP Units 3 and 4.[74] The total area to be disturbed during construction of CPNPP Units 3 and 4 is 675 acres, including permanent structures, the blowdown treatment facility area, and construction laydown areas.[75]
- Purpose – The purpose of CPNPP Units 3 and 4 is to operate as an independent merchant baseload plant. The power produced will be sold in the Electric Reliability Council of Texas ("ERCOT") wholesale market.[76]
- Capacity – CPNPP Units 3 and 4 will each have a net electrical output of approximately 1600 electric megawatts ("MWe").[77] Based upon a capacity factor of 93%, CPNPP Units 3 and 4 will have a combined average annual energy output of approximately 25,500,000 megawatt-hours ("MWh").[78]

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[73] ER Rev. 1, at 4.1-1; 1 DEIS at 2-1.

[74] ER Rev. 1, at 2.2-1, 2.3-1, 2.3-14, 2.3-22; DEIS at 2-7; Joint Aff. at ¶ 29. In addition to cooling water, SCR is also used for recreational purposes. Joint Aff. at ¶ 29.

[75] ER Rev. 1, at 4.1-1; DEIS at 3-32.

[76] ER Rev. 1, at 1.0-1, 9.0-1; DEIS at 1-6.

[77] ER Rev. 1, at 1.0-1; DEIS at 3-4.

[78] ER Rev. 1, sec. 10.4.1.2.1. *Cf.* DEIS at 10-21 (approximately 26,630,000 MWh at 95% capacity factor).

- Environmental Impacts – The adverse environmental impacts of CPNPP Units 3 and 4 upon aesthetics, waste management, environmental justice, historic and cultural resources, air quality, and human health each will be SMALL.[79] The adverse environmental impacts of CPNPP Units 3 and 4 upon land use, water use and quality, and ecological resources may be MODERATE.[80] Living organisms in and around CPNPP Units 3 and 4 would be exposed to low-levels of radiation and radiological effluents.[81] Exposure from liquid pathways, gaseous pathways, or direct radiation from the station operation would be within the limits specified by NRC and EPA regulations.[82] Accordingly, human health impacts and environmental impacts from radiological effluents from CPNPP Units 3 and 4 would be SMALL.[83] Similarly, the risk-based radiological impacts of accidents at CPNPP Units 3 and 4 will be SMALL.[84]

Because there are no admitted contentions related to the environmental impacts of CPNPP Units 3 and 4, or the information from the ER that is provided above, that information is not open to dispute in response to this Motion.[85]

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79 ER Rev. 1, tbl. 9.2-1; DEIS at 5-46, 9-32.

80 DEIS at 9-32. The ER determined that the adverse environmental impacts of CPNPP Units 3 and 4 upon land use, water use and quality, and ecological resources will each be SMALL. ER, Rev. 1, tbl. 9.2-1. Although the Intervenors did not challenge these conclusions, this Motion conservatively assumes that the characterization of these impacts in the DEIS as MODERATE is correct.

81 ER Rev. 1, at 5.4-1; DEIS at 5-80 to 5-83.

82 ER Rev. 1, at 5.4-1 to 5.4-13; DEIS at 5-79 to 5-80.

83 *See* ER Rev. 1, secs. 5.4.3, 5.4.4 & tbl. 9.2-1; DEIS at 5-80.

84 *See* ER Rev. 1, §§ 7.1, 7.2. *See also* ER § 7.5 as provided in the attachment to Letter from J. Rund, Counsel for Luminant, to the Board, Notification of Filing Related to Contention 13 (Jan. 15, 2010)

85 *See S. Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), LBP-08-2, 67 NRC 54, 78 (2008) (refusing to consider new bases that were included in an answer to summary disposition motion and were outside the scope of the original contention).

B. **There Is No Issue of Material Fact Regarding the Feasibility and Availability of the Four-Part Combination**

Both the body of Alternatives Contention A, and Issues (a) and (b) in the Contention pertain to the feasibility and availability of the four-part combination of wind, solar, energy storage, and natural gas to produce baseload power. This section of the Motion addresses the issue of feasibility and availability of the four-part combination.

Individually, each of the four parts of the combination is a feasible, available, and proven method for generating some amount of electricity:

- Wind Power – As of 2009, there was approximately 8000 MWe of wind power installed in the ERCOT region.[86] As of mid-2009, the largest wind power facility in the world was the Horse Hollow Wind Energy Center in Texas, with a capacity of 735 MWe.[87] Wind power has nationwide capacity factors 25 to 45%.[88] In Texas, the capacity factors of wind farms range from 29 to 55%, depending on region and the time of year.[89] Wind power alone is not capable of producing baseload power.[90] Most of the wind power generation capacity is available in the western portion of Texas.[91]
- Solar Power – As of 2009, no solar power generation was installed at the transmission level in the ERCOT region.[92] However, several solar projects are being developed in the ERCOT region, which if completed would add approximately 460 MWe cumulatively of

86 Statement of Material Fact # I.A.1; Joint Affidavit at ¶ 33; DEIS at 9-20.

87 Statement of Material Fact # I.A.2; Joint Affidavit at ¶ 37; ER Rev. 1, at 9.2-8; DEIS at 9-20.

88 Statement of Material Fact # I.A.3; ER Rev. 1, at 9.2-8. The DEIS (at 9-21) states that newer wind turbines typically operate at 36% capacity.

89 Statement of Material Fact # I.A.3; ER Rev. 1, at 9.2-8.

90 Statement of Material Fact # I.A.3; ER Rev. 1, at 9.2-7 & -8; DEIS at 9-24.

91 Statement of Material Fact # I.A.4; ER Rev. 1, at 9.2-8; DEIS at 9-22.

92 Statement of Material Fact # I.B.1; Joint Affidavit at ¶ 43.

installed capacity by 2011.[93] The largest operational solar thermal power facility in the world is the 354-MWe facility in the Mojave Desert of southern California.[94] Capacity factors of solar power are typically 24 to 32%.[95] Solar power alone is not capable of producing baseload power.[96] The western portions of the ERCOT region receive considerably more direct solar radiation than the eastern ERCOT regions.[97] Based on solar radiation maps, numerous areas in the western portion of the ERCOT region would meet or exceed the minimum insolation standard for generation of solar power.[98]

- Energy Storage – There are a number of possible energy storage mechanisms. Compressed air energy storage ("CAES") and molten salt thermal storage are the two most promising storage mechanisms in Texas for producing large amounts of electricity.[99]
    - There are two CAES facilities in operation, the 290-MWe Huntorf facility in Germany and the 110-MWe McIntosh plant in Alabama.[100] Those facilities are primarily used for generating peaking power and do not produce baseload power.[101] The Intervenors have agreed that existing CAES facilities are used

[93] Statement of Material Fact # I.B.1; Joint Affidavit at ¶ 43; DEIS at 9-24.

[94] Statement of Material Fact # I.B.2; Joint Affidavit at ¶ 44; DEIS at 9-24.

[95] Statement of Material Fact # I.B.3; ER Rev. 1, at 9.2-10. The DEIS reports capacity factors of 24 to 50%, the latter being with energy storage. DEIS at 9-24.

[96] Statement of Material Fact # I.B.3; ER, Rev. 1, at 9.2-10, 9.2-11; DEIS at 9-25.

[97] Statement of Material Fact # I.B.4; Joint Affidavit at ¶ 46.

[98] Statement of Material Fact # I.B.4; Joint Affidavit at ¶ 45; DEIS at 9-24.

[99] Statement of Material Fact # I.C.2; ER Update sec. 9.2.2.11.2.

[100] Statement of Material Fact # I.C.3; ER Update at 9.2-38; DEIS at 9-21.

[101] Statement of Material Fact # I.C.3; ER Update, § 9.2.2.11.2.

as peaking power facilities.[102] Several combined renewable energy and CAES projects are under development or in the planning stages,[103] including one that might produce baseload power.[104]

- There are several commercial molten salt thermal storage systems in operation.[105] Other solar power plants using molten salt storage have been proposed, but have not been built.[106]

- Natural Gas – Natural gas is the largest single technology for energy production in the ERCOT region.[107] Natural gas provides approximately 70% of the energy generating capacity for the ERCOT power grid.[108] There are 18 natural gas power plants in the ERCOT system with capacities over 1000 MWe; an additional 33 natural gas plants have capacities between 500 and 1000 MWe.[109] The largest of these are the 2241-MWe Cedar Bayou Units 1, 2, and 3 in Chambers County, the 2234-MWe PH Robinson Units 1, 2, 3, and 4 in Galveston County, and the 1804-MWe Forney Energy Center in Kaufman County.[110] Modern natural gas plants have a capacity factor of approximately 85% and are capable of producing baseload power.[111]

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102 *See* Intervenors' Response Opposing Applicant's Motion to Dismiss Contention 18 as Moot 5 (Jan. 4, 2010) ("Intervenors' Contention 18 Response").

103 Statement of Material Fact # I.C.4; ER Update at 9.2-39.

104 Joint Affidavit at ¶ 54; DEIS at 9-21.

105 Statement of Material Fact # I.C.5; Joint Affidavit at ¶ 61.

106 Statement of Material Fact # I.C.6; Joint Affidavit at ¶ 61; DEIS at 9-25.

107 Statement of Material Fact # I.D.1; ER Rev. 1, at 9.2-29; DEIS at 9-6.

108 Statement of Material Fact # I.D.1; ER Rev. 1, at 9.2-29.

109 Statement of Material Fact # I.D.2; ER Rev. 1, at 9.2-29.

110 Statement of Material Fact # I.D.2; ER Rev. 1, at 9.2-29.

111 Statement of Material Fact # I.D.3; ER Rev. 1, at 9.2-29 & tbl. 9.2-4; DEIS at 9-7.

As discussed above, although wind and solar power are both available in the ERCOT region, most of the available generation capacity from these sources exists in the western portion of Texas. There currently is transmission congestion in the ERCOT region and new bulk transmission lines likely would be needed to support transfers of significant amounts of any additional wind or solar generation to be developed.[112] If the wind and solar portion of the four-part combination were located in western Texas (which would probably be necessary since both the wind and solar resources are predominately located in that part of the state), additional transmission lines likely would be needed to transfer the power from the generating facilities to the load centers in Texas.[113]

There are innumerable ways to combine wind, solar, energy storage, and natural gas. In some of those combinations, natural gas would produce the majority of the electricity. In other combinations, natural gas would not produce the majority of the electricity. These two types of combinations are discussed below.

1. Combinations in Which Natural Gas Produces the Majority of the Electricity

Natural gas, by itself, is capable of generating baseload power.[114] Furthermore, natural gas is developed, proven, and available for producing baseload power in Texas.[115] Therefore, combinations involving natural gas (including the four-part combination that is the subject of Alternatives Contention A) are also developed, proven, and available for producing baseload power, provided that natural gas supplies the majority of the electricity. As a result, such

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112 Statement of Material Fact # I.E.1; Joint Affidavit at ¶ 64; DEIS at 9-22.

113 Statement of Material Fact # I.E.2; Joint Affidavit at ¶ 64; DEIS at 9-22.

114 Statement of Material Fact # I.D.3; ER Rev. 1, at 9.2-29 to 9.2-30; DEIS at 9-27.

115 Statement of Material Fact # I.D.2; ER Rev. 1, at 9.2-29 to 9.2-30; DEIS at 9-6, 9-7.

combinations are a reasonable alternative for producing baseload power.[116] The environmental impacts of such combinations are addressed as part of Bounding Case 1 in Section IV.D.2 below.

2. Combinations in Which Natural Gas Does Not Produce the Majority of the Electricity

As discussed above, wind, solar, energy storage, and natural gas are proven methods for generating some amounts of electricity. A four-part combination involving wind, solar, energy storage, and natural gas, in which natural gas does not supply the majority of the electricity, is a feasible and available method for producing baseload power.[117] However, for several reasons, such a combination has not been proven for producing baseload power equivalent to CPNPP Units 3 and 4, as outlined below:

- Such a four-part combination does not exist anywhere in the world.[118] Instead, with a few exceptions, wind, solar, and natural gas have been operated as independent projects rather than as part of a combination.[119]
- As discussed above, the largest wind and solar facilities in the world have capacities of 735 MWe and 354 MWe, respectively. Even if these facilities were combined with storage facilities to produce baseload power, their total capacity would be less than 1100 MWe. Furthermore, given the capacity factors of the individual elements, the combination would be able to generate far less than half the energy to be generated by CPNPP Units 3 and 4.[120] In such a combination, natural gas would need to generate the

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116 Statement of Material Fact # I.F.1; ER Update secs. 9.2.2.11.4.1, 9.2.2.11.4.2; DEIS at 9-28.

117 Statement of Material Fact # I.F.2; Joint Affidavit at ¶ 72. The DEIS does not evaluate a combination in which natural gas does not produce the majority of the energy, stating that a fossil-fueled energy source "would need to be a significant contributor to a reasonable combination of energy alternatives." DEIS at 9-28.

118 Statement of Material Fact # I.F.3; Joint Affidavit at ¶ 72.

119 Statement of Material Fact # I.F.4; Joint Affidavit at ¶ 72.

120 Statement of Material Fact # I.F.5; Joint Affidavit at ¶ 72.

majority of the electricity for the combination to be able to produce as much energy as CPNPP Units 3 and 4.

Thus, the four-part combination (with natural gas producing less than half of the electrical energy) is technologically feasible and available, but is not proven for generating baseload power.

Constructing and operating large generating facilities of any kind are expensive endeavors.[121] In light of the high financial costs, utilities and merchant generators use proven technologies for large generating facilities.[122] Thus, before committing to a technology (including a combination of technologies) for a large generating facility, it is typical and prudent for a utility or merchant generator to establish that the technology has been demonstrated at an existing commercial generating facility, or to develop a pilot project or a small-scale facility to prove that the technology works and is cost-effective.[123] Because the four-part combination (with natural gas producing less than half of the electrical energy) has not been proven for generating large amounts of baseload power, it is not a reasonable alternative for a utility or merchant generator for producing baseload power equivalent to CPNPP Units 3 and 4.

Nevertheless, the following discussion assumes, arguendo, that the four-part combination is a reasonable alternative for producing baseload power. The environmental impacts of such a four-part combination are discussed as part of Bounding Case 2 in Section IV.D.2 below. As that discussion demonstrates, such a combination is not environmentally preferable to CPNPP

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[121] Joint Affidavit at ¶ 30.

[122] Statement of Material Fact # I.F.6; Joint Affidavit at ¶ 30.

[123] Statement of Material Fact # I.F.6; Joint Affidavit at ¶ 30.

Units 3 and 4. Therefore, even if it is assumed that the four-part combination is a reasonable method for producing baseload power, Luminant is still entitled to a decision as a matter of law because the four-part combination is not environmentally preferable to CPNPP Units 3 and 4.

C. There Is No Issue of Material Fact Regarding the Environmental Impacts of Wind, Solar, Natural Gas, Compressed Air Energy Storage, and Molten Salt Storage as Individual Alternatives

Although wind power, solar power, compressed air energy storage, molten salt storage, and natural gas power as individual alternatives are not within the scope of Alternatives Contention A, the following sections discuss the environmental impacts of each of these alternatives alone in order to provide relevant background for the discussion of combinations involving all of them. As discussed below, some environmental impacts of a wind, solar, or natural gas facility the size of CPNPP Units 3 and 4 are greater than the impacts from the proposed CPNPP Units 3 and 4. Given that background, as explained in Section IV.D, combinations of wind, solar, storage, and natural gas facilities are not environmentally preferable alternatives to CPNPP Units 3 and 4.

1. Wind Power

A wind power facility comparable in capacity to CPNPP Units 3 and 4 would cause LARGE impacts on aesthetics and land use, based upon the following factors:[124]

- Wind Turbines – Wind turbines vary in size, typically from about 1.5 to 2.5 MWe (and some even larger).[125] The height of the towers also varies, but towers are typically 200 to 300 feet tall.[126]

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[124] Statement of Material Fact ## II.A.9, II.A.11; ER Rev., 1 at 9.2-9.

[125] Statement of Material Fact # II.A.1; Joint Affidavit at ¶ 34.

[126] Statement of Material Fact # II.A.1; Joint Affidavit at ¶ 34.

- Number of Turbines – A wind-power project with a nameplate capacity comparable to the proposed CPNPP Units 3 and 4 (*i.e.,* not accounting for the lower capacity factor) would require approximately 1600 above-ground towers, assuming that each tower supported a 2-MWe wind turbine.[127]

- Land Requirements – Wind turbines must be sufficiently spaced to maximize capture of wind energy. Typically, 100 acres of unobstructed area is needed around each wind turbine.[128] Approximately a quarter to a half acre is needed for actual placement and support of a wind tower.[129] These values are consistent with Intervenors' statement that the area occupied by the foundations of 4000 wind turbines is from 1000 to 2000 acres.[130] Land is also needed for support facilities and roads. As a result, approximately 2 to 5% of the total land area needed for a wind facility is actually occupied by wind turbines, support facilities, and roads.[131] This value is consistent with the value of 3.5% cited by the Intervenors.[132] Luminant does not dispute the Intervenors' statement that land use of wind power is consistent with other uses.[133] Land not used for wind turbines, support facilities, and roads can be used for other purposes, such as agriculture or ranching, provided that it does not obstruct the wind flow.[134] However, a wind facility would

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127 Statement of Material Fact # II.A.2; Joint Affidavit at ¶ 35.

128 Statement of Material Fact # II.A.4; Joint Affidavit at ¶ 36.

129 Statement of Material Fact # II.A.4; Joint Affidavit at ¶ 36. The DEIS has a slightly higher estimate of 0.3 to 0.4 ha per turbine. DEIS at 9-23.

