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COMMENTS ON ALLEN FOSSIL PLANT EMISSION CONTROL PROJECT DRAFT ENVIORNMENTAL ASSESSMENT

The Southern Alliance for Clean Energy respectfully submits these comments on the Tennessee Valley Authority's ("TVA") Draft Environmental Assessment ("Draft EA") for the "Allen Fossil Plant ("ALF") Emission Control Project" on behalf of itself and the following organizations: Southern Environmental Law Center, Tennessee Clean Water Network, Sierra Club, Environmental Integrity Project and Earthjustice (collectively the "Clean Energy Commenters"). For the reasons detailed below, we believe that the Draft EA fails to satisfy the requirements of the National Environmental Policy Act ("NEPA") and does not ensure that TVA is making a decision regarding ALF that is consistent with the goal of satisfying energy needs in a low-cost, reliable, and environmentally sound manner.

Notwithstanding our substantive and procedural concerns, we commend TVA for its decision to replace three coal-fired electric generating units at Allen. We fully agree with TVA that it is appropriate to move forward with a cost-effective and timely plan to meet the needs of Memphis and the entire Valley with continued, reliable electric service.

As discussed in detail below, the Draft EA fails to adequately consider an appropriate range of alternatives, including in particular an alternative that optimizes available resources to meet the project purpose and need[1]. To reach the best decision, TVA should take the following actions:

1. Move forward expeditiously with the most time-sensitive component of its plan to retire the coal units, and construction of the natural gas combined cycle ("NGCC") units, at the minimum scale that TVA determines to be necessary.
2. Reconsider other generation needs of the project, specifically, the natural gas combustion turbine ("CT") units should be delayed and either scaled back or cancelled.
3. Re-evaluate solar power and wind power projects located near Memphis, in combination with reactive power solutions, to meet all or part of the remaining capacity need.
4. Fully evaluate comparative impacts and benefits of pursuing a combination of energy resources, rather than relying singularly on natural gas, and inappropriately dismissing feasible alternatives through a specious all-or-nothing analysis.

In short, TVA should identify an optimal combination of replacement generation options.

[1] According to the Draft EA, TVA's Purpose and Need for the proposed action are "to reduce sulfur dioxide (SO_2) emissions at ALF in order to comply with the EPA Clean Air Agreements consistent with TVA's mission to provide reliable and affordable power" and "to achieve and maintain a balance portfolio of generation resources." Draft EA at 2.

The thorough evaluation required by law will almost certainly lead to the conclusion that replacing ALF with a combination of natural gas generation, reactive power solutions and cleaner energy resources is the most reasonable decision from an economic and resource diversity perspective and fulfills the Purpose and Need of TVA's proposed action. The Draft EA fails to include an alternative consisting of precisely the "balanced portfolio of generation resources" identified in the Purpose and Need statement.

As this statement suggests, TVA should not view the Allen decision in isolation. TVA's CEO William Johnson has described an aspirational portfolio goal for TVA's energy mix of 40% nuclear, 20% natural gas, 20% coal, and 20% renewable energy.[2] If TVA proceeds with a 1,400 MW natural gas plant at Allen (as well as the recently approved Paradise project), then TVA will likely need only a few hundred more megawatts of NGCC plants to meet this target through 2025. In contrast, TVA has hardly begun building the gigawatts of wind and solar projects it will need to grow renewable and efficiency resources from about 13% to 20% of energy production.

Furthermore, TVA is currently engaged in an extensive and potentially groundbreaking 2015 Integrated Resource Planning ("IRP") process. We believe that this process may identify that as much as 4 GW of solar resources and 4 GW of wind resources could be needed by TVA to provide the most reliable, cost-effective and environmentally sustainable electric system in 2025 and beyond. Yet in such a scenario, there would be virtually no additional gas resources needed by TVA beyond the Paradise and a 1,400 MW Allen build.

Whether TVA's 40-20-20-20 vision is adopted, or an even cleaner solution is found to be optimal, building 1,400 MW of natural gas generation at Allen could result in an overconcentration of natural gas resources. It would seem to be in TVA's best interests to build a smaller natural gas plant at ALF in conjunction with development of renewable energy resources in and around the greater Memphis area, and retain the flexibility to deploy other small, dispersed natural gas facilities to replace lost capacity from additional coal unit retirements. Dispersing those resources across the system, and building them in parallel with the expansion of solar and wind resources, would likely represent a more prudent and flexible approach.

TVA should not be too hasty to develop all the new natural gas generation it may need at just two or three locations during the initial years of what is likely to be a decade-long transformation of its resource mix. TVA must reconsider its analysis in the Draft EA and amend the Draft EA to reflect additional analysis focused on optimizing the replacement of ALF with renewable energy generation and reactive power solutions in combination with a smaller capacity natural gas plant.

