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Declaration of Arjun Makhijani regarding the revision of Luminant's Environmental Report concerning Commanche Peak Units 3 and 4 (Attachment to the December 8, 2009 letter from Jonathan Rund to the NRC).

The following are my opinions to the best of my professional judgment.¹

I have reviewed the above-cited Attachment entitled "COL Application Part 3, Environmental Report Revision 1, Update Tracking Report Revision 0" (hereafter cited as Luminant 2009). My comments are focused on Luminant's conclusion there is no available renewable energy alternative to CPNPP units 3 and 4 to meet baseload power requirements, even when combined with storage technologies.

Luminant does not provide a substantial analysis for the first assertion. Luminant's arguments that wind with compressed air storage or solar with heat storage are not feasible alternatives for baseload are without technical merit.

For instance, the attached paper from the National Renewable Energy Laboratory shows the configuration of wind and compressed air storage, with a small natural gas supplement, that can meet baseload requirements. While Luminant states that wind and CAES have not been built together, this is not an obstacle to the use of the combination in baseload mode.

There are two large scale CAES systems in operation, one in Germany and one in Alabama, and there is considerable experience with this system. Luminant acknowledges this experience. There is no material difference between using coal-fired electricity to drive the air compressor and using wind-generated electricity to do so. Both coal and wind are commercially-established sources of electricity. There is no technical difference between operating the compressor using coal-generated electricity or wind-generated electricity. The compression of air and its storage underground are the same, as is the process of recovery of compressed air, the use of supplemental natural gas fuel, and generation of electricity using a gas turbine. The only difference is in the protocol of when the compressor is operated and when the reserve of compressed air is used to generate electricity.

¹ Many of the issues I raise here have been discussed in greater depth in my previous report, which was submitted on April 6, 2009 with the Intervenors' initial Petition to Intervene.

In a coal-fired system, off peak electricity is used for compression and the stored energy is recovered and combined with a supplement of natural gas fuel to generate electricity during peak hours. In a wind-CAES system, wind energy in excess of the system's baseload rating is used to compress air; the energy is withdrawn for generation when wind-generation is below the rated baseload capacity. Whether wind with CAES operates in a peaking, intermediate load, or baseload capacity depends on the amount of storage relative to peak wind capacity. In other words, only the times when the system operation is triggered and the source of electricity to drive the compressor are different. There is no material technical difference between the Huntorf and MacIntosh plants and wind with CAES. The fact that the Huntorf and MacIntosh facilities are built for peaking is irrelevant to the technical feasibility discussion. As noted, this is simply a function of protocol to operate the facilities and the size of the storage cavern.

To say that wind plus CAES is not a feasible technology for meeting baseload is like saying that operating a refrigerator on wind-generated electricity is not feasible. A refrigerator, after all, is a compressor-driven machine. The Luminant statement that "wind power is considered to not be available as a technology capable of generating baseload power comparable to that of the proposed CPNPP Units 3 and 4 within the project time frame" (Luminant 2009, p. 9.2-39) is without technical merit. Luminant simply would have to buy commercially available parts and hook them up. If it cannot do that, it cannot build a nuclear power plant.

We acknowledge that the siting of a storage facility presents challenges. However, Luminant has presented no evidence for its conclusion that it would take longer for a wind plus CAES facility to be available than for CPNPP to come on line. Luminant did not review the history of how fast wind power plants come on line. It did not review the time frame for Huntorf or MacIntosh facilities to be built. It did not take delays in nuclear power plant construction into account – and there is an extensive history for this. It did not take into account the fact that the USAPWR, which it wants to build, is not yet a certified design. It did not take into account delays that may be caused by unavailability of loan guarantees. Hence, Luminant's statement that "Third, the combination of a wind power and CAES project comparable to CPNPP Units 3 and 4 are not expected to be available during the same time frame as CPNPP Units 3 and 4" (p. 9-2.40) has no foundation in any analysis or history.

Luminant's statement that the impacts of wind are large does not take into account the fact that the actual physical footprint of wind facilities plus CAES facilities on land is quite small. Luminant has cited no actual land footprint data for existing facilities.

Finally, the fact that CPNPP is an order of magnitude larger than existing CAES facilities is also technically irrelevant; in fact, it could be economically very advantageous. Facilities that are in the ~100 MW to 300 MW range can be scaled up or, preferably, be built on a modular basis. Given the great uncertainties in demand projections eight to ten years hence, a modular approach is much less risky since growth in supply can be more closely tailored to growth in demand. The one requirement that this strategy would require is the acquisition of a suitable number of sites for wind and CAES development.

Solar thermal with heat storage facilities are currently being built on a scale that modules could be built that would add up to the equivalent of CPNPP. There is no technical reason for a ~3,000

MW facility to consist of just one or two units. Indeed, even some nuclear power advocates are now advocating modular systems, as is clear from the website of the World Nuclear Association.²

A handwritten signature in black ink that reads "Arjun Makhijani". The signature is written in a cursive style with a large initial 'A'.

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² See “Small Nuclear Power Reactors,” at <http://www.world-nuclear.org/info/inf33.html>