130 Intervenors' New Contentions at 4; Intervenors' Response Opposing Applicant's Motion to Dismiss Contention 18 as Moot at 6 (Jan. 4, 2010).

131 Statement of Material Fact # II.A.5; Joint Affidavit at ¶ 36; DEIS at 9-22.

132 Intervenors' New Contentions at 4; Intervenors' Contention 18 Response at 5.

133 *See* Intervenors' New Contentions at 3.

134 Statement of Material Fact # II.A.5; ER Rev. 1, at 9.2-9; DEIS at 9-22 to 9-23.

preclude a number of land uses, particularly uses requiring above-ground structures that could interfere with, or disrupt, the wind flow patterns driving the turbines.[135]

- Land Use – The 735-MWe Horse Hollow Wind Energy Center in Texas utilizes a total land area of 47,000 acres.[136] As ruled by the Licensing Board,[137] it is not contested in this proceeding that a wind-power project with a nameplate capacity comparable to the proposed CPNPP Units 3 and 4 would require approximately 204,000 acres of land.[138] Of that amount, approximately 4100 to 10,200 acres of land would be occupied by wind turbines, support facilities, and roads.[139]
- Aesthetics Impacts – As indicated above, approximately 1600 wind towers, each several hundred feet tall, spread over hundreds of thousands of acres, would be needed for a wind facility the size of CPNPP Units 3 and 4. This would result in a LARGE impact on aesthetics.[140]

Wind power also has other environmental impacts (adverse and beneficial) as discussed below.

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135 Statement of Material Fact # II.A.5; ER Rev. 1, at 9.2-9.

136 Statement of Material Fact # II.A.3; ER Rev. 1, at 9.2-9; Joint Affidavit at ¶ 37; DEIS at 9-22.

137 *See* LBP-10-10, slip op. at 39, 43-44.

138 Statement of Material Fact # II.A.6; Joint Affidavit at ¶ 37; ER Rev. 1, at 9.2-8.

139 Statement of Material Fact # II.A.6; Joint Affidavit at ¶ 37.

140 Statement of Material Fact # II.A.11; ER Rev. 1, at 9.2-9; DEIS at 9-23. The Intervenors have not contested the discussion in the original ER that this impact would be LARGE. As indicated by the Board with respect to its ruling on land usage, it is now too late for the Intervenors to contest this conclusion related to aesthetics. *See* LBP-10-10, slip op. at 43-44.

- Other Environmental Impacts – Wind power causes SMALL impacts in most other areas, including water quality, air quality, and human health.[141] Wind power on the scale of CPNPP Units 3 and 4 likely would cause MODERATE adverse impacts on ecological resources, protected species, and cultural resources, depending upon the location of the wind facility.[142] Those impacts are predominately a result of the large amounts of land that would be disturbed for a wind facility comparable in capacity to CPNPP Units 3 and 4.[143] Additionally, depending upon location, some wind farms have caused bird kills.[144]
- Socioeconomic Benefits – Wind power with a capacity of 3200 MWe would have a MODERATE beneficial impact on socioeconomics.[145]
- Additional Considerations – Operation of wind facilities comparable in capacity to CPNPP Units 3 and 4 likely would necessitate construction and operation of substantial new transmission lines from western Texas (where most of the wind potential is located) to eastern Texas (where most of the demand is located).[146] This would entail additional land use and terrestrial impacts.[147]

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[141] Statement of Material Fact # II.A.8; Joint Affidavit at ¶ 39; ER Rev. 1, at 9.2-9.

[142] Statement of Material Fact # II.A.10; ER. Rev. 1, at 9.2-9; DEIS at 9-23 to 9-24. The Intervenors have not contested the discussion in the original ER that this impact likely would be MODERATE. As indicated by the Board with respect to its ruling on land usage, it is now too late for the Intervenors to contest this conclusion related to ecological resources, protected species, and cultural resources. LBP-10-10, slip op. at 43-44.

[143] Statement of Material Fact # II.A.10; Joint Affidavit at ¶ 39.

[144] Statement of Material Fact # II.A.10; Joint Affidavit at ¶ 39; DEIS at 9-23.

[145] Statement of Material Fact # II.A.12; ER Rev. 1, at 9.2-9.

[146] Statement of Material Fact # II.A.7; Joint Affidavit at ¶ 64; DEIS at 9-22.

[147] Statement of Material Fact # II.A.7; Joint Affidavit at ¶ 64.

2. Solar Power

There are two types of solar plants in use: solar thermal and photovoltaic cells.[148] Solar thermal power systems convert sunlight into electricity using heat as an intermediate step.[149] Photovoltaic cells convert sunlight directly into electricity using semiconducting materials.[150]

Solar power comparable in capacity to CPNPP Units 3 and 4 would have LARGE impacts on land use and aesthetics, based upon the following factors:[151]

- Land Use – Current solar power plants utilize from approximately 3.8 to 10 acres per MWe, depending on solar insolation and the type of solar plant.[152] As ruled by the Licensing Board,[153] it is not contested in this proceeding that a solar plant with a nameplate capacity equivalent to CPNPP Units 3 and 4 would require approximately 38,000 acres.[154]
- Aesthetic Impacts – As indicated above, solar power facilities comparable in capacity to CPNPP Units 3 and 4 would entail large amounts of land with solar panels or reflectors, which in turn would have a LARGE impact on aesthetics.[155]

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148 Statement of Material Fact # II.B.1; ER Rev. 1, at 9.2-10.

149 Statement of Material Fact # II.B.1; ER Rev. 1, at 9.2-10.

150 Statement of Material Fact # II.B.1; ER Rev. 1, at 9.2-10.

151 Statement of Material Fact # II.B.9; ER, Rev. 1 at 9.2-11.

152 Statement of Material Fact # II.B.3; ER, Rev. 1 at 9.2-11. The DEIS reports approximately 5 to 10 acres per MWe. DEIS at 9-24.

153 *See* LBP-10-10, slip op. at 46, 49.

154 Statement of Material Fact # II.B.5; ER Rev. 1, at 9.2-11.

155 Statement of Material Fact # II.B.9; ER, Rev. 1 at 9.2-11. The Intervenors have not contested the discussion in the original ER that this impact would be LARGE. As indicated by the Board with respect to its ruling on land usage, it is now too late for the Intervenors to contest this conclusion related to aesthetics. LBP-10-10, slip op. at 49.

Solar power also has other environmental impacts (adverse and beneficial) as discussed below.

- <u>Other Impacts</u> – Solar power causes SMALL impacts on air quality, human health, and waste management.[156] However, a solar thermal facility with wet cooling on the scale of CPNPP Units 3 and 4 would require approximately the same amount of water as CPNPP Units 3 and 4, which likely would cause MODERATE adverse impacts on water use and quality.[157] Solar power on the scale of CPNPP Units 3 and 4 likely would cause MODERATE adverse impacts on ecological resources, protected species, and cultural resources, depending upon the location of the solar facility.[158] Those impacts are predominately a result of the large amounts of land that would be disturbed for a solar facility comparable in capacity to CPNPP Units 3 and 4.[159]
- <u>Socioeconomic Benefits</u> – A solar facility of the same capacity as the proposed CPNPP Units 3 and 4 would have a MODERATE beneficial impact on socioeconomics due to job creation.[160]
- <u>Additional Considerations</u> – Additional transmission lines likely would be necessary to transport power from the western portion of the state (which is the best source for solar

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156 Statement of Material Fact # II.B.6; ER Rev. 1, at 9.2-11.

157 Statement of Material Fact # II.B.8; Joint Affidavit at ¶ 49; DEIS at 9-25.

158 Statement of Material Fact ## II.B.8, II.B.10; ER Rev. 1, at 9.2-11. The Intervenors have not contested the discussion in the original ER that this impact likely would be MODERATE. As indicated by the Licensing Board with respect to its ruling on land usage, it is now too late for the Intervenors to contest this conclusion related to ecological resources, protected species, and cultural resources. LBP-10-10, slip op. at 49.

159 Statement of Material Fact # II.B.10; ER Rev. 1, at 9.2-11.

160 Statement of Material Fact # II.B.11; ER, Rev. 1 at 9.2-11.

power in Texas) to the eastern portion of the state (which has the major load centers). Additional transmission lines would likely increase land use and terrestrial impacts.[161]

3. Natural Gas

The Intervenors have not contested the environmental impacts of natural gas facilities, as discussed in ER Sections 9.2.2.10 and 9.2.3.2. In summary, a natural gas-fired plant likely would produce SMALL adverse impacts in several areas, including aesthetics, waste management, environmental justice, historical and cultural resources, and human health.[162] It would create SMALL to MODERATE air quality impacts substantially greater than those caused by nuclear generation.[163] For example, a 3200-MWe natural gas-fired plant would generate 253 tons per year ("Tpy") of SO_x, 2676 Tpy of NO_x, 1115 Tpy of CO, 142 Tpy of particulate matter ("PM"), and 8.2 million Tpy of CO_2.[164] Approximately 350 acres would be needed for a natural gas-fired generating facility equivalent to CPNPP Units 3 and 4.[165] Additional land would be affected for natural gas wells, collection stations, and a pipeline to serve the plant.[166] A natural gas-fired plant alternative at the proposed CPNPP Units 3 and 4 site would require approximately 11,500 acres of additional land for such facilities.[167] Overall, a natural-gas fired

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161 Statement of Material Fact # I.E.2; Joint Affidavit at ¶ 64.

162 Statement of Material Fact # II.C.4; ER Rev. 1, at 9.2-38 to 9.2-40; DEIS at 9-18, 9-32.

163 Statement of Material Fact # II.C.1; ER Rev. 1, at 9.2-37; DEIS at 9-32.

164 Statement of Material Fact # II.C.1; ER Rev. 1, at 9.2-36; DEIS at 9-14 to 9-15.

165 Statement of Material Fact # II.C.2.a; ER Rev. 1, at 9.2-38; DEIS at 9-17.

166 Statement of Material Fact # II.C.2.b; ER Rev. 1, at 9.2-38; DEIS at 9-17.

167 Statement of Material Fact # II.C.2.b; ER Rev. 1, at 9.2-38; *see also* DEIS at 9-17 (noting that approximately 3600 acres would be needed per 1000 MWe for natural gas wells and collections stations).

plant alternative to CPNPP Units 3 and 4 would cause MODERATE adverse impacts to land-use, water use and quality, and ecology.[168]

4. <u>Compressed Air Energy Storage</u>

CAES involves using compressors powered by the generation source to pump air into a storage facility, such as an underground cavern.[169] The compressed air is then used in combination with a heat source, such as natural gas, to drive turbines and generate electricity.[170] The two existing CAES facilities both use natural gas as the heat source.[171] The natural gas usage for generating electricity from CAES is between one third and one half that needed to generate the same amount of electricity at a natural gas plant.[172]

CAES requires land areas that possess suitable geologic formations for large-scale underground storage.[173] Texas has mines, depleted oil and gas wells, and geological formations that some have suggested might be suitable for CAES.[174]

The CAES reservoir would be underground. The above-ground facilities would consist of a CAES building that would occupy a relatively small area.[175] The need for the underground facilities would require Luminant to purchase or obtain the rights to underground land, and that

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168 Statement of Material Fact # II.C.3; ER Rev. 1, at 9.2-38 to 9.2-39, 9.2-50; DEIS at 9-32. The ER states that the impacts on water use and ecology of both nuclear and natural gas would be SMALL. ER Rev. 1, at 9.2-50. The DEIS indicates that those impacts would be MODERATE for both nuclear and natural gas. DEIS at 9-32. To be consistent with the DEIS, this analysis assumes that the impacts of both would be MODERATE.

169 Statement of Material Fact # III.A.1; ER Update at 9.2-33; DEIS at 9-21.

170 Statement of Material Fact # III.A.1; ER Update at 9.2-33; DEIS at 9-21.

171 Statement of Material Fact # III.A.3; ER Update at 9.2-34.

172 Statement of Material Fact # III.A.2; ER Update at 9.2-33.

173 Statement of Material Fact # III.A.5; ER Update at 9.2-34.

174 Statement of Material Fact # III.A.5; Joint Affidavit at ¶ 51.

175 Statement of Material Fact # III.A.6; Joint Affidavit at ¶ 57.

underground land would not be available for other uses (such as mineral extraction).[176] The above-ground areas could be used for other purposes, provided these uses are not incompatible with the underground storage systems. Thus, a large-scale CAES facility would require the purchase of underground land,[177] but would have SMALL impacts on above-ground land use.

Energy is lost during the storage and conversion process.[178] As a result, when CAES is used in combination with wind, solar, and natural gas, more energy must be produced by wind, solar, and natural gas than if CAES were not used.[179]

CAES in a salt dome or bedded salt deposits found in Texas would have MODERATE impacts on water quality, air quality, and waste management, depending upon the host geological formation and the amount of CAES used.[180] The water quality impacts would result from the large amount of freshwater required for solution mining to create CAES storage caverns.[181] Disposal of the large volumes of salt water, along with other impurities in the rock formations, from the cavern creation process would further impact water quality and increase waste management impacts.[182] These impacts might be minimized or eliminated if a pre-existing underground space, such as a depleted gas well, is used.[183]

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176 Statement of Material Fact # III.A.6; Joint Affidavit at ¶ 57.

177 As provided in NUREG-1555, Environmental Standard Review Plan, Section 4.1.1 (at 4.1.1-9), it is appropriate to account for impacts to the geologic environment when assessing land use impacts.

178 Statement of Material Fact # III.A.7; Joint Affidavit at ¶ 58.

179 Statement of Material Fact # III.A.7; Joint Affidavit at ¶ 58; ER Update at 9.2-40.

180 Statement of Material Fact # III.A.8; Joint Affidavit at ¶ 59; ER Update at 9.2-40.

181 Statement of Material Fact # III.A.8; Joint Affidavit at ¶ 59; ER Update at 9.2-40.

182 Statement of Material Fact # III.A.8; Joint Affidavit at ¶ 59; ER Update at 9.2-40.

183 Statement of Material Fact # III.A.8; Joint Affidavit at ¶ 59.

As discussed above, existing CAES facilities use natural gas in the CAES electrical generation processes. Use of natural gas would create air quality impacts (about one third to one half of the emissions of an equivalent-sized natural gas plant).[184]

Although CAES is a net energy consumer and has environmental impacts as discussed above, both of these factors are ignored in the bounding analysis of the environmental impacts of the four-part combination discussed in Section IV.D below.

5. <u>Molten Salt Storage</u>

Molten salt can be used to store heat.[185] For example, the sun's energy can be concentrated by a field of hundreds or thousands of mirrors called "heliostats" onto a receiver.[186] The energy heats molten salt flowing through the receiver; the salt's heat energy is used to boil water to create steam that generates electricity in a conventional steam turbine generator.[187] The molten salt retains heat relatively efficiently, so it can be stored for hours or even days before it loses its capacity to generate electricity.[188]

Combining solar power and molten salt storage would create greater environmental impacts than those caused by solar power alone because energy is lost during the storage and conversion process.[189] Thus, with energy storage, an even larger solar facility and greater resultant land use would be needed than discussed in Section IV.C.2 above to produce the same

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184 Statement of Material Fact # III.A.4; ER Update at 9.2-40.

185 Statement of Material Fact # III.B.1; ER Update at 9.2-35.

186 ER Update at 9.2-35.

187 ER Update at 9.2-35.

188 Statement of Material Fact # III.B.1; ER Update at 9.2-35.

189 Statement of Material Fact # III.B.2; Joint Affidavit at ¶ 62.

amount of electricity.[190] The molten salt facility would occupy a relatively small area compared to the area occupied by the solar power farm.[191]

Although molten salt storage is a net energy consumer and has environmental impacts as discussed above, both of these factors are ignored in the bounding analysis of the environmental impacts of the four-part combination discussed in Section IV.D below.

D. There Is No Issue of Material Fact Regarding the Environmental Impacts of Four-Part Combinations Involving Wind and Solar Power, Storage, and Supplemental Natural Gas

As discussed below, even assuming that there are efficiencies arising from overlapping land uses for four-part combinations involving wind, solar, storage, and supplemental natural gas, there is no genuine issue of material fact that these alternative combinations would not be environmentally preferable to CPNPP Units 3 and 4.

1. Overlapping Land Uses

Issue (c) in Alternatives Contention A questions the extent to which there may be efficiencies arising from overlapping uses of land for each of the four parts of the combination as well as for other reasonable purposes. The undisputed facts are as follows:

- As discussed in Section IV.C.1 above, about 2 to 5 % of the land comprising a wind facility is devoted to the structures for the wind turbines, roads, and other support facilities. The remaining land is available for other uses, such as farming and ranching, provided that the other uses do not interfere with wind flow.

190 Statement of Material Fact # III.B.2; ER Update at 9.2-43.

191 Joint Affidavit at ¶ 63.

- The land comprising a solar facility as discussed in Section IV.C.2 is devoted to the structures for the solar panel and/or reflectors and support facilities, and is not available for any other above-ground uses.[192]
- As discussed in Section IV.C.4 above, CAES facilities are largely underground facilities. In general, the surface would be available for other conforming uses. It is theoretically possible that the same land could be used for a wind and/or solar facility above-ground and a CAES facility underground, provided that the appropriate geology and wind and/or solar resources exist at the same location.[193]
- Molten salt thermal storage systems are located at solar facility sites. The land use requirements discussed in Section IV.C.2 above encompass the land needed for a thermal storage system.[194]
- The land use associated with natural gas facilities, as discussed in Section IV.C.3 above, is devoted to the plant itself, support facilities, and pipelines. If the pipelines are buried underground, the land above the pipelines can be used for other purposes, such as agriculture or ranching, provided the activity does not impact the pipelines.[195] However, the land devoted to the plant itself and support facilities would not be available for other uses.[196]

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[192] Statement of Material Fact # IV.B; Joint Affidavit at ¶ 66.