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[2] Statement by TVA CEO Bill Johnson at November 14, 2013 TVA Board of Directors meeting, http://www.tva.com/news/releases/octdec13/board_111413.html

I. The Draft EA Improperly Regards Numerous Viable Alternatives Individually, Instead of Optimizing Their Use to Replace Real and Reactive Power Needs

TVA's preferred alternative, Alternative B, recommends a range of natural gas combustion turbine ("CT") and natural gas combined-cycle ("CC") unit sizes, addressing both the real and reactive power needs in part. The specific design and capacity of the replacement natural gas plant is not specified in the Draft EA. Instead TVA presents a range of sub-alternatives within Alternative B consisting of different sizes and designs of a replacement natural gas plant.[3] Other alternatives within the Draft EA, Alternatives C- H, consist of various replacement options that TVA considered but are ultimately deemed unreasonable as they fail to meet TVA's Purpose and Need for the project.[4]

TVA's exclusion of renewable energy, reactive power compensation, and other technologies included in Alternatives C - H is only reached because TVA required that each alternative needed to meet *both the entire real and reactive power needs* of ALF on schedule as a stand-alone resource. TVA unreasonably failed to consider an alternative in which a combination of natural gas, renewable energy, and reactive power compensation could be optimized to meet TVA's Purpose and Need for the project.

II. Recommended Alternatives that Optimize Resource Replacement Options

TVA should amend the Draft EA to include an alternative that combines renewable generation resources and reactive power solutions with a smaller capacity natural gas plant. The Draft EA should be revised to include, in addition to the CT or CC options laid out in Alternative B, three additional options for meeting TVA's needs at ALF:

- Up to 600 megawatts ("MWs") of dependable capacity supplied by utility-scale solar generation and/or wind generation, delivered via existing transmission lines or relatively small new transmission lines (e.g., 0-20 mile connections of 161 kV or less).[5]
- Up to 200 mega-volt-amperes reactive ("MVArs") of reactive power compensation devices, such as synchronous condensers or Static Var Compensators ("SVCs"), built in combination with new generation at ALF.
- Design requirements for the new natural gas generation at ALF to ensure that it can supply excess MVArs to meet reactive power requirements during periods in which the plant is not operating at full real power output.[6]

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[3] Draft EA at 10-19.
[4] Draft EA at 19-28.
[5] *See* Attachment 1: Utility-Scale Solar Photovoltaic Development in the Tennessee Valley
[6] For example, a plant rated at 842 MVA can produce 800 MW and 263 MVAr at a power factor of 0.95, or it can produce 758 MW and 367 MVAr if it is engineered to be operated at a power factor of 0.90 when desired.

a. Renewable Power Resources as Real Power Replacement Alternatives at ALF

TVA could build or solicit development of up to 880 MWac nameplate solar tracking systems in and around the greater Memphis area. Solar systems using single-axis tracking technology located in the western portion of the TVA service territory would deliver 68% net dependable capacity, according to the current assumptions in the TVA IRP process, which could thus supply up to 600 MWac net dependable capacity. Approximately 11 square miles of land could be required for solar systems with nameplate capacity of 880 MWac. These could be spread out across 20-30 sites depending on available land, transmission constraints and reliability concerns.

Along with solar generation resources, wind generation resources are also available to satisfy part of the needs at ALF. New "low capacity factor wind" turbine and blade technology can provide substantially better performance during periods of time with relatively low windspeeds, such as those that commonly occur during periods of peak demand. Data regarding the performance and anticipated technology development of these machines were supplied by industry experts through the TV-RIX (Tennessee Valley Renewable Information Exchange) process.