[193] Statement of Material Fact # IV.C; Joint Affidavit at ¶ 67.

[194] Statement of Material Fact # IV.D; Joint Affidavit at ¶ 68.

[195] Statement of Material Fact # IV.E; Joint Affidavit at ¶ 69.

[196] Statement of Material Fact # IV.E; Joint Affidavit at ¶ 69.

In the following evaluation of the environmental impacts of the four-part combination, it is conservatively assumed that the energy storage facilities require no additional land, and it is conservatively assumed that the sites for the wind and solar facilities overlap.

2. **Environmental Impacts of Four-Part Combinations Involving Wind and Solar Power, Storage, and Supplemental Natural Gas**

There are many possible combinations of wind and solar power, storage, and natural gas.[197] It is unnecessary under NEPA[198] and would be contrary to Council on Environmental Quality guidance[199] to examine every possible combination. However, to illustrate the range of combinations, this section analyzes the environmental impacts of two bounding cases. Although other possible combinations could be postulated, the results of the analyses would not be materially different.

Bounding Case 1 – This case assumes that energy is produced from the largest wind facility (735 MWe) and the largest solar facility (354 MWe), combined with storage and supplemented with natural gas.[200] The amount and type of storage in this Bounding Case are not material since the Bounding Case assumes that the storage is 100% efficient and has no environmental impacts.[201] Based upon a conservative capacity factor for a wind facility in Texas of 55% (which is the maximum seasonal capacity factor for a wind facility in Texas) and no

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[197] Joint Affidavit at ¶ 74.

[198] *See PFS*, LBP-03-30, 58 NRC at 479 ("the discussion 'must consider not every *possible* alternative, but every *reasonable* alternative'").

[199] Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. at 18,027 (acknowledging that certain projects could involve an infinite number of alternatives, but indicating that an agency need only discuss a "reasonable number of examples, covering the *full spectrum* of alternatives").

[200] This case is similar to the combination evaluated in the DEIS, which assumed 650 net MWe of wind with storage and 330 net MWe of solar with storage, with the remaining energy predominately supplied by natural gas. DEIS at 9-28 to 9-29.

[201] Joint Affidavit at ¶ 75.

energy loss during storage and conversion, the wind and CAES portion of the combination would generate approximately 3,600,000 MWh annually.[202] Based upon maximum capacity factor for a solar facility (32%) and no energy loss during energy storage and conversion, the solar power and molten salt storage facility portion of the combination would generate approximately 990,000 MWh annually.[203] Natural gas would be used to provide energy in sufficient quantity to supply the difference between the annual energy production of CPNPP Units 3 and 4 (25,500,000 MWh) and the energy produced by the combination of wind, CAES, solar, and molten salt storage. Thus, natural gas would provide approximately 21,000,000 MWh of electricity per year, requiring a 2800-MWe natural-gas fired plant (assuming an 85% capacity factor).[204]

The environmental impacts of such a combination would be the following:

- Land Use – As discussed in Section IV.C.1 above, a 735-MWe wind facility would utilize approximately 47,000 acres of land.[205] Of this, about 940 to 2350 acres would be covered by the wind turbines, roads, and support facilities. Based on the 3.8 to 10 acres per MWe for a solar facility as discussed in Section IV.C.2 above, a 354-MWe solar facility would utilize approximately 1350 to 3500 acres of land.[206] As discussed in Section IV.C.3 above, the natural gas facility would utilize approximately 350 acres of land, plus another approximately 11,500 acres for natural gas wells, collection stations and pipelines. Although placing the solar facility on the same area covered by the wind

202 *Id.*

203 *Id.*

204 *Id.*

205 Statement of Material Fact # II.A.3; Joint Affidavit at ¶ 75.

206 Statement of Material Fact # II.B.4; Joint Affidavit at ¶ 75.

turbines, roads, and support facilities could adversely impact the generation capacities of the wind and solar facilities, this analysis conservatively assumes that this overlapping land use is possible.[207] Based upon the conservative assumption that the solar plant, and storage facilities were all on the same land as the wind farm, the four-part combination would entail the following total land use impacts: approximately 1700 to 3850 acres that would be directly covered by facilities and roads; approximately 11,500 acres would be needed for natural gas wells, collection stations and pipelines; and more than 40,000 acres of land between the wind turbines, which could be used for other conforming purposes such as agriculture or ranching; not accounting for the additional transmission lines that likely would be needed to transmit the power from the wind and solar facilities.[208] Such land-use impacts would be LARGE.[209]

- Aesthetics – Given the amount of land that would be covered by wind turbines and solar panels, there would be a LARGE impact on aesthetics.[210]
- Ecological Resources, Protected Species and Cultural Resources – Given the large amounts of land that would be disturbed by the wind facility, solar facility, natural gas facility, and associated wells, collection stations, and pipelines, there likely would be a MODERATE adverse impact on ecological resources, protected species, and cultural resources depending upon the location of the facilities.[211]

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207 Joint Affidavit at ¶ 75.

208 *Id.*

209 *Id.*

210 Joint Affidavit at ¶ 75.

211 *Id.* *See also* DEIS at 9-32.

- Air Quality Impacts – The natural gas plant would generate approximately 221 Tpy of SO_x, 2340 Tpy of NO_x, 975 Tpy of CO, 124 Tpy of particulate matter and 7.2 million Tpy of CO_2.[212] Consequently, the air quality impacts would be SMALL to MODERATE.[213] The use of natural gas in the CAES compression and energy generation process would increase the air impacts; however, such impacts (and the other environmental impacts of CAES) are conservatively neglected in this analysis.
- Water Use and Quality Impacts – The impacts on water use and quality from the natural gas plant would be comparable to the impacts associated with CPNPP Units 3 and 4.[214] Furthermore, a solar thermal facility using wet cooling would have additional impacts on water use and quality.[215] The impacts from the natural gas facility alone would be MODERATE. Therefore, the overall impacts on water use and quality would also be MODERATE.[216]
- Other Impacts – Other impacts would be SMALL except for socioeconomic impacts, which could be MODERATE beneficial impacts.[217]

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[212] Joint Affidavit at ¶ 75.

[213] *Id. See also* DEIS at 9-32.

[214] Joint Affidavit at ¶ 75.

[215] *Id.*

[216] *Id*. *See also* DEIS at 9-32.

[217] Joint Affidavit at ¶ 75; *see also* DEIS at 9-32.

Bounding Case 2 – This case assumes the use of a wind plant and CAES facility with a nameplate capacity of 3200 MWe, a solar power and molten salt storage facility with a nameplate capacity of 3200 MWe, and a natural-gas fired plant that supplies the difference between available energy from both wind and solar and the total energy required, *i.e.* the energy that would be generated annually by CPNPP Units 3 and 4. Again, the amount and type of storage in this Bounding Case are not material since the Bounding Case assumes that the storage is 100% efficient and has no environmental impacts.[218] Assuming a conservative capacity factor for a wind facility in Texas of 55% (which is the maximum seasonal capacity factor for a wind facility in Texas) and no energy loss during storage and conversion, the combined wind and CAES facility would generate approximately 15,500,000 MWh annually.[219] Based upon the maximum capacity factor for a solar facility (32%) and no energy loss during energy storage and conversion, the combined solar power and molten salt storage facility would generate approximately 9,000,000 MWh annually.[220] Natural gas would be used to provide energy in sufficient quantity to supply the difference between the annual energy production of CPNPP Units 3 and 4 (25,500,000 MWh) and the energy produced by the combination of wind, CAES, solar, and molten salt storage. Thus, natural gas would need to provide approximately 1,000,000 MWh of electricity per year, requiring approximately one 135-MWe natural-gas fired plant (assuming an 85% capacity factor).[221]

The environmental impacts of such a combination would be the following:

[218] Joint Affidavit at ¶ 76.

[219] *Id.*

[220] *Id.*

[221] *Id.*

- Land Use Impacts – As discussed in Section IV.C.1 above, a wind facility with a capacity equivalent to CPNPP Units 3 and 4 would cover 204,000 acres of land, of which approximately 4100 to 10,200 acres would be occupied by wind turbines, support facilities, and roads. As discussed in Section IV.C.2 above, a solar facility with a capacity equivalent to CPNPP Units 3 and 4 would cover 38,000 acres of land. Although placing the solar facility on the same area covered by the wind turbines, roads, and support facilities could adversely impact the generation capacities of the wind and solar facilities, this analysis conservatively assumes that this overlapping land use is possible.[222] Based upon the conservative assumption that the solar plant and storage facilities were all on the same land as the wind farm, and that support facilities for a natural gas plant did not need to be constructed, the four-part combination would require 204,000 acres of land, of which more than 38,000 acres would be fully occupied by facilities and roads.[223] This does not account for the additional transmission lines that likely would be needed to transmit the power from the wind and solar facilities, or the land impacts for natural gas generation. Accordingly, the land use impacts would be LARGE.[224]
- Aesthetics – Given the large amount of land that would be covered with wind turbines and solar power, there would be a LARGE impact on aesthetics.[225]

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222 *Id.*

223 *Id.* Changing the mix between solar and wind power would not materially affect these conclusions. For example, if the capacity of wind power were substantially increased while the capacity of solar power were substantially decreased, (1) the total acreage of the four-part combination would also substantially increase, and (2) the amount of land fully occupied by facilities and roads would decrease, but in any event would be at least 10,000 to 20,000 acres (which would correspond to a MODERATE to LARGE land use impact), without accounting for the land impacts of transmission lines and natural gas generation. *Id.* at ¶ 77.

224 *Id.* at ¶ 76.

225 *Id.*

- Ecological Resources, Protected Species and Cultural Resources – The large amount of land that would be disturbed would also likely cause a MODERATE adverse impact on ecological resources, protected species, and cultural resources, depending upon the location of the facilities.[226]
- Water Use and Quality Impacts – The impacts on water use and quality from a solar thermal facility using dry cooling would be SMALL. The impacts on water use and quality from a solar thermal facility using wet cooling would be comparable to the impacts associated with CPNPP Units 3 and 4 (*i.e.*, MODERATE).[227] Furthermore, the natural gas facility would have additional impacts on water use and quality.[228] Overall, the impacts on water use and quality would be SMALL to MODERATE.[229]
- Other Impacts – The impacts in other areas would be SMALL except for socioeconomics, which could be MODERATE beneficial.[230]

Results of Bounding Case Analysis – Bounding Case 1 is bounding in the sense that it represents a relatively large contribution from natural gas.[231] Bounding Case 2 is bounding in the sense that it represents a relatively large contribution from wind, solar, and storage.[232]

Importantly, as noted above, these bounding cases conservatively assume that storage is 100% efficient and has no environmental impacts. Furthermore, these bounding cases conservatively assume that the solar plant and storage facilities are all on the same land as the

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226 *Id.*

227 *Id.*

228 *Id.*

229 *Id.*

230 *Id.*

231 *Id.* at ¶ 79.

232 *Id.*

wind farm; and that the solar facility can overlap areas covered by the wind turbines, roads, and support facilities. These cases also conservatively assume very high capacity factors for wind and solar generation facilities, and do not account for the environmental impacts of construction and operation of new transmission lines that likely would be needed to transmit power from new wind and solar facilities.

As these cases illustrate, there is a trade-off between increased land-use, ecology, and aesthetics impacts from increased use of renewables, and increased air emissions from increased use of natural gas. The following table contains a comparison of the environmental impacts of CPNPP Units 3 and 4, and the two alternative energy combinations considered above:

Category	Nuclear	Bounding Case 1	Bounding Case 2
Air Quality	SMALL	SMALL to MODERATE	SMALL
Land Use	MODERATE	LARGE	LARGE
Ecology	MODERATE	MODERATE	MODERATE
Water Use and Quality	MODERATE	MODERATE	SMALL to MODERATE
Waste Management	SMALL	SMALL	SMALL
Radiological Impacts[233]	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	SMALL
Socioeconomic	MODERATE (Beneficial)[234]	MODERATE (Beneficial)	MODERATE (Beneficial)
Aesthetics	SMALL	LARGE	LARGE
Historic and Cultural Resources	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL

As this table demonstrates, based on the material facts, any combination of wind and solar power, storage and natural gas would have overall environmental impacts that would be equal to or greater than the impacts from CPNPP Units 3 and 4.[235] Therefore, there is no issue of material fact that combinations of solar and wind energy, energy storage methods (including

233 We have assumed that the radiological impacts for the Bounding Cases are zero.

234 The DEIS (at 9-32) states that CPNPP Units 3 and 4 would have a LARGE beneficial socioeconomic impact. This table conservatively assumes that the impact is MODERATE.

235 As the above table demonstrates, the impacts from the Bounding Cases are all greater than or equal to the impacts of Nuclear, except for Water Use and Quality where the impact for Nuclear is MODERATE and the impact for Bounding Case 2 is SMALL to MODERATE. However, given the LARGE impacts on Land Use and Aesthetics for Bounding Case 2 versus the MODERATE and SMALL impacts, respectively, for Nuclear, it is evident that the overall impacts of Bounding Case 2 are greater than or equal to those for Nuclear.

CAES and molten salt storage), supplemented with natural gas, are not environmentally preferable to CPNPP Units 3 and 4.[236]

E. Intervenors' Bases Are Not Inconsistent with the Material Facts

Intervenors have not provided anything to date that is inconsistent with the material facts discussed in these sections. First, the Intervenors have not provided any information during discovery that is inconsistent with the Statement of Material Facts. The Intervenors have provided Luminant a series of mandatory discovery disclosures pursuant to 10 C.F.R. § 2.336. All of those disclosures have stated that the Intervenors do not have "any documents that require disclosure."[237]

Second, the information the Intervenors previously provided as support for their contentions, and in their replies, is not inconsistent with any material fact. In particular, Luminant does not dispute the availability or feasibility of combining solar and wind energy, energy storage methods, and natural gas to produce baseload power in the area of Texas which would be served by CPNPP Units 3 and 4. The environmental impacts of combinations of wind and solar energy, energy storage methods, and the supplemental use of natural gas are not in dispute in any material respect. Thus, Luminant is entitled to a decision on this issue as a matter of law, regardless of whether these combinations are developed and proven.

Furthermore, the bounding cases discussed above conservatively assume that there are efficiencies arising from overlapping uses of land for each of the parts of the wind, solar, storage, and natural gas facilities. Specifically, the evaluation conservatively assumes that the wind, solar, storage, and natural gas facilities can be constructed within the same boundaries. Even

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236 *See also* DEIS at 9-32.

237 *See, e.g.*, Intervenors' Eighth Update to Disclosures (May 18, 2010).

with this assumption, no dispute of material fact exists that the adverse environmental impacts from this combination are equal to or greater than those caused by CPNPP Units 3 and 4.

F. **Issues Related to Costs Are Not Material**

Issue (d) in Alternatives Contention A pertains to the operation and maintenance costs of solar power. The extent to which operation and maintenance costs of a solar facility may present a comparative benefit is immaterial since the four-part combination is not environmentally preferable to CPNPP Units 3 and 4. As the Licensing Board recognized when it admitted Issue (d), and as the issue statement itself explicitly states, this issue is material only if the four-part combination is environmentally preferable.[238] Similarly, the Commission has made clear that cost issues are only relevant if an environmentally preferable alternative is identified.[239] Thus, in the *Summer* COL proceeding, the Commission explained that if an environmentally preferable alternative is *not* identified, the rationale in the *Midland* decision "would form a valid basis for excluding [cost] claims."[240] As explained above, no dispute of material fact exists that combinations of solar and wind energy, energy storage methods (including CAES and molten salt storage), supplemented with natural gas, are not environmentally preferable to CPNPP Units 3 and 4. Given the absence of any environmentally preferable alternative, issues concerning the operations and maintenance costs of solar power are not material. Accordingly, Luminant is entitled to a decision on this issue as a matter of law.

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238 *See* LBP-10-10, slip op. at 50-51, 74-75.

239 *S.C. Elec. & Gas Co.* (Virgil C. Summer Nuclear Station, Units 2 & 3), CLI-10-1, 71 NRC __, slip op. at 30-31 (Jan. 7, 2010) (*citing Consumers Power Co.* (Midland Plant, Units 1 & 2), ALAB-458, 7 NRC 155, 162 (1978)).

240 *Id.* at 31-32 & n.118.

V. CONCLUSION

In summary, the Licensing Board should grant summary disposition of Alternatives Contention A because there is no genuine issue of material fact regarding the feasibility, availability, and environmental impacts of combinations of solar and wind energy, energy storage methods, including CAES and molten salt storage, and the supplemental use of natural gas to produce baseload power equivalent to CPNPP Units 3 and 4.

Respectfully submitted,

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Dated in Washington, D.C.
this 26th day of August 2010

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 52-034-COL
LUMINANT GENERATION COMPANY LLC	)	52-035-COL
	)	
(Comanche Peak Nuclear Power Plant Units 3 and 4)	)	August 26, 2010

STATEMENT OF MATERIAL FACTS ON WHICH THERE IS NO GENUINE ISSUE TO BE HEARD

Applicants Luminant Generation Company LLC and Comanche Peak Nuclear Power Company LLC (jointly, "Luminant") submit this Statement of Material Facts in support of their Motion for Summary Disposition of Contention 18 and Alternatives Contention A.[1]

The following facts include a classification of environmental impacts from the proposed Comanche Peak Nuclear Power Plant ("CPNPP") Units 3 and 4, and various alternatives. This classification is based upon the following significance levels established by the NRC: (1) SMALL – environmental effects are not detectable or are so minor that they will neither destabilize, nor noticeably alter any important attribute of the resource; (2) MODERATE – environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource; and (3) LARGE – environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.[2]

[1] 10 C.F.R. § 2.1205 refers to 10 C.F.R. § 2.710, which in turns states that a party submitting a motion for summary disposition shall submit a statement of material facts and that those facts will be considered admitted, unless controverted by a statement of material facts submitted by an opposing party.

[2] *See* DEIS at 1-3; 10 C.F.R. pt. 51, app. B, tbl. B-1, n.3.

I. Feasibility of Four-Part Combination

A. Wind Power

1. Wind power is a developed and proven technology that is used in the ERCOT area.[3] As of 2009, there were approximately 8000 MWe of wind power installed in Texas.[4]

2. As of mid-2009, the largest wind power facility in the world was the Horse Hollow Wind Energy Center in Texas, with a capacity of 735 MWe.[5]

3. Wind power has nationwide capacity factors 25 to 45%.[6] In Texas, the capacity factors of wind farms range from 29 to 55%, depending on region and the time of year.[7] Wind power alone is not capable of producing baseload power.[8]

4. Most of the available wind power generation capacity in Texas is in the western portion of Texas.[9]

B. Solar Power

1. Solar power is a developed and proven technology that is used in the ERCOT area for producing small amounts of power.[10] As of 2009, no solar power generation was installed at the transmission level in the ERCOT region.[11] Several solar projects are being developed in the ERCOT region, which if completed would add approximately 460 MWe cumulatively of installed capacity by 2011.[12]

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3 ER Rev. 1, at 9.2-7.

4 Joint Affidavit at ¶ 33; DEIS at 9-20.

5 Joint Affidavit at ¶ 37; ER Rev. 1, at 9.2-8; DEIS at 9-20.

6 ER Rev. 1, at 9.2-8;. DEIS at 9-21.

7 ER Rev. 1, at 9.2-8, 9.2-9.

8 *Id.* at 9.2-7 & -8; DEIS at 9-24.

9 Joint Affidavit at ¶ 64; ER Rev. 1, at 9.2-8; DEIS at 9-22.

10 ER Rev. 1, at 9.2-10.

11 Joint Affidavit at ¶ 43.

12 *Id.*

2. The largest operational solar thermal power facility in the world is the 354-MWe facility in the Mojave Desert of southern California.[13]

3. Capacity factors of solar power are typically 23 to 32%.[14] Solar power alone is not capable of producing baseload power.[15]

4. The western portions of the ERCOT region receive considerably more direct solar radiation than the eastern ERCOT regions.[16] Based on solar radiation maps, numerous areas in the western portion of the ERCOT region would meet or exceed the minimum insolation standard for generation of solar power.[17]

C. Energy Storage

1. Pumped hydropower storage is not available in the ERCOT area.[18]

2. Compressed air energy storage ("CAES") and molten salt thermal storage are the two most promising storage mechanisms in Texas.[19]

3. There are two CAES facilities in operation, the 290-MWe Huntorf facility in Germany, and the 110-MWe McIntosh plant in Alabama.[20] Those facilities are primarily used for generating peaking power and do not produce baseload power.[21]

4. Several combined renewable energy and CAES projects are under development.[22]

5. There are several commercial molten salt thermal storage systems in operation.[23]

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13 Joint Affidavit at ¶ 44; DEIS at 9-24.

14 ER Rev. 1, at 9.2-10. The DEIS reports capacity factors of 24 to 50%, the latter being with energy storage. DEIS at 9-24.

15 ER Rev. 1, at 9.2-10 & -1; DEIS at 9-25.

16 Joint Affidavit at ¶ 46.

17 *Id.* at ¶ 45; DEIS at 9-24.

18 ER Update at 9.2-33.

19 *Id.* § 9.2.2.11.2.

20 ER Update at 9.2-38; DEIS at 9-21.

21 ER Update, sec. 9.2.2.11.2.2

22 ER Update at 9.2-33, 9.2-34; *see* Joint Affidavit at ¶¶ 53-56.

23 Joint Affidavit at ¶ 61.

6. Other solar power plants using molten salt storage have been proposed.[24]

D. Natural Gas

1. Natural gas is the largest single technology of energy production in the ERCOT region.[25]

2. Natural gas is developed, proven, and available for producing baseload power in Texas.[26] There are 18 natural gas power plants in the ERCOT system with a capacity over 1000 MWe and an additional 33 natural gas plants with a capacity between 500 and 1000 MWe. The largest of these are the 2241-MW Cedar Bayou Units 1, 2, and 3 in Chambers County, the 2234-MWe PH Robinson Units 1, 2, 3, and 4 in Galveston County, and the 1804-MWe Forney Energy Center in Kaufman County.[27]

3. Modern natural gas plants have a capacity factor of approximately 85% and are capable of producing baseload.[28]

E. Transmission

1. Most of the available wind and solar power in Texas is in the western portion of the state.[29] There currently is transmission congestion in the ERCOT region.[30]

2. If large amounts of new wind and/or solar resources were to be located in the western part of Texas, additional transmission lines likely would be needed to transfer the power from the generating facilities to the load centers in Texas.[31] This would entail additional land use and terrestrial impacts.[32]

F. Four-Part Combinations

1. Combinations involving natural gas (including the four-part combination that is the subject of Alternatives Contention A) are developed, proven,

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24 ER Update at 9.2-42; DEIS at 9-25.

25 ER Rev. 1, at 9.2-29; DEIS at 9-6.

26 ER Rev. 1, at 9.2-29 – 30; DEIS at 9-6, 9-7.

27 ER Rev. 1, at 9.2-29.

28 ER Rev. 1, tbl. 9.2-4; DEIS at 9-7.

29 ER Rev. 1, at 9.2-8; Joint Affidavit at ¶ 64; DEIS at 9-22.

30 Joint Affidavit at ¶ 64.

31 *Id.*; DEIS at 9-22.

32 Joint Affidavit at ¶ 64.

and available (i.e., reasonable) for producing baseload power, provided that natural gas supplies the majority of the electricity.[33]

2. A four-part combination involving wind, solar, energy storage, and natural gas, in which natural gas does not supply the majority of the electricity, is a theoretically feasible and available method for producing baseload power in Texas.[34]

3. A four-part combination involving wind, solar, energy storage, and natural gas, in which natural gas does not supply the majority of the electricity, does not exist anywhere in the world.[35]

4. With a few exceptions, wind, solar, and natural gas have been operated as independent projects rather than as part of a combination.[36]

5. If the largest wind, solar, CAES, and molten salt storage facilities were combined to produce baseload power, their total capacity would be less than 1100 MWe. Given the capacity factors of the individual elements, the combination would be able to generate less than half of the energy to be generated by CPNPP Units 3 and 4.[37]

6. Utilities and merchant generators use proven technologies for large generating facilities.[38] Before committing to a technology (including a combination of technologies) for a large generating facility, it is typical and prudent for a utility or merchant generator to establish that the technology has been demonstrated at an existing commercial generating facility, or to develop a pilot project or a small-scale facility to prove that the technology works and is cost-effective.[39]

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33 ER Update at §§ 9.2.2.11.4.1, 9.2.2.11.4.2; DEIS at 9-28.

34 Joint Affidavit at ¶ 72.

35 *Id*.

36 *Id.*

37 *Id.*

38 *Id.* ¶ 32.

39 *Id.* ¶ 30.

II. Environmental Impacts of Wind Power, Solar Power, and Natural Gas Alone

A. Wind Power

1. Wind turbines vary in size, typically from about 1.5 to 2.5 MWe (and some are larger).[40] The height of towers varies, typically from 200 to 300 feet tall.[41]

2. A wind-power project of nameplate capacity comparable to the proposed CPNPP Units 3 and 4 would require approximately 1600 above-ground towers, assuming that each tower supported a 2-MWe wind turbine.[42]

3. The 735-MWe Horse Hollow Wind Energy Center utilizes a total land area of 47,000 acres.[43]

4. Wind turbines must be sufficiently spaced to maximize capture of wind energy. Typically, 100 acres of unobstructed area is needed around each wind turbine, of which a quarter to half acre is needed for actual placement and support of the wind tower.[44]

5. About 2 to 5% of the land needed for a wind farm is used for towers, roads, and support facilities. The remaining land can be used for other purposes, such as agriculture and ranching, provided that the use does not interfere with wind flow.[45] However, a wind facility would preclude a number of land uses, particularly uses requiring above-ground structures that could interfere with, or disrupt, the wind flow patterns driving the turbines.[46]

6. A wind facility with a capacity equivalent to CPNPP Units 3 and 4 would cover approximately 204,000 acres of land, of which approximately 4100 to 10,200 acres would be occupied by wind turbines, support facilities, and roads.[47]

7. Operation of wind facilities comparable in capacity to CPNPP Units 3 and 4 likely would necessitate construction and operation of new

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40 *Id.* ¶ 34.

41 *Id.*

42 *Id.* ¶ 35.

43 ER Rev. 1, at 9.2-9.

44 Joint Affidavit at ¶ 36. The DEIS has a slightly higher estimate of 0.3 to 0.4 ha per turbine. DEIS at 9-23.

45 ER Rev. 1, at 9.2-8; DEIS at 9-22.

46 ER Rev. 1, at 9.2-9.

47 *Id.* at 9.2-8; Joint Affidavit at ¶ 37.

transmission lines from western Texas (where most of the wind potential is located) to eastern Texas (where most of the demand is located).[48] Construction and operation of new transmission lines likely would entail additional land use and terrestrial impacts.[49]

8. Potential adverse impacts of wind power on water quality, air quality, human health, and waste management are SMALL.[50]

9. A wind power facility with a capacity of 3200 MWe would have a LARGE impact on land use based upon the following considerations:[51]

a. The total amount of land for the facility would be approximately 204,000 acres.[52]

b. About 2 to 5% of the total amount of land would be occupied by the wind towers, roads, and support facilities for the wind farm, or approximately 4100 acres to 10,200 acres. This land would not be available for other uses.[53]

c. Some compatible land uses, such as agriculture and ranching, could utilize the land not occupied by the wind towers, roads, and support facilities.[54]

d. A number of land uses, particularly uses requiring above-ground structures that could interfere with, or disrupt, the wind flow patterns driving the turbines, would not be compatible for land not occupied by the wind towers, roads, and support facilities.[55]

10. A wind power facility with a capacity of 3200 MWe likely would have MODERATE impacts on ecological resources, protected species, and cultural resources, depending upon the location of the facility, due to the large amounts of land that would be disturbed for such a facility.[56]

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48 Joint Affidavit at ¶ 64.

49 *Id.*

50 ER Rev. 1, at 9.2-9.

51 *Id.* at 9.2-9.

52 *Id.* at 9.2-8. *See also* LBP-10-10, slip op. at 39, 43-44.

53 Joint Affidavit at ¶ 36.

54 *Id.*; DEIS at 9-22 to 9-23.

55 ER, Rev. 1, at 9.2-9.

56 *Id.* at 9.2-9; DEIS at 9-23 to 24.

Additionally, depending on location, some wind farms have caused bird kills.[57]

11. A wind power facility with a capacity of 3200 MWe would have a LARGE adverse impact on aesthetics due to the visibility of a large number of the tall towers and blades spread over hundreds of thousands of acres.[58]

12. A wind power facility with a capacity of 3200 MWe would have a MODERATE beneficial impact on socioeconomics.[59]

B. Solar Power

1. There are two types of solar plants: solar thermal and photovoltaic cells.[60] Solar thermal power systems convert sunlight into electricity using heat as an intermediate step.[61] Photovoltaic cells convert sunlight directly into electricity using semiconducting materials.[62]

2. Operation of solar facilities with a capacity of 3200 MWe likely would necessitate construction and operation of new transmission lines from western Texas (where most of the solar potential is located) to eastern Texas (where most of the demand is located).[63]

3. The area of land required for a solar plant depends on the available solar insolation and type of plant.[64] Current solar power plants utilize from approximately 3.8 to 10 acres per MWe.[65]

4. Based on the 3.8 to 10 acre per MWe, a 354-MWe solar facility would utilize approximately 1350 to 3500 acres of land.[66]

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57 Joint Affidavit at ¶ 39; DEIS at 9-23.

58 ER Rev. 1, at 9.2-9; DEIS at 9-23.

59 ER Rev. 1, at 9.2-9.

60 Joint Affidavit at ¶ 44; DEIS at 9-24.

61 Joint Affidavit at ¶ 44; DEIS at 9-24.

62 Joint Affidavit at ¶ 44; DEIS at 9-24.

63 Joint Affidavit at ¶ 64.

64 ER Rev. 1, at 9.2-11.

65 *Id.* at 9.2-11. The DEIS reports approximately 5 to 10 acres per MWe. *See* DEIS at 9-24.

66 Joint Affidavit at ¶ 63.

5. A solar plant with a capacity equivalent to CPNPP Units 3 and 4 would require approximately 38,000 acres.[67]

6. The potential adverse impacts of solar power on air quality, human health, and waste management would be SMALL.[68]

7. The potential adverse impacts of solar power on water quality would be SMALL for a facility using photovoltaics or dry cooling.[69]

8. A 3200-MWe solar thermal facility with wet cooling would require roughly the same amount of water as CPNPP Units 3 and 4.[70] Such a facility likely would cause MODERATE adverse impacts on water use and quality.[71]

9. A solar power facility with a capacity of 3200 MWe would have a LARGE adverse impact on land use and aesthetics due to the large number of solar panels or reflectors covering tens of thousands of acres required for the solar facility. [72]

10. A solar power facility with a capacity of 3200 MWe likely would have MODERATE impacts on ecological resources, protected species, and cultural resources, depending upon the location of the facility, due to the large amounts of land that would be disturbed for such a facility.[73]

11. A solar facility with a capacity of 3200 MWe would have a MODERATE beneficial impact on socioeconomics due to job creation.[74]

C. Natural Gas

1. A 3200 MWe natural gas-fired alternative to CPNPP Units 3 and 4 would have SMALL to MODERATE impacts on air quality due to the following emissions:[75]

SO_x = 253 tons per year ("Tpy")

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67 ER Rev. 1, at 9.2-11. *See also* LBP-10-10, slip op. at 46, 49.

68 ER Rev. 1, at 9.2-11.

69 *Id.*

70 Joint Affidavit at ¶ 49. *See also* DEIS at 9-25.

71 Joint Affidavit at ¶ 49.

72 ER Rev. 1, at 9.2-11.

73 *Id.*.

74 *Id.*.

75 *Id.* at 9.2-36 and 9.2-37; DEIS at 9-14 to 9-16.

NO_x = 2676 Tpy

CO = 1115 Tpy

PM = 142 Tpy (all particulates are $PM_{2.5}$)

CO_2 = 8.2 million Tpy

These air quality impacts are substantially greater than those caused by nuclear generation.[76]

2. Land-use impacts for construction and operation of a 3200-MWe natural gas-fired plant would be MODERATE due to the following:[77]

a. A 3200-MWe natural gas-fired plant would require approximately 350 acres, based on the NUREG-1437 factor of 0.11 acre/MWe as the land use requirement for gas-fired plants.[78]

b. A 3200-MWe natural gas-fired plant at the proposed CPNPP Units 3 and 4 site would require approximately 11,500 acres of additional land for natural gas wells, collection stations and pipelines, based on the NUREG-1437 factor of 3.6 acres/MWe as the additional land use requirement for gas-fired plants.[79]

3. Overall, a 3200-MWe natural-gas fired plant would cause MODERATE adverse impacts to land use, water use and quality, and ecology.[80]

4. A natural-gas fired plant likely would produce SMALL adverse impacts on waste management, human health, aesthetics, environmental justice, and historical and cultural resources.[81]

III. Energy Storage

A. CAES

1. CAES involves using compressors powered by the generation source to pump air into a storage facility, such as an underground cavern.[82] The

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76 ER Rev. 1 at 9.2-37; DEIS at 9-32.

77 ER Rev. 1 at 9.2-38.

78 *Id.*

79 *Id.*

80 *Id.* at 9.2-38 to 9.2-40; DEIS at 9-32.

81 ER Rev. 1 at 9.2-38 to 9.2-40; DEIS at 9-18, 9-32.

82 ER Update at 9.2-33; DEIS at 9-21.

compressed air is used in combination with a heat source, such as natural gas, to drive turbines and generate electricity.[83]

2. If natural gas is used as the heat source for CAES, the natural gas usage for generating electricity from CAES is between one third and one half that needed to generate the same amount of electricity at a natural gas plant.[84]

3. The two existing CAES facilities both use natural gas as the heat source.[85]

4. The use of natural gas in the CAES compression and energy generation processes will cause air quality impacts.[86] A 3200-MWe CAES facility that uses natural gas as the heat source would generate approximately 85 to 125 Tpy of SO_x, 890 to 1340 Tpy of NO_x, 370 to 560 Tpy of CO, 47 to 71 Tpy of PM, and 2.7 to 4.1 million Tpy of CO_2.[87]

5. CAES requires land areas that possess the suitable geologic formations for large-scale underground storage.[88] Texas has mines, depleted oil and gas wells, and geological formations that some have suggested might be suitable for CAES.[89]

6. The use of CAES would require Luminant to purchase or obtain the rights to underground land that would not be available for other uses (such as mineral extraction).[90] The above-ground facilities would consist of a CAES building that would occupy a relatively small area.[91]

7. Energy is lost during the storage and conversion process. For a given amount of net energy production, use of CAES requires the generating facility to have a greater capacity to compensate for the net energy loss in CAES.[92]

8. A CAES project in the salt dome or bedded salt deposits found in Texas, equivalent in size to CPNPP Units 3 and 4, would have MODERATE

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83 ER Update at 9.2-33; DEIS at 9-21.

84 ER Update at 9.2-33.

85 *Id.* at 9.2-34.

86 Joint Affidavit at ¶ 52.

87 *Id.*

88 ER Update at 9.2-34.

89 Joint Affidavit at ¶ 51.

90 *Id.* ¶ 57.

91 *Id.*

92 *Id.* ¶ 58.

impacts on water quality and waste management depending upon the host geological formation.[93] The water quality impacts would be attributable to the large amount of freshwater that would be required to create the CAES storage caverns in either salt dome or bedded salt deposits found in Texas.[94] The disposal of the large volumes of salt water, along with other impurities in the rock formations, from the cavern creation process would impact water quality and increase waste management impacts.[95] These impacts might be minimized or eliminated if a pre-existing underground space, such as a depleted gas well, was used.[96]

B. Molten Salt Storage

1. Molten salt can be used to store solar heat.[97] Molten salt retains heat relatively efficiently, and it can be stored for hours or even days before it loses its capacity to generate electricity.[98]

2. Energy is lost during the storage and conversion process. For a given amount of net energy production, use of molten salt energy storage requires the generating facility to have a greater capacity to compensate for the net energy loss in the molten salt energy storage.[99] Thus, an even larger facility and greater resultant land use would be needed to produce the same amount of electricity.[100]

IV. Overlapping Land Uses

A. About 2 to 5% of the land needed for a wind farm is used for towers, roads, and support facilities. The remaining land can be used for other purposes, such as agriculture and ranching, provided that the use does not interfere with wind flow.[101]

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93 ER Update at 9.2-40.

94 *Id.*.

95 *Id.*

96 Joint Affidavit at ¶ 59.

97 ER Update at 9.2-35.

98 *Id.*

99 *Id.* at 9.2-43.

100 *Id.*

101 ER Rev. 1, at 9.2-8; DEIS at 9-22.

B. The land comprising a solar facility is devoted to the structures for the solar panel and/or reflectors and support facilities, and is not available for any other above-ground uses.[102]

C. CAES facilities are largely underground facilities. In general, the surface would be available for other conforming uses. It is theoretically possible that the same land could be used for a wind and/or solar facility above-ground and a CAES facility underground, provided that the appropriate geology and wind and/or solar resources existed at the same location.[103]

D. Molten salt thermal storage systems are located at the site of the solar facility. The land use requirements for a solar facility encompass the land needed for a thermal storage system.[104]

E. The land use associated with natural gas facilities is devoted to the plant itself, support facilities, and pipelines.[105] If the pipelines are buried underground, the land above the pipelines can be used for other purposes, such as agriculture or ranching, provided the activity does not impact the pipelines.[106] However, the land devoted to the plant itself and support facilities would not be available for other uses.[107]

V. Four-Part Combinations of Wind and Solar Power, Storage, and Natural Gas

A. Relative to CPNPP Units 3 and 4, four-part combinations of wind, solar, energy storage, and natural gas that would produce an equivalent amount of baseload power would have greater environmental impacts in the areas of land use and

102 Joint Affidavit at ¶ 66.

103 *Id.* ¶ 67.

104 *Id.* ¶ 68.

105 *Id.* ¶ 69.

106 *Id.*

107 *Id.*

aesthetics; and would possibly have greater environmental impacts in the area of air quality (depending upon the amount of natural gas used).[108]

[108] *Id.* at ¶ 80; DEIS at 9-32.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 52-034-COL
LUMINANT GENERATION COMPANY LLC	)	52-035-COL
	)	
(Comanche Peak Nuclear Power Plant Units 3 and 4)	)	August 26, 2010
	)	

JOINT AFFIDAVIT OF DONALD R. WOODLAN, JOHN T. CONLY, IVAN ZUJOVIC, DAVID J. BEAN, JOHN E. FORSYTHE, AND KEVIN FLANAGAN

I. PERSONAL QUALIFICATIONS OF DONALD R. WOODLAN

1. [DRW] My name is Donald R. Woodlan. I am currently the Manager, Nuclear Regulatory Affairs NuBuild for Luminant Generation Company LLC ("Luminant"). I have more than 35 years of experience in the commercial nuclear industry and I have been in my current position since November of 2006. My current responsibilities include interfacing with the NRC and coordinating the development of the information needed to allow the NRC to conduct its review of the Comanche Peak Nuclear Power Plant ("CPNPP") combined license ("COL") application.

2. [DRW] Prior to my current position, I was the STARS Regulatory Affairs Manager. I coordinated generic licensing activities for six nuclear generating stations. From May 1979 to the present, I have worked for Luminant (and its predecessors). Prior to that I worked for the Cleveland Electric Illuminating Company and served in the nuclear Navy. Prior to that, I earned a Master of Science degree in Electrical Engineering from Michigan State University. A copy of my resumé is attached to this affidavit as Attachment A.

3. [DRW] With respect to this joint affidavit, I prepared those sections that (i) provide an overview of Luminant's COL application; (ii) compare the information in the NRC staff's Draft Environmental Impact Statement for Comanche Peak Nuclear Power Plant Units 3 and 4, NUREG-1943 (Aug. 2010) ("DEIS") with information in the COL application; and (iii) demonstrate that the information contained in Intervenors' pleadings and supporting reports is consistent with the information in the COL application, the DEIS, and the bounding analyses in this affidavit. To more readily identify these sections, I have included my initials within brackets (*i.e.*, [DRW]) immediately preceding those sections I prepared.

II. PERSONAL QUALIFICATIONS OF JOHN T. CONLY

4. [JTC] My name is John T. Conly. I am currently the Combined License Application (COLA) Project Manager, NuBuild for Luminant. I have more than 35 years of experience in the commercial nuclear industry and I have been in my current position since January 2008. My current responsibilities include owner oversight responsibility for the preparation and submittal of the COLA and the responses to NRC Requests for Additional Information.

5. [JTC] Prior to my current position, I was the COLA Coordinator for South Texas Project Units 3 & 4 with much the same responsibility that I have now. From September 1973 to the present, I have worked for various architect/engineering and consulting firms in the area of licensing nuclear power plants. Prior to that, I served four years assigned to a nuclear submarine in the U.S. Navy. I earned a Bachelor of Science degree in Electrical Engineering from the University of Texas in Austin. A copy of my resumé is attached to this affidavit as Attachment B.

6. [JTC] With respect to this joint affidavit, I prepared those sections that (i) provide an overview of Luminant's COL application; (ii) compare the information in the NRC staff's DEIS with information in the COL application; (iii) provide additional information on the transmission

system and renewable energy development in the ERCOT region; and (iv) demonstrate that the information contained in Intervenors' pleadings and supporting reports is consistent with the information in the COL application, the DEIS, and the bounding analyses in this affidavit. To more readily identify these sections, I have included my initials within brackets (*i.e.*, [JTC]) immediately preceding those sections I prepared.

III. PERSONAL QUALIFICATIONS OF IVAN ZUJOVIC

7. [IZ] My name is Ivan Zujovic. I am currently a Lead Engineer for Enercon Services, Inc. in the Power Generation Services Division. I have more than 13 years of experience in process evaluation and engineering, remediation design, site assessment, and environmental compliance and permitting. I was the lead author for the section of the COL application evaluating alternative energy sources. I have been in my current position since November 2009. My current responsibilities include providing engineering design and support services to operating commercial nuclear power plants.

8. [IZ] Prior to my current position, I was the Principal Engineer for Enercon Services' Environmental and Industrial Services division. I provided environmental permitting, compliance and engineering services to clients in various industrial sectors. From June 2001 to June 2007, I worked for Environmental Consulting and Technology, Inc.; from January 2000 to June 2001 I worked for Guide Corporation; and from June 1997 to November 1999 I worked for Reisz Engineers. Prior to that, I earned a BSE degree in Chemical Engineering from the University of Alabama in Huntsville. I also have a Master of Chemical Engineering degree from the University of South Florida. I am a Licensed Professional Engineer in the State of Florida (PE License Number 59560). A copy of my resumé is attached to this affidavit as Attachment C.

9. [IZ] With respect to this joint affidavit, I prepared those sections that (i) provide an overview of Luminant's COL application; (ii) compare the information in the NRC staff's DEIS

with information in the COL application; (iii) provide additional information about the feasibility, availability, and environmental impacts of wind, solar, natural gas, and energy storage facilities; and (iv) demonstrate that the information contained in Intervenors' pleadings and supporting reports is consistent with the information in the COL application, the DEIS, and the bounding analyses in this affidavit. To more readily identify these sections, I have included my initials within brackets (*i.e.*, [IZ]) immediately preceding those sections I prepared.

IV. PERSONAL QUALIFICATIONS OF DAVID J. BEAN

10. [DJB] My name is David J. Bean. I am currently serving as a Senior Technical Specialist and advisor to the Enercon Services, Inc. team. My responsibilities include providing technical and environmental support services for preparing COL applications and license renewal applications for licensing of nuclear power plants. I have more than 33 years of experience in the environmental industry and I have been in my current position since June 2010.

11. [DJB] Prior to my current position, I was a Technical Specialist and provided environmental support in various industrial sectors. From 2004 to 2005, I worked for URS Inc. Prior to that, I earned a Bachelor of Science degree in biology from the State University of New York at Oswego and a Master of Science degree in zoology from the Ohio State University. A copy of my resumé is attached to this affidavit as Attachment D.

12. [DJB] With respect to this joint affidavit, I prepared those sections that deal with wind generation of electricity and compressed air energy storage. To more readily identify these sections, I have included my initials within brackets (*i.e.*, [DJB]) immediately preceding those sections I prepared.

V. PERSONAL QUALIFICATIONS OF JOHN E. FORSYTHE

13. [JEF] My name is John E. Forsythe. I am currently a Project Director – Energy Planning Services for Enercon Services, Inc. I have more than 20 years of experience in environmental

planning projects with an emphasis in the preparation and management of environmental compliance studies, and I have been in my current position since December 1, 2010. My current responsibilities include managing environmental permitting and licensing for energy projects.

14. [JEF] Prior to my current position, I was employed by several other national environmental consulting firms. Prior to that, I earned a Bachelor of Science degree in Environmental Studies and Planning, Sonoma State University, and a Master of City and Regional Planning ("MCRP") degree from California Polytechnic State University. A copy of my resumé is attached to this affidavit as Attachment E.

15. [JEF] With respect to this joint affidavit, I prepared sections that deal with solar energy and molten salt technology. To more readily identify these sections, I have included my initials within brackets (*i.e.*, [JEF]) immediately preceding those sections I prepared.

VI. PERSONAL QUALIFICATIONS KEVIN FLANAGAN

16. [KF] My name is Kevin Flanagan. I am currently a Senior Project Manager for Enercon Services, Inc. I have more than 20 years of experience performing evaluations in the geology, hydrogeology, and environmental fields, and I have been in my current position since 2007. My current responsibilities include providing project management services for various types of soil and groundwater investigations and providing support for the preparation of applications for combined licenses for nuclear power plants, including performing cost-benefit analyses.

17. [KF] Prior to my current position, I was a project manager for Oklahoma Environmental Industries. As such, I provided environmental consulting services to clients primarily in the retail gasoline service station industry. From April 2003 to December 2006 I worked for Oklahoma Environmental Industries, from November 1997 to April 2003 I worked for National Environmental Services Company, and from November 1989 to November 1997 I worked for SEARCH, Inc. Prior to that, I earned Bachelor of Science and Master of Science degrees in

geology from Oklahoma State University, Stillwater. A copy of my resumé is attached to this affidavit as Attachment F.

18. [KF] With respect to this joint affidavit, I prepared sections that deal with solar energy and molten salt energy storage. To more readily identify these sections, I have included my initials within brackets (*i.e.*, [KF]) immediately preceding those sections I prepared.

VII. PURPOSE OF THE AFFIDAVIT

19. [All] The purpose of this affidavit is to: (a) provide an overview of the consideration of energy alternatives in the CPNPP Units 3 and 4 Environmental Report ("ER"), including the December 8, 2009 update ("ER Update"); (b) provide additional information regarding energy alternatives to CPNPP Units 3 and 4; (c) demonstrate that the information in the DEIS on alternative energy generation methods is consistent with the information in the ER Update; and (d) demonstrate that the factual information relied on by the Intervenors in Alternatives Contention A is not inconsistent in any material respect with the information in the ER, ER Update, and DEIS.

VIII. OVERVIEW OF THE ER UPDATE AND THE DEIS

20. [DRW, JTC, IZ] ER Section 9.2 presents an analysis of the environmental impacts associated with energy alternatives to the proposed CPNPP Units 3 and 4. This section contains a detailed evaluation of energy generation alternatives, including wind power, solar thermal power, and photovoltaic cells. Section 9.2.2.1 concludes that wind power is not a reasonable energy alternative and has potential adverse environmental impacts in excess of CPNPP Units 3 and 4. Section 9.2.2.2 states that solar power (including thermal power and photovoltaic cells) is not a reasonable energy alternative to CPNPP Units 3 and 4 and has potential adverse environmental impacts in excess of CPNPP Units 3 and 4.

21. [DRW, JTC, IZ] On December 8, 2009, Luminant submitted an ER Update for CPNPP Units 3 and 4. The ER Update added Section 9.2.2.11, "Alternatives Requiring New Generation in Combination with Energy Storage."

22. [DRW, JTC, IZ] Section 9.2.2.11.2 evaluates various energy storage technologies, including pumped hydropower, compressed air energy storage ("CAES"), batteries, hydrogen, molten salt, and super-capacitors. This section and Section 9.2.2.11.3 conclude that CAES appears to be the most suitable energy storage method for evaluation in combination with wind power, and molten salt in combination with solar is a promising alternative.

23. [DRW, JTC, IZ] Section 9.2.2.11.3.1 contains a detailed analysis of wind power combined with CAES, finding that this combination is not feasible as a baseload power source comparable to CPNPP Units 3 and 4, and that the anticipated environmental impacts would be greater than the impacts from a wind power project alone.

24. [DRW, JTC, IZ] Section 9.2.2.11.3.2 contains a detailed analysis of solar power combined with molten salt storage, finding that this combination appears to be feasible, but is not developed, proven, and available as a baseload power source comparable to CPNPP Units 3 and 4, and that the anticipated environmental impacts would be greater than the impacts from a solar power project alone.

25. [DRW, JTC, IZ] Section 9.2.2.11.4 contains a detailed analysis of renewable energy sources combined with storage and natural gas power generation. This section states that a renewable power source combined with an energy storage option supplemented with natural gas is not developed, proven, and available in the ERCOT region, unless natural gas produces the majority of the electricity. This section additionally concludes that the potential environmental impacts from renewable power combined with storage and natural gas would have significant

adverse environmental impacts and would not be environmentally preferable to CPNPP Units 3 and 4.

26. [All] We attest to the truthfulness and accuracy of ER Section 9.2, including the December 8, 2009 ER Update, and we adopt them as part of this affidavit.

27. [All] We have compared the information in DEIS Section 9.2 with the information in ER Section 9.2. As stated in the DEIS, the NRC staff determined that given Luminant's objective of generating baseload power, a fossil energy source, most likely coal or natural gas, would need to be a significant contributor to any reasonable alternative energy combination. The DEIS concludes that combinations of power generation alternatives involving wind power, solar power, energy storage, and natural gas are not clearly environmentally preferable to CPNPP Units 3 and 4. Those conclusions are consistent with our conclusions in this Joint Affidavit.

IX. ADDITIONAL INFORMATION TO SUPPORT THE MOTION

A. Proposed Comanche Peak Units 3 and 4

28. [DRW, IZ] As discussed in ER Section 10.4.1.2.1, CPNPP Units 3 and 4 will each have a net electrical output of approximately 1600 MWe. Based upon a capacity factor of 93%, which is the approximate average capacity factor of operating nuclear plants in the United States, CPNPP Units 3 and 4 will have a combined average annual energy output of approximately 25,500,000 MWh.

29. [DRW, IZ] As discussed in ER Sections 2.2 and 2.3, approximately 3300 acres of the site are devoted to Squaw Creek Reservoir ("SCR"), which is used for cooling water for CPNPP Units 1 and 2, but will not be used for cooling water for CPNPP Units 3 and 4. In addition to cooling water, SCR is also used for recreational purposes.

B. It Is Reasonable for Utilities and Merchant Generators to Require That a Technology be Proven Before Investing in a Large-Scale Facility

30. [DRW] Constructing and operating large electrical generating facilities of any kind are expensive endeavors. In light of the high financial costs, utilities cannot afford to gamble on unproven technologies. Before a utility or merchant generator commits to build a large generation facility, it is prudent to either require that the technology has been demonstrated elsewhere on the same or similar scale, or first develop a pilot project or small-scale project to prove that the technology works and is cost-effective on a smaller scale.

31. [DRW] Even if a facility or project is technologically feasible, or if a demonstration facility is planned or being constructed, the technology in question is not necessarily commercially feasible, especially on a large scale. The purpose of a demonstration facility is to demonstrate the extent to which a technology is technologically and commercially feasible. If a technology is successfully demonstrated, then a next step might be to scale up the technology to meet power demands. Difficulties and delays are associated with each of these steps. For example, demonstration projects may identify areas for further research and development. Furthermore, even if a small-scale demonstration project operates successfully, it often takes years or decades for a technology to substantially increase in scale.

32. [DRW] For prudent utilities and merchant generators, it is insufficient that a particular technology may be theoretically feasible or under development on a small scale—it must be proven before a commitment is made to develop a large generating facility.

C. Wind, Solar, and Natural Gas as Individual Energy Generation Alternatives

1. Wind Energy

33. [DJB] As of 2009, there was approximately 8000 MWe of wind power installed in the ERCOT region. Approximately 70% of that capacity is located in western Texas.

34. [IZ] Wind turbines vary in size, typically from about 1.5 to 2.5 MWe (and some are larger). The height of towers varies, typically from 200 to 300 feet tall.

35. [IZ] A wind-power project of capacity comparable to the proposed CPNPP Units 3 and 4 would require approximately 1600 above-ground towers, assuming that each tower supported a 2-MWe wind turbine.

36. [DJB] Wind turbines must be sufficiently spaced to maximize capture of wind energy. Typically, 100 acres of unobstructed area is needed around each wind turbine, of which a quarter to half acre is need for actual placement and support of the wind tower. About 2 to 5% of the land needed for a wind farm is used for towers, roads, and support facilities. This land is not available for other uses. The remaining land can be used for other purposes, such as agriculture and ranching, provided that the use does not disrupt the wind flow needed for the wind turbines. For example, the land used for the Indian Mesa Wind Energy Project in Pecos County, Texas also is used for grazing livestock and hunting.

37. [IZ] As of mid-2009, the largest wind facility in the world was the 735-MWe Horse Hollow Wind Energy Center in Texas, which utilizes a total land area of 47,000 acres. As discussed in ER Section 9.2.2.1, a wind facility with a capacity equivalent to CPNPP Units 3 and 4 would cover approximately 204,000 acres of land. Of this, approximately 4100 to 10,200 acres would be occupied by wind turbines, support facilities, and roads, based upon the 2 to 5% factor discussed in the previous paragraph.

38. [DJB] Most (approximately 70%) of the wind power generation capacity in Texas is available in the western portion of the state. A similar proportion of future wind projects in Texas will likely be constructed in western Texas.

39. [IZ] Wind power comparable in capacity to CPNPP Units 3 and 4 likely would have MODERATE impacts on ecological resources, protected species, and cultural resources, depending upon the location of the facility, due to the large amounts of land that would be disturbed by the wind facility. Depending on location, some wind farms have caused bird kills. The size of wind power plants increases the likelihood that sensitive resources could be impacted because of the extremely large amounts of land required. The greater the acreage, the smaller the chance of avoidance.

40. [IZ] The use of wind power comparable in capacity to CPNPP Units 3 and 4 would have a LARGE adverse impact on aesthetics. Aesthetic concerns arise from the visibility of more than a thousand tall towers and blades spread over several hundred thousand acres. The recreational and scenic value of ridge tops would be reduced by the presence of a very large wind farm.

41. [IZ] Wind power will cause SMALL environmental impacts in other areas, including water and air quality, and human health.

42. [IZ] Wind power comparable in capacity to CPNPP Units 3 and 4 will have a potential MODERATE beneficial impact on socioeconomics. The leases for wind power may be on the order of $2000 to $5000 per turbine per year, adding to the other salaries and economic activity associated with constructing and operating a wind farm.

2. Solar Energy

43. [IZ] As of 2009, no solar power generation was installed at the transmission level in the ERCOT region. However, as indicated in the ERCOT Report on the Capacity, Demand, and Reserves in the ERCOT Region on page 19 (May 2010), several solar projects are being developed in the ERCOT region, which would add approximately 460 MWe of installed capacity by 2011.

44. [IZ] There are two types of solar plants: solar thermal and photovoltaic cells. Solar thermal power systems convert sunlight into electricity using heat as an intermediate step. Photovoltaic cells convert sunlight directly into electricity using semiconducting materials. The largest solar power facility in the world is in the Mojave Desert of California. Although the capacity of that facility has changed over time, its current capacity is approximately 354 MWe.

45. [IZ] For thermal power solar technologies to be effective, the average ground-level insolation rate must be a minimum of 6.0 kWh/m2/day. The ERCOT region receives 3.5 to 7.0 kWh/m2/day. Based on solar radiation maps, numerous areas in the western portion of the ERCOT region would meet or exceed the 6.0 kWh/m2/day minimum insolation standard, especially in the far western portion of the ERCOT region.

46. [KF] The western portions of the ERCOT region receive considerably more direct solar radiation than the eastern ERCOT regions. A similar proportion of future solar projects will likely be constructed in western Texas.

47. [IZ] As discussed in ER Section 9.2.2.2, a solar plant with a capacity equivalent to CPNPP Units 3 and 4 would require 38,000 acres. Unlike wind power, the development of solar power would limit the other uses that could be made of the land, as the solar panels or reflectors would occupy a large portion of the site, and most of the remaining areas would be occupied by

roads and support facilities. Therefore, the use of solar power comparable in capacity to CPNPP Units 3 and 4 would cause LARGE adverse environmental impacts on land use and aesthetics.

48. [IZ] A solar power facility comparable in size to CPNPP Units 3 and 4 likely would have MODERATE impacts on ecological resources, protected species, and cultural resources, depending upon the location of the facility, due to the large amounts of land that would be disturbed by the solar facility. The size of solar power projects increases the likelihood that sensitive resources could be impacted because of the extremely large amounts of land required; with the greater acreage, the change of avoidance could be reduced.

49. [KF] Solar power generation would cause SMALL environmental impacts in other areas, including air quality and human health. However, a 3200-MWe solar thermal facility with wet cooling would require roughly the same amount of water as CPNPP Units 3 and 4. Therefore, to the extent that the water use and quality impacts from CPNPP Units 3 and 4 are considered MODERATE, the impacts from a similarly sized solar thermal facility with wet cooling would also be MODERATE. A facility using solar photovoltaics or dry cooling would have SMALL impacts on water use and quality.

50. [DJB] The potential impact on socioeconomics of a solar facility of the same capacity as the proposed CPNPP Units 3 and 4 is expected to be a MODERATE beneficial impact due to job creation.

D. Storage Systems

1. CAES

51. [DJB] As discussed in ER Update Section 9.2.2.11.2.2, land areas that possess suitable geologic formations for large scale underground storage capacity are required. Texas has mines, depleted oil and gas wells, and geological formations that some have suggested might be suitable for CAES.

52. [IZ] CAES needs a source of natural gas or another equivalent heat source in order to increase the energy and pressure of the compressed gas to render it suitable for use in turbine-generators. A 3200-MWe natural gas-fired plant would generate 253 Tpy of SO_x, 2676 Tpy of NO_x, 1115 Tpy of CO, 142 Tpy of PM, and 8.2 million Tpy of CO_2. The natural gas usage for generating electricity from CAES is between one third and one half of that needed to generate the same amount of electricity at a natural gas plant, so the air emissions from CAES using natural gas will be about one third to one half these amounts. Thus, use of natural gas in the CAES compression and energy generation processes will increase air impacts related to a renewable energy facility. A 3200-MWe CAES facility that uses natural gas as the heat source would generate approximately 85 to 125 Tpy of SO_x, 890 to 1340 Tpy of NO_x, 370 to 560 Tpy of CO, 47 to 71 Tpy of PM, and 2.7 to 4.1 million Tpy of CO_2.

53. [IZ, JTC] Luminant and Shell-Wind Energy are proposing wind farm projects in Texas totaling 3000 MWe and are evaluating the potential for incorporating CAES facilities in conjunction with the wind farm projects. Luminant's proposed use of CAES is not for the generation of baseload power.

54. [DJB] ConocoPhillips and General Compression are planning to develop a pilot facility that uses wind power and CAES to generate electricity (including possibly baseload power), but it is still in the planning and development stages and has not yet been built. Further, this is a demonstration project to evaluate whether this technology is technically feasible. If it is proven a viable option, it will still take time to scale-up this technology so that it can generate greater amounts of power.

55. [DJB] New York State Electric and Gas is developing a CAES demonstration project with a 150 MWe capacity, funded by the American Recovery and Reinvestment Act. This project is for peak power generation and is also not yet online.

56. [DJB] Other projects receiving grants funded by the American Recovery and Reinvestment Act include a 300-MWe Pacific Gas & Electric Co. CAES demonstration project, and a Duke Energy 151-MWe wind and 20-MWe battery-storage facility at its Notrees site, but these projects are for peak power generation and also have yet to be completed.

57. [DJB] The use of CAES would require Luminant to purchase or obtain the rights to underground land that would not be available for other uses (such as mineral extraction). For example, the McIntosh CAES facility utilizes a salt cavern with dimensions of 220 feet in diameter and 1000 feet tall with a total volume of 19 million cubic feet, and the proposed Norton Energy Storage Project will utilize a 600-acre abandoned limestone mine with 9.6 million cubic meters of storage. The above-ground facilities would consist of a CAES building that would occupy a relatively small area.

58. [DJB] Because energy is lost during the energy storage and recovery process, use of CAES requires the generating facility to have a greater capacity to compensate for the net energy loss in CAES. If energy storage is used, more wind power, solar power, or natural gas capacity must be constructed and operated to generate the same amount of net electrical output.

59. [DJB] Additionally, CAES in the salt dome or bedded salt deposits found in Texas would have MODERATE impacts on water quality and waste management. The water quality impacts would be attributable to the large amount of freshwater required to create the CAES storage caverns in either salt dome or bedded salt deposits found in Texas. The disposal of the large volumes of salt water, along with other impurities in the rock formations, from the cavern

creation process would further impact water quality and increase waste management impacts. These impacts might be minimized or eliminated if storage in areas other than salt domes or salt deposits was used.

60. [DJB] As discussed above, adverse air impacts would result from a CAES that uses natural gas.

2. Molten Salt

61. [JEF] There are several commercial molten salt storage systems in operation. Additionally, other solar power plants using molten salt storage systems have been proposed, including projects in California and Arizona. However, none of these facilities is or would be used for baseload power.

62. [KF] Molten salt thermal storage is relatively efficient. However, combining solar power and storage would create greater environmental impacts than those caused by solar power alone. Energy is lost during the energy storage and recovery process. If energy storage is used, more solar power, wind power, or natural gas must be constructed and operated to generate the same amount of net electrical output.

63. [IZ] Based on the 3.8 to 10 acre per MWe, a 354-MWe solar facility would utilize approximately 1350 to 3500 acres of land. The molten salt storage facility would occupy a relatively small area compared to the area occupied by the solar facility.

E. New Transmission

64. [JTC] Most of the wind and solar power potential generation capacity in Texas is in the western portion of the state. However, there currently is transmission congestion in the ERCOT region and new bulk transmission would be needed to support transfers of significant amounts of additional wind generation to be developed. Operation of wind facilities and solar facilities comparable in capacity to CPNPP Units 3 and 4 likely would necessitate construction and

operation of substantial new transmission lines from western Texas (where most of the wind and solar potential is located) to eastern Texas (where most of the demand is located). This would likely entail additional land use and terrestrial impacts.

F. Overlapping Land Uses

65. [DJB] As discussed above, about 2 to 5% of the land needed for a wind farm is used for towers, roads, and support facilities. The remaining land can be used for other purposes, such as agriculture and ranching, provided that the use does not interfere with the wind flow.

66. [IZ] The land comprising a solar facility is devoted to the structures for the solar panels and/or reflectors and support facilities, and is not available for any other above-ground uses.

67. [IZ] CAES facilities are largely underground facilities. In general, the surface would be available for other conforming uses. It is theoretically possible that the same land could be used for a wind and/or solar facility above-ground and a CAES facility underground, provided that the appropriate geology and wind and/or solar resources existed at the same location.

68. [JEF] Molten salt thermal storage systems are located at the site of the solar facility. The land use requirements for a solar facility encompass the land needed for a thermal storage system.

69. [DJB] The land use associated with natural gas facilities is devoted to the plant itself, support facilities, and pipelines. If the pipelines are buried underground, the land above the pipelines can be used for other purposes such as agriculture or ranching, provided the activity does not impact the pipelines. However, the land devoted to the plant itself and support facilities would not be available for other uses.

X. FOUR-PART COMBINATIONS OF WIND AND SOLAR POWER, STORAGE, AND NATURAL GAS

70. [KF] Currently, there are no four-part combinations of wind and solar power, energy storage and natural gas. Additionally, there are no announced plans to develop such facilities. Instead, with a few exceptions, wind, solar, and natural gas have been operated as independent projects rather than as part of a combination.

71. [IZ] Since natural gas alone is a proven method for generating baseload power, combinations involving wind and solar power, energy storage and natural gas can also be considered a developed, proven, and available method for generating baseload power, provided that natural gas generates the majority of the electricity.

72. [IZ] A four-part combination involving wind, solar, energy storage, and natural gas, in which natural gas does not supply the majority of the electricity, is a theoretically feasible and available method for producing baseload power. However, for several reasons, such a combination has not been proven for producing baseload power equivalent to CPNPP Units 3 and 4:

- Such a four-part combination does not exist anywhere in the world. Instead, with a few exceptions, wind, solar, and natural gas facilities have been operated as independent projects rather than as part of a combination.
- As discussed above, the largest wind facility and solar facility in the world have capacities of 735 MWe and 354 MWe, respectively. Even if these facilities were combined with energy storage to produce baseload power, their total capacity would be less than 1100 MWe. Furthermore, given the capacity factors of the individual elements, the combination would generate far less than half of the energy to be generated by CPNPP Units 3 and 4. In such a

combination, natural gas would need to generate the majority of the electricity for the combination to be able to produce as much energy as CPNPP Units 3 and 4.

In summary, the four-part combination (with natural gas producing less than half of the electrical energy) is technologically feasible, but is not proven for generating an amount of baseload power equivalent to that of CPNPP Units 3 and 4.

73. [IZ] Combining wind, solar, storage, and natural gas might reduce the environmental impacts of the individual technologies in certain areas. For example, greater reliance on natural gas would reduce the amount of land needed for the wind and/or solar element of the combination. Similarly, a greater use of wind, solar, and/or storage would reduce the impacts on air quality from the natural gas element of the combination.

74. [All] There are many possible combinations of wind and solar power, storage, and natural gas. We analyze two bounding cases below.

75. [All] <u>Bounding Case 1</u> – This case assumes that energy is produced from the largest wind facility (735 MWe) and the largest solar facility (354 MWe), both combined with unlimited storage (which we conservatively assume has no environmental impact or energy loss for the purpose of this analysis). Assuming a conservative capacity factor for a wind facility in Texas of 55% (which is the maximum seasonal capacity factor for a wind facility in Texas) and no energy loss during storage and conversion, the combined wind and CAES facility would generate approximately 3,600,000 MWh annually. Assuming the maximum capacity factor for a solar facility (32%) and no energy loss during energy storage and conversion, the combined solar power and molten salt storage facility would generate approximately 990,000 MWh annually. If natural gas is used to provide energy in sufficient quantity to supply the difference between the

annual energy production of CPNPP Units 3 and 4 (25,500,000 MWh) and the energy produced by the combination of wind, CAES, solar, and molten salt storage, natural gas would need to provide approximately 21,000,000 MWh of electricity per year, equivalent to a 2800-MWe natural-gas fired plant operating at an 85% capacity factor. This combination would entail the following environmental impacts:

- Based on the information in the ER, a 735-MWe wind facility would utilize 47,000 acres of land. Of this, about 940 to 2350 acres would be covered by the wind turbines, roads, and support facilities. Based on the 3.8 to 10 acre per MWe for a solar facility, a 354-MWe solar facility would utilize approximately 1350 to 3500 acres of land. The natural gas facility would utilize approximately 350 acres of land, plus approximately 11,500 acres for natural gas wells, collection stations and pipelines. If the pipelines are buried underground, the land above the pipelines can be used for other purposes, provided the activity does not impact the pipeline. Although placing the solar facility on the same area covered by the wind turbines, roads, and support facilities could adversely impact the generation capacities of the wind and solar facilities, this analysis conservatively assumes that overlapping land use is possible. Based upon the conservative assumption that the solar plant and storage facilities were all on the same land as the wind farm, the four-part combination would entail the following total land use impacts: approximately 1700 to 3850 acres that would be directly covered by facilities and roads (not accounting for the additional transmission lines that likely would be needed to transmit the power from the wind and solar facilities); approximately 11,500 acres for natural gas wells, collection stations and pipelines; and more than 40,000 acres of land between the wind turbines that could be used for other conforming purposes such as agriculture or ranching. Such land-use impacts would be LARGE.

- The amount of wind towers (approximately 365) spread over 47,000 acres would cause a LARGE impact on aesthetics.
- The significant amount of land disturbance likely would cause MODERATE adverse impact on ecological resources, protected species, and cultural resources, depending upon the location of the facilities.
- The impacts on water use and quality from the natural gas plant would be comparable to the impacts associated with CPNPP Units 3 and 4, which are characterized in the DEIS as MODERATE. If CAES was used in the salt dome or bedded salt deposits found in Texas, it would cause additional adverse impacts on water quality and waste management. However, we again have conservatively ignored that impact.
- The natural gas plant would generate approximately 221 Tpy of SO_x, 2340 Tpy of NO_x, 975 Tpy of CO, and 124 Tpy of particulate matter, and 7.2 million Tpy of CO_2. Consequently, the air quality impacts would be SMALL to MODERATE.
- Although the use of natural gas in the CAES compression and energy generation process would increase the air impacts, we have conservatively ignored that impact.
- The impacts in other areas would be SMALL except for socioeconomics, which could be MODERATE beneficial.

76. [All] <u>Bounding Case 2</u> – This case assumes the use of a wind plant and CAES facility with a nameplate capacity of 3200 MWe, a solar power and molten salt storage facility with a nameplate capacity of 3200 MWe, and a natural-gas fired plant that supplies the difference between available energy from both wind and solar and the total energy required, i.e. the energy

that would be generated annually by CPNPP Units 3 and 4. Assuming a conservative capacity factor for a wind facility in Texas of 55% (which is the maximum seasonal capacity factor for a wind facility in Texas) and no energy loss during storage and conversion, the combined wind and CAES facility would generate approximately 15,500,000 MWh annually. Assuming the maximum capacity factor for a solar facility (32%) and no energy loss during energy storage and conversion, the combined solar power and molten salt storage facility would generate approximately 9,000,000 MWh annually. If natural gas is used to provide energy in sufficient quantity to supply the difference between the annual energy production of CPNPP Units 3 and 4 (25,500,000 MWh) and the energy produced by the combination of wind, CAES, solar, and molten salt storage, natural gas would need to provide approximately 1,000,000 MWh of electricity per year, equivalent to a 135-MWe natural-gas fired plant operating at an 85% capacity factor. This combination would entail the following environmental impacts:

- Assuming that the solar plant and storage facilities were all on the same land as the wind farm, and that natural gas wells, collection stations, and pipelines did not need to be constructed, and extrapolating the total land requirements from the land-use of Horse Hollow Wind Energy Center (64 acres/MWe), the combined wind, CAES, solar, molten salt storage, and natural gas facility would require approximately 204,000 acres. This land could be at a single site or spread over multiple sites. Of that the 204,000 acres, approximately 4100 to 10,200 acres would be occupied by wind turbines, support facilities, and roads. As discussed in ER Section 9.2.2.2, a solar facility with a capacity equivalent to CPNPP Units 3 and 4 would cover approximately 38,000 acres of land. Although placing the solar facility on the same area covered by the wind turbines, roads, and support facilities could adversely impact the generation capacities of both wind and solar facilities, this analysis conservatively assumes overlapping land use is possible. Based upon the conservative assumption that the solar plant and storage facilities were all on the same land as the wind farm, and that a natural gas pipeline did not need to be constructed, the four-part combination would require 204,000 acres of land, of which more than 38,000 acres would be fully occupied by facilities and roads. This does not account for the additional transmission lines that likely would be needed to transmit the power from the wind and solar facilities. Accordingly, the land use impacts would be LARGE.

- The large number of wind towers and solar panels spread over hundreds of thousands of acres would also cause a LARGE impact on aesthetics.
- The large land disturbance likely would have a MODERATE adverse impact on ecological resources, protected species, and cultural resources, depending upon the location of the facility.
- The impacts on water use and quality from a solar thermal facility with wet cooling would be comparable to the impacts associated with CPNPP Units 3 and 4, which are characterized in the DEIS as MODERATE; otherwise the impacts would be SMALL. Additional impacts on water use and water quality would be attributable to the natural gas facility. If CAES was used in the salt dome or bedded salt deposits found in Texas, it would cause additional adverse impacts on water quality and waste management. However, we have conservatively ignored that impact. Overall, the impacts on water use and quality would be SMALL to MODERATE.

- The natural gas plant would generate approximately 11 Tpy of SO_x, 112 Tpy of NO_x, 47 Tpy of CO, 6 Tpy of particulate matter, and 344,000 Tpy of CO_2. Consequently, the air impacts would be SMALL.
- The impacts in other areas would be SMALL except for socioeconomics, which could be MODERATE beneficial.

77. [All] Changing the mix between solar and wind power would not materially affect these conclusions. For example, if the capacity of wind power were substantially increased (*e.g.*, to 5800 MWe) while the capacity of solar power and natural gas were substantially decreased:

(1) The total acreage of the four-part combination would also proportionally increase (*e.g.*, up to approximately 370,000 acres), and

(2) The amount of land fully occupied by facilities and roads would decrease (*e.g.*, down to about 11,000 to 18,000 acres assuming no land for solar, storage or natural gas).

The latter alone would correspond to a MODERATE to LARGE land use impact, which is not materially different from the impacts assumed for Bounding Case 2.

78. [IZ] In categorizing the land use impacts discussed above, we used NUREG-1555, Environmental Standard Review Plan ("ESRP") 4.1.1 as guidance. ESRP 4.1.1 indicates that both the quality and quantity of the land should be taken into account in categorizing the land use impacts. Since the site for the wind and/or solar power facility for this analysis is hypothetical, the quality is not known. However, since such facilities would like be in western Texas, we have assumed that the quality of land is low. Pages 4.1.1-10 to 11 of ESRP 4.1.1 provides the following land use categorization of land with relatively low quality:

(1) For fewer than 500 hectares (1235 acres), the land use impact is "not of major significance," which roughly corresponds to a SMALL impact;

(2) Between 500 and 5000 hectares (1235 to 12,350 acres), the land use impact is "adverse," which roughly corresponds to a MODERATE impact; and

(3) Greater than 5000 hectares (12,350 acres), the land use impacts "are sufficiently adverse to require mitigation," which roughly corresponds to a LARGE impact.

A hectare corresponds to 2.471 acres.

79. [All] Bounding Case 1 is bounding in the sense that it represents a relatively large contribution from natural gas and any greater contribution natural gas would not be distinguishable from the alternative consisting entirely of natural gas. Bounding Case 2 is bounding in the sense that it represents a relatively large contribution from wind, solar, and storage. Furthermore, any greater contribution from wind, solar, and storage would not reduce the environmental impacts of Bounding Case 2, as presented in the following table. Similarly, as discussed above, it is possible to change the mix between solar and wind; for example, to have more wind capacity and less solar capacity than assumed in Bounding Case 2. However, such a change would not materially affect the results as presented in the following table, since wind and solar power have somewhat similar environmental impacts.

80. [All] As these cases illustrate, there is a tradeoff between increased land-use, ecology, and aesthetics impacts from greater use of renewables, and increased air emissions from greater use of natural gas. The following table contains a comparison of the environmental impacts of CPNPP Units 3 and 4, and the two alternative energy combinations considered above:

Category	Nuclear	Bounding Case 1	Bounding Case 2
Air Quality	SMALL	SMALL to MODERATE	SMALL
Land Use	MODERATE	LARGE	LARGE
Ecology	MODERATE	MODERATE	MODERATE
Water Use and Quality	MODERATE	MODERATE	SMALL to MODERATE
Waste Management	SMALL	SMALL	SMALL
Radiological Impacts	SMALL	SMALL*	SMALL*
Human Health	SMALL	SMALL	SMALL
Socioeconomic	MODERATE (Beneficial)	MODERATE (Beneficial)	MODERATE (Beneficial)
Aesthetics	SMALL	LARGE	LARGE
Historic and Cultural Resources	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL

* We assume that the radiological impacts for the cases using renewable energy are zero

As the above table demonstrates, four-part combinations have overall environmental impacts that would be equal to or greater than CPNPP Units 3 and 4. As the above table demonstrates, the impacts from the Bounding Cases are all greater than or equal to the impacts of Nuclear, except for Water Use and Quality where the impact for Nuclear is MODERATE and the impact for Bounding Case 2 is SMALL to MODERATE. However, given the LARGE impacts on Land Use and Aesthetics for Bounding Case 2 versus the MODERATE and SMALL impacts, respectively, for Nuclear, it is evident that the overall impacts of Bounding Case 2 are greater than or equal to those for Nuclear. In other words, any four-part combination would not be environmentally preferable to CPNPP Units 3 and 4.

XI. EVALUATION OF INTERVENORS' BASES IN SUPPORT OF ALTERNATIVES CONTENTION A

81. [All] We have reviewed each of the reports cited by Intervenors in support of their energy alternatives contention. We have compared the ER, including the ER Update, and the DEIS with the information in the reports. We have determined that the information contained in the reports is consistent with the ER and DEIS. More specifically, we agree that combinations of solar and wind energy, energy storage methods, and natural gas are available and feasible for producing baseload power in the area of Texas which would be served by CPNPP Units 3 and 4. Furthermore, our bounding cases discussed above conservatively assume that there are efficiencies arising from overlapping uses of land for each of the parts of the wind, solar, and storage facilities. Even with this assumption, the adverse environmental impacts from this combination are equal to or greater than those caused by CPNPP Units 3 and 4.

XII. CONCLUSIONS

82. [All] We conclude that the four-part combination of wind, solar, storage, and natural gas is a feasible, available, and proven method for generating baseload power, if natural gas generates the majority of the electricity. We also conclude that the four-part combination is technologically feasible and available in Texas but is not a proven method for generating baseload power equivalent to that to be produced by CPNPP Units 3 and 4, if natural gas does not generate the majority of the electricity. Finally, the adverse environmental impacts of any four-part combination would be equal to or greater than the adverse environmental impacts that would be attributable to CPNPP Units 3 and 4. Therefore, we conclude that any four-part combination would not be environmentally preferable to CPNPP Units 3 and 4.

[All] I declare under penalty of perjury that the foregoing is true and correct. Executed on August 26, 2010.

Executed in Accord with 10 C.F.R. § 2.304(d)

/s/ Donald R. Woodlan
Donald R. Woodlan
Luminant Generation Company LLC

Executed in Accord with 10 C.F.R. § 2.304(d)

/s/ John T. Conly
John T. Conly
Luminant Generation Company LLC

Executed in Accord with 10 C.F.R. § 2.304(d)

/s/ Ivan Zujovic
Ivan Zujovic
Enercon Services, Inc.

Executed in Accord with 10 C.F.R. § 2.304(d)

/s/ David J. Bean
David J. Bean
Enercon Services, Inc.

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/s/ John E. Forsythe
John E. Forsythe
Enercon Services, Inc.

Executed in Accord with 10 C.F.R. § 2.304(d)

/s/ Kevin Flanagan
Kevin Flanagan
Enercon Services, Inc.

Donald R. Woodlan

Mr. Woodlan is currently serving as the Manager, Nuclear Regulatory Affairs NuBuild for Luminant Generation Company LLC.

Mr. Woodlan received his bachelor's degrees from the U. S. Naval Academy in 1968 and his graduate degree in Electrical Engineering from Michigan State University in 1969. After serving in the U.S. Navy for seven years on two nuclear powered submarines, Mr. Woodlan left the Navy and joined the operations staff of the Perry Nuclear Power Plant, which was under construction at the time.

In May of 1979, Mr. Woodlan came to the licensing staff of Comanche Peak. He has been in licensing ever since. He worked his way up from licensing engineer to senior licensing engineer to supervisor and finally to manager. He was the Docket Licensing Manager when CPSES (Comanche Peak Steam Electric Station) Unit 1 was licensed in 1990 and when CPSES Unit 2 was licensed in 1993.

Mr. Woodlan has been involved in numerous industry activities over the years including equipment qualification, fire protection (Thermo-Lag), backfitting, the revision of 10 CFR 50.59, the operability determination process, and the Nuclear Energy Institute (NEI) Licensing Action Task Force. Mr. Woodlan was the manager of the Joint Licensing Subcommittee (JLS), a combined effort by Comanche Peak, Diablo Canyon, Callaway and Wolf Creek to convert their Technical Specifications to the improved Standard Technical Specifications.

Mr. Woodlan has been involved in STARS (*Strategic Teaming and Resource Sharing*, an alliance composed of Callaway, Comanche Peak, Diablo Canyon, Palo Verde, South Texas Project and Wolf Creek) from its very beginnings in 1999 and was one of the initial members of the STARS Integrated Regulatory Affairs Group (IRAG). Mr. Woodlan became the Chairman of IRAG in May of 2001 and the STARS Regulatory Affairs Manager in June of 2002.

Mr. Woodlan was selected as the Manager, Nuclear Regulatory Affairs NuBuild for Luminant Generation Company LLC.

EDUCATION TRAINING LICENSES

- B.S. in Electrical Engineering and Mathematics - U. S. Naval Academy, Annapolis, MD 1964-1968
- MS in Electrical Engineering - Michigan State University, East Lansing, Michigan 1968-1969
- Qualification to operate and maintain Naval Nuclear Power Plants - US Navy Nuclear Power School, Mare Is., CA, 1969 - US Naval Nuclear Power Training Unit, Windsor, CT, 1970
- Registered Professional Engineer, State of Ohio, July 28, 1977
- Complete generic portion of Licensed Operator Training, 1979
- Nuclear Safety course form MIT, 1999

EXPERIENCE

- 1968 to 1975 - U. S. Navy - USS Sam Rayburn (SSBN 635) Gold 1970-1972, *Division Officer* Communications; USS Jack (SSN 605) 1973-1975, "M" Division Officer, "A" *Division Officer*, Weapons *Department Head*.
- 1975 to 1979 - Cleveland Electric Illuminating Company - *Operations Engineer* for Perry Nuclear Power Plant which was under construction. Responsibilities included: control room panel layouts, spare parts program, system operating descriptions, and technical specifications. Supervised up to six operations personnel.
- 1979 to 1980 - Texas Utilities Services, Inc./ Texas Utilities Generating Company/ TU Electric *Licensing Engineer* (lead in electrical, I&C and equipment qualification areas)
- 1980 to 1985 - *Senior Licensing Engineer* (lead in electrical, I&C and equipment qualification areas, member of several industry groups on equipment qualification)
- 1985 to 1988 - *Licensing Supervisor* for docket licensing activity, member of several industry groups in areas such as equipment qualification, and technical specification
- 1988 to 2001 - *Docket Licensing Manager* (included receipt of operating licenses for CPSES Units 1 and 2, set up the on-site licensing group for Unit 2, managed a joint Technical Specification Conversion effort for CPSES, Diablo Canyon, Callaway and Wolf Creek, original member of team that created STARS and IRAG, participated in industry groups on topics such as technical specifications, updating 10CFR50.59, and enhancing licensing processes)
- 2001 to 2002 - *STARS, Integrated Regulatory Affairs Group (IRAG) Chairman and Docket Licensing Manager*. (Member and Chairman Licensing Actions Task Force)
- 2002 to 2006 - *STARS, Regulatory Affairs Strategic Issues Group (RASIG) Manager and Integrated Regulatory Affairs Group (IRAG) Chairman* (Member NEI Licensing Actions Task Force)
- 2006 to Present - Manager, Nuclear Regulatory Affairs NuBuild for Luminant Generation Company LLC

John T. Conly

Mr. Conly is currently serving as the Combined License Application (COLA) Project Manager for the Luminant Power Company (Luminant) NuBuild Team on Comanche Peak Nuclear Power Plant (CPNPP) Units 3 and 4.

Mr. Conly received his bachelor's degree from the University of Texas (Austin) in 1969. After serving in the U.S. Navy for four years on a nuclear-powered submarine, Mr. Conly joined Bechtel Power Corporation (Houston) in the Nuclear Department and has been involved primarily with licensing commercial nuclear power plants since 1973 (~35 years).

In 2006, at South Texas Project (STP) Units 3 & 4, Mr. Conly wrote Chapter 8 of the Environmental Report (ER), "Need for Power," for the COLA, based on Electric Reliability Council of Texas (ERCOT) documents and interviews with ERCOT staff. After submittal of the STP 3 & 4 COLA, Mr. Conly contracted with Luminant as the COLA Project Manager. The same basic information was used in CPNPP Units 3 and 4 ER Chapter 8 because both STP and CPNPP are deregulated power generators located in the ERCOT area.

EDUCATION, TRAINING

- B.S. in Electrical Engineering – University of Texas, Austin, Texas 1969
- Graduate level courses - U.S. Navy Nuclear Power School, Mare Island, CA, 1969
- Qualification to operate and maintain Naval Nuclear Power Plants – U.S. Navy Nuclear Power School, Mare Island, CA, 1969 and U.S. Naval Nuclear Power Training Unit, Idaho Falls, ID, 1970

EXPERIENCE

- 1970 to 1973 - U. S. Navy, USS Casimir Pulaski (SSBN 633): Assistant Reactor Controls Division Officer; Communications Division Officer; Sonar Division Officer; Operations Officer
- 1973 to 1978 – *Staff Licensing Engineer*, Bechtel Power Corp. Blue Hills Station: assigned to the department responsible for preparation, review, and technical accuracy of the Preliminary Safety Analysis Report for a nuclear power plant
- 1978 to 1979 – *Regional Sales Engineer*, Newport News Industrial Corp.: developed and serviced clients for fabricated steel products, radwaste incineration systems, emergency nuclear-grade welding repair services, and planned outage services
- 1979 to 1986 – *Environmental Licensing Engineer, System Engineer, Licensing Group Leader*, Bechtel Energy Corp.: environmental licensing engineer for a coal degasification plant; responsible engineer for flue gas desulfurization system and scrubber waste handling system on a coal plant; licensing supervisor for a nuclear power plant.

- 1986 to 1993 - *Licensing Supervisor*, Comanche Peak: responsible for the licensing supervision of four major engineering contractors; coordinated resolution of 3500 licensing commitments; performed planning, scheduling and staffing for licensing effort
- 1993 to 1996 – *Licensing Engineer, Assistant Project Manager – Litigation Support,* South Texas Project: responsible for regulatory compliance and licensing support; supervised 26 personnel in support of co-owner litigation:
- 1996 – *Licensing Consultant*, Maine Yankee: assisted in licensee preparation for an NRC Independent Safety Assessment
- 1996 to 1998 – *Licensing Engineer*, South Texas Project: prepared response to NRC 10 CFR 50.54(f) letter regarding design bases information; performed Safety System Functional Analysis with team of ten and prepared the report; developed, submitted, and defended Updated Final Safety Analysis Report (UFSAR) and Technical Specification changes for Unit 1 steam generator replacement (SGR) project.
- 1998 to 2000 – *Licensing Consultant*, Ontario Hydro Nuclear/Ontario Power Generation: assisted in the recovery of eight voluntarily shutdown CANDU units; drafted regulatory positions; wrote procedures; prepared presentations to the AECB/CNSC; developed training program for regulatory analysts
- 2000 to 2007 – *Licensing Engineer*, South Texas Project: prepared, reviewed, and approved UFSAR revisions and updates; developed and submitted changes to Technical Specification and UFSAR for Unit 2 SGR project; provided licensing support for meeting multiple NRC Orders regarding plant security and for subsequent NRC Security inspection; assigned as the COLA coordinator for Units 3 & 4; wrote Environmental Report Chapter 8, "Need for Power;" developed and delivered presentations to the NRC regarding the STP 3 & 4 COLA
- 2008 to Present – *COLA Project Manager*, Comanche Peak Units 3 and 4 - responsible for owner's oversight of preparation and submittal of the COLA and responses to NRC Requests for Additional Information

Ivan Zujovic, M.Ch.E, P.E.

Expertise Summary

- Over 13 years of professional experience in process evaluation and engineering, remediation design, site assessment, and environmental compliance and permitting.
- Licensed Professional Chemical Engineer, with experience in a broad spectrum of environmental issues.
- Principal Engineer for Enercon's Tampa office, with over 13 years experience as project manager responsible for site assessment, remedial design, regulatory compliance, reporting, and permitting.
- Significant experience with site environmental compliance with air permits, NPDES permits, chemical control, SARA 312/313, and waste management and minimization.
- Experience in wastewater and stormwater monitoring requirements.

Representative Experience Description

Process Evaluation
Site assessments
Air emissions permitting
NPDES permitting (wastewater and stormwater) compliance
Wastewater design, monitoring, and compliance
Hazardous waste management and compliance

Process Engineering
Remedial design
Project management
Full spectrum of regulatory
Stormwater management
Development of SWPPP and SPCC plans

Nuclear Power Plant Application

- Lead author for a Section of Combined Operating License Application (COLA) for a proposed new nuclear power plant. Directed a team of four scientists and engineers.

Hazardous Waste

- Managed the hazardous waste compliance program for numerous clients including a major pharmaceutical manufacturer, composite manufacturer, automotive manufacturer and four-year college. The work included waste characterization, on-site management, and waste transport. Managed the overall assessment of all waste streams to ascertain waste generation and waste types in order to fully assess facility generator status. Prepared hazardous waste management plans and trained facility personnel in proper management of generated hazardous waste.

Contamination Assessment and Remediation

- Served as the Engineer of Record for a three-month excavation and removal project at a former Raceway in Jacksonville, Florida. Designed the assessment and remediation plans for the removal of approximately 42,000 tons of Bunker C Fuel Oil-contaminated soil. Also designed a water treatment system for dealing with exposed groundwater.

- Project Manager and Engineer of Record for contaminated site assessments, remedial design and implementation, data analysis and reporting, and regulatory assistance for numerous clients whose sites were contaminated with petroleum, chlorinated solvents, and other contaminants. Managed O&M for numerous Florida Department of Environmental Protection petroleum pre-approval sites.

Chemical Engineering

- Managed and conducted process evaluations, for process inputs and outputs, for clients in various industries in order to provide the client with permitting/compliance/design solution. The industries included:
    - Power plants
    - Food processing
    - Pharmaceutical manufacturing
    - Fertilizer manufacturing
    - Automotive and electronics manufacturing
    - Aircraft engine refurbishing
    - Composite manufacturing
    - Sealant manufacturing and packaging

- Managed a team that designed a system for the recovery of sulfurous gases at a powdered metal plant.
  The system utilized inexpensive, off-the-shelf, automobile catalytic converters as reactors for the conversion of hydrogen sulfide to sulfur dioxide/trioxide. Performed mass balance calculations and cost estimates; conducted reactor design and piping layout; generated CAD drawings; and served as customer contact point.
- Lead a two-man team that designed an exhaust system for the magnesium parts milling machines at an engine block manufacturing plant. The system was designed to be NFPA compliant. In addition, it used the extra capacity of the pre-purchased wet scrubber for ventilation of a section of the plant, enabling a comfortable work environment and saving the plant utility cost. Involved in every aspect of design. Balanced system after installation. Served as customer contact point.
- Lead a multi-disciplinary team that designed and supervised installation of a humidifying/dehumidifying system for the "environmental chamber" at Army's Redstone Arsenal. This chamber was a one of a kind facility for testing rocket propellant. It simulated weather conditions anywhere on earth, ranging from extreme cold and humid to extreme hot and dry conditions. After implementation of the design, operators were able to control the chamber from the control room by dialing-in the desired atmospheric parameters, and run several tests per day. This project was rewarded a contract renewal and an *excellent* rating from the Department of Defense. Involved in every aspect of the design, equipment purchase and installation, and customer interaction.
- Prepared air emissions permit applications for numerous clients in the printing industry including major newspaper publishers Sun-Sentinel, Scripps Publishing, and Naples News. Also prepared air permit applications for composite manufacturing, metals processing, and printed circuit boards manufacturing clients.
- Conducted several specialty studies including nitrogen deposition into Tampa Bay from NOx emissions resulting from a proposed fossil fuel power plant.

Wastewater Treatment/Discharge

- Project manager of wastewater compliance services, including sanitary and industrial sewer discharge, and stormwater and surface water (NPDES) discharge, for numerous industrial clients. The work included permitting, sampling and measurement, data analysis, water balance calculations and compliance recommendations.
- Managed the work of a team that analyzed the operation of an existing wastewater treatment plant at an automotive production facility. Analyzed production processes which discharged to industrial sewer; reviewed historical records; collected and analyzed wastewater samples; and prepared report on how to minimize water discharge and maximize treatment capabilities of the existing plant.
- Prepared NPDES permit applications for several industrial facilities including Cargill Fertilizer and Nitram Inc. (fertilizer manufacturing facilities), and Cardinal Health (pharmaceutical manufacturer). Work included preparation of water balance calculations, water usage drawings, and chemical usage analysis.
- Conducted plant-wide water usage analysis; created a plant-wide water usage flow diagram; and developed a water usage calculation spreadsheet for Cardinal Health (now Catalent Pharma Solutions), a major pharmaceutical plant. Information was used by the entire engineering department which previously had no method to track water usage in the plant. In addition, information was used to reduce the plant's overall monthly water usage invoice by 30%.
- Project manager for the installation of backflow pollution prevention devices for the Fort McClellan (Alabama) potable water system. Managed every aspect of the project: design, scheduling, writing weekly progress reports, invoicing, customer interaction, purchasing, and general overseeing of project progress. Created a database for Fort McClellan containing all devices installed, location, size, quantity, and other pertinent information.
- Conducted an evaluation of a municipal solid waste recycling pilot plant in Albertville, Alabama. Sampled and analyzed all processed waste. Wrote the report, which included recommendations for improved plant performance.
- Managed wastewater compliance program including sampling, monitoring and reporting at Tampa Bay Fisheries, a seafood processing facility with an on-site wastewater treatment plant. Work included groundwater monitoring, compliance, and reporting; wastewater permit support; and recommendation for improving treatment plant operation.

- Prepared SWPPP for several industrial facilities including:

  - James Hardie Inc., Plant City – manufacturer of Hardie-board;
  - Industrial Galvanizers – zinc galvanizing facility, located on a Superfund site;
  - Linde Gas – several of Linde's acetylene gas production facilities;
  - Port of St. Petersburg, FL – work included conducting stormwater management training for port personnel

Education and Professional Recognition

- M.C.H.E, Master of Chemical Engineering, University of South Florida
- B.S.E Chemical Engineering, Biophysical Chemistry Option, University of Alabama in Huntsville

- Florida Professional Engineer, License Number 59560
- Member of the National Society of Professional Engineers
- 40-hour HAZWOPER
- RCRA Hazardous Waste Manager
- DOT HazMat
- ISO 14001 Lead Auditor

ENERCON SERVICES, INC.

David J. Bean

Experience Summary

- 33 years of experience in the Environmental Industry
- Experience in both Combined Construction and Operating License Application (COLA) and Early Site Permit (ESP) applications for the nuclear industry, including planning, document preparation, pre-application meetings with the Nuclear Regulatory Commission (NRC), responses to Requests for Additional Information (RAIs), and providing support to the applicant in preparation for a hearing with the Atomic Safety and Licensing Board (ASLB).
- Experienced in environmental impact analysis/assessment, NEPA, and Strategic Environmental Management
- Experience performing Risk assessment/analysis, ES&H compliance strategy development, waste management, site evaluation and selection planning.
- Has managed million-dollar plus multi disciplinary projects for industrial and government clients
- Prepared the Biological Assessment for the endangered American Burying Beetle (*Nicrophorus americanus*)

Experience Description

Mr. Bean is currently serving as a senior technical reviewer and advisor to the Enercon team preparing the Supplemental Environmental Impact Statement (SEIS) and License Renewal Application (LRA) for the renewal of the operating licensing for TVA's Sequoyah Nuclear Station Units 1 and 2 (SQN). Mr. Bean is the site liaison, working with both TVA technical and managerial people and the Enercon Team to provide the technical information needed to prepare the documents and review the documents to assure completeness and comprehensiveness. Mr. Bean routinely visits the SQN site to access TVA reports and information, both electronic and hard copy, required for the SEIS and LRA. In this capacity, he is working with both the environmental and safety technical people. Mr. Bean attends TVA's SEIS Core Team meetings to provide input and comments and help assure the responsiveness of documents being prepared for the LRA effort.

Mr. Bean's recent assignment has been Environmental Project Management for the preparation of a COLA for new nuclear power plants in the United States. He is responsible for all aspects of site characterization and development of the Environmental Report (ER), and Chapter 2 of the Final Safety Analysis Report (FSAR) for the COLA. Responsibilities include budget and schedule control, interaction with both the client and NRC, coordination of technical experts on the project, and technical review of sections of the ER and FSAR prepared for the COLA. Mr. Bean's recent work has dealt with the certified design of the AP1000 reactor.

Working with the US Fish and Wildlife Service (FWS), Mr. Bean prepared the Biological Assessment for the endangered American Burying Beetle (*Nicrophorus americanus*). The FWS then used this information to prepare their Biological Opinion that resulted in procedures for protecting the beetle from earth disturbing activities within its limited range.

Mr. Bean coordinated the preparation of the environmental sections of the Early Site Permit for Entergy's Grand Gulf Nuclear Station near Port Gibson, MS. Mr. Bean provided support to the applicant in preparation for the hearing with the Atomic Safety and Licensing Board (ASLB).

Mr. Bean managed the preparation of the environmental impact statement (EIS) for the Spallation Neutron Source (SNS) at the Oak Ridge National Laboratory. Responsible for all aspects of the EIS preparation, including budget and schedule planning, public scoping and comment meetings and preparation of the draft and final versions of the EIS. This EIS evaluated the potential impacts of the SNS at four candidate sites across the country.

Mr. Bean coordinated NEPA compliance for construction and operation of a nuclear production reactor at the Savannah River Site. He was also responsible for environmental regulatory compliance planning for nuclear production reactor. This effort included developing strategies for compliance with the numerous environmental regulations including Clean Air Act, Clean Water Act, and RCRA, and obtaining consensus of State regulators and resulted in the development of the comprehensive planning document "New Production Reactor Capacity Environmental Regulatory Compliance Plan, Savannah River Site".

Mr. Bean developed and implemented comparative evaluation of potential sites and the selection of the preferred site for environmentally sensitive facilities. The process involved comparative evaluation of alternative sites, trade off analyses, and consensus building in a team of technical experts. The facilities included:

- The Environment Management Waste Management Facility for the Oak Ridge Reservation
- Geologic Repository for the development of a geologic repository for high level radioactive waste
- Waste Management Central Verification Facility for the Oak Ridge Reservation
- Nuclear reactor for the production of tritium at the Savannah River Site

Education and Professional Recognition

M.S. Zoology, the Ohio State University, 1980
B.A. Biology, State University of New York at Oswego, 1973

Human Health and Ecological Risk Assessment, 24-hour (SENES Oak Ridge, Inc., 1993)
Team Building and Coaching (Career Track, Inc., 1993)
Mixed Waste Regulation Conference (Executive Enterprises, Inc., 1991)
Environmental Regulations Course (Executive Enterprises, Inc., 1989)
Principles of Management (Battelle Memorial Institute 1987)

John Edward Forsythe, AICP

Experience Summary

• Recent focus has been on the energy sector, including transmission line siting, hydroelectric facilities, and wind/solar renewable resource projects.

• Experience in energy projects has included strategic and technical advisement, siting studies, permitting, licensing, and impact assessment tasks for large investor-owned utilities and private interests.

• Experience includes working with the Federal Energy Regulatory Commission (FERC), the California Energy Commission (CEC), the California Public Utilities Commission (CPUC), and the Bureau of Land Management (BLM).

Experience Description

Mr. Forsythe has 20 years of experience in environmental planning projects with an emphasis on the preparation and management of CEQA and NEPA compliance studies. Following is a description of select work experience.

Consultant

• Formulated strategic partnerships for energy and environmental project opportunities.
• Provided on-call strategy development and project management to key clients.
• Monitored emerging energy-related policy and tracked stimulus funding related to renewable and green energy.
• Provided consulting services and technology solutions in energy, climate change, environment, transportation, social programs, health, defense, and emergency management.

As Senior Project Manager, Mr. Forsythe managed a large-scale Central California Valley PG&E transmission line project, known as the "C3ET". He managed an energy-based portfolio of nearly $4.5 million and was responsible for technical staff development and training in which his duties included coordinating and managing multi-million dollar projects and proposal efforts. Mr. Forsythe established a new practice focused on licensing and permitting of various statewide telecommunication efforts.

Mr. Forsythe spearheaded the development of a specialized internal group focused on the growing energy sector. He also served as a special consultant to several communities providing technical and strategic guidance related to electric utility industry issues.

Mr. Forsythe performed as a Senior Environmental Planner. In this role, he was responsible for the management and preparation of project-related, issue-oriented environmental planning studies focusing on impact assessment (pursuant to CEQA, NEPA compliance), permitting, baseline analyses, and site assessments.

He successfully completed numerous project and task management assignments exhibiting coordination, budgeting, and negotiation skills. Mr. Forsythe prepared senior-level land use and socioeconomic studies.

Education and Professional Recognition

Master of City and Regional Planning (MCRP), California Polytechnic State University, San Luis Obispo School of Architecture and Environmental Design, San Luis Obispo, California, 1992

B.A., Environmental Studies and Planning, Sonoma State University, Rohnert Park, California, 1988

A.S., Horticulture, The College of San Mateo, San Mateo, California, 1985 American Institute of Certified Planners (AICP) Certified July, 1996 - #012114

Presentations and Publications

Forsythe, John, Energy Crisis – Impact to Local Planners, APA Northern News, July, 2001. Also published in the August, 2001 issue of the Association of Environmental Planners, Superior California Chapter monthly publication.

Utility Restructuring and Community Planning; Panel Moderator; American Planning Association, Region VI Conference; Long Beach, California, Fall, 2000

Professional Affiliations

American Planning Association
Association of Environmental Professionals (California)

Kevin Flanagan, P.G.

Experience Summary

- More than 20 years of professional experience in geology, hydrogeology, and environmental
- Experienced in Combined Construction and Operating License Application (COLA) for the nuclear industry, including work for the Bellefonte Nuclear Power Plant, Lee Nuclear Station, and Grand Gulf Nuclear Station, including cost/benefit analyses and groundwater impacts studies
- Phase I and Phase II environmental audits
- Experience in all phases of underground storage tank (UST) and above ground storage tank (AST) project management in several states, including UST/AST removal

Experience Description

Mr. Flanagan has assisted in preparation of combined construction and operation licensing applications (COLA) for nuclear power plants. This has included preparation of cost benefit analyses for three proposed nuclear facilities and the preparation of a study related to potential impacts to groundwater related to construction and operation of one proposed facility.

Mr. Flanagan has experience dealing with various regulatory agencies at the local and state level. He has worked with clients in the Oil and Gas industry. Mr. Flanagan has experience in site investigation/characterization, and risk assessment at petroleum underground storage tank (UST) facilities, industrial facilities, and petrochemical pipeline release sites.

Some of Mr. Flanagan's work experience is listed below.

- Risk Assessments utilizing the American Petroleum Institute (API)/Decision Support system (DSS) and American Society for Testing and Materials (ASTM)/Risk-Based Corrective Action (RBCA)
- Certified environmental consultant in several states

Education and Professional Recognition

M.S. Geology, Oklahoma State University, Stillwater, 1989
B.S. Geology, Oklahoma State University, Stillwater, 1985
Practical Approaches to Ground-Water Hydrology and Contamination, 6-week course at OSU, 1990 Oklahoma Corporation Commission Consultant #221
American Institute of Professional Geologists, Professional Geologist # AIPG 10103
40-Hour HAZWOPER Certification 8-Hour OSHA/SARA Hazwoper Supervisor Training

Affiliations

National Groundwater Association
American Institute of Professional Geologist

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 52-034-COL
LUMINANT GENERATION COMPANY LLC	)	52-035-COL
	)	
(Comanche Peak Nuclear Power Plant Units 3 and 4)	)	August 26, 2010

CERTIFICATE OF SERVICE

I hereby certify that on August 26, 2010, copies of "Luminant's Motion for Summary Disposition of Contention 18 and Alternatives Contention A"; "Statement of Material Facts on Which No Genuine Dispute Exists"; and "Joint Affidavit of Donald R. Woodlan, John T. Conly, Ivan Zujovic, David J. Bean, John E. Forsythe, and Kevin Flanagan" were served by the Electronic Information Exchange on the following recipients:

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