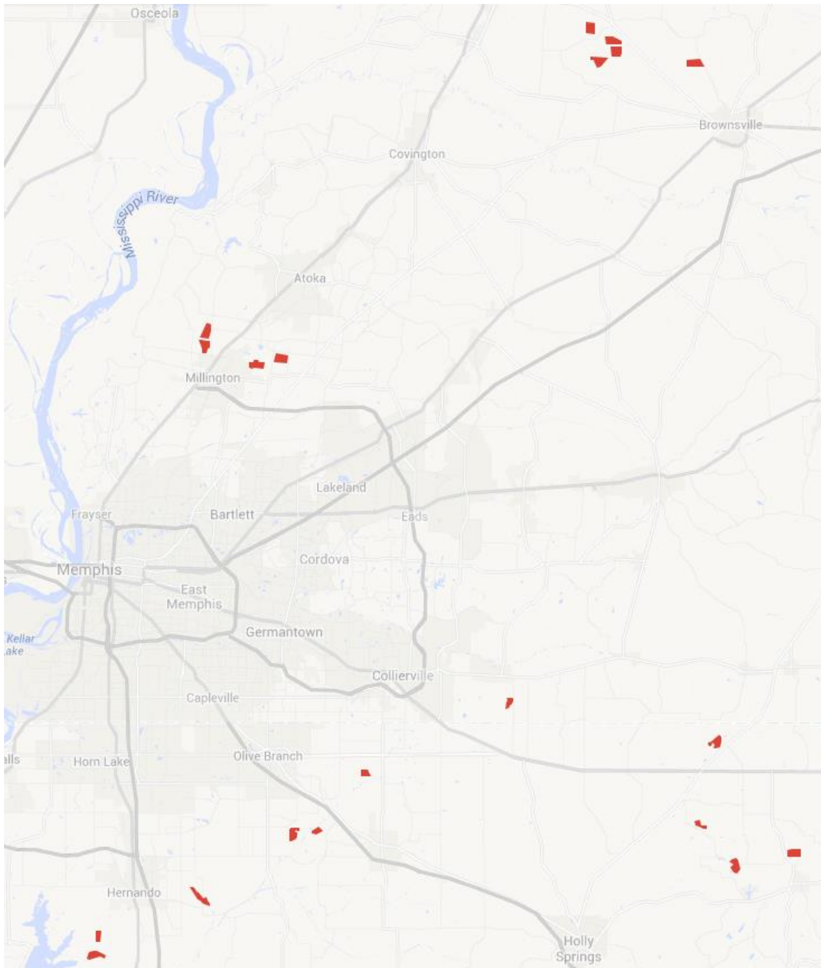
The Southeastern Wind Energy Association ("SWEA") studied several locations across TVA to illustrate the suitability of the latest wind turbine technology, and submitted model data to the TV-RIX process. Of the sites modeled, the West Memphis area (farmland just across the Mississippi River from ALF) indicated the highest performance both in terms of annual energy and net dependable capacity. Apex Clean Energy recently announced the Volunteer Wind project on farmland in Gibson County, Tennessee, just over 100 miles northeast of Memphis. Just as technology is rapidly changing the production profile of wind turbines, it is also shifting the opportunities for development from ridgetops all the way down to Mississippi Valley farmland.

Depending on market availability, TVA could build or solicit development of 800 MWs nameplate wind generation, a figure we have selected to illustrate the potential opportunity for development subject to limitations discussed below. Using TVA's current assumption that the net dependable capacity for wind projects in the TVA region is 14% (which may prove to be an underestimate), the wind resources could supply up to 110 MWs net dependable capacity (or more if TVA's net dependable capacity estimate is low).

Notably, proposed high voltage direct current ("HVDC") projects including the Clean Line and Pattern Energy projects are likely to provide substantial power to meet demand that would otherwise be served by the Allen project. Even if TVA determines that the schedule for completing of these projects is not be adequately secure for the purpose and need of the project, designing the project to include less generation and greater availability of reactive power compensation produced at ALF would provide prudent anticipatory support to the development of these highly cost-effective renewable energy generation projects.

If 800 MWs of wind resources were developed, the remaining portion of 600 MWs of dependable capacity could be supplied by 635 MWac nameplate solar tracking systems (rather than 880 MWac with no wind development). Taking the midpoint of this range, Figure 1 illustrates the scale at which such facilities could be developed in the Memphis region. Alternatively, smaller amounts of both wind and solar could be supplied to provide less than 600 MWs of dependable capacity in combination with varying capacities of CT and CC generation to satisfy the total requirements that TVA may finally establish for this project.

Figure 1: 760 MW of Hypothetical Solar Power Projects in the Memphis Area



b. Reactive Power Replacement Alternatives at ALF

The Draft EA describes the need for *local, dynamic reactive power* in order to ensure reliable service.[7] TVA has experienced reliability issues in the Memphis area in the past and it continues to forecast significant, complex reliability issues in the area. The Purpose and Need of the ALF project justifiably includes capabilities to respond to those issues and meet or exceed system reliability standards. Renewable energy generation, particularly wind generation, can be and is relied upon by utilities to deliver reactive power. (Solar power developers do not always choose to install the types of inverters required to deliver reactive power.) The Draft EA unreasonably omits consideration of the reactive power delivered by renewable energy.

[7] "The proposed CT/CC facility would not only provide the real power to meet are loads but also serve as a major source of dynamic and reactive power for the area that is needed to rapidly respond to changes in demand." Draft EA at 10.

If TVA views reactive power as insufficiently local or dynamic to meet its reactive power needs, there are two approaches TVA could use to provide additional dynamic reactive compensation capabilities. The Draft EA should be amended to include a full evaluation of these two approaches as part of an optimized mix of resource solutions to TVA's Purpose and Need.

First, TVA would need to design various interconnection equipment to allow natural gas units at ALF to supply excess reactive power as well as real power capacity. If 800 MW of power generation is operated at approximately 760 MW of real power, it could supply over 100 MVAr of additional reactive power when operated at a power factor of 0.9 rather than a typical power factor of 0.95. According to experts we consulted with, is not unusual for thermal generation to be operated at power factors even lower, down to about 0.85. Thus, when operating at a slight real power output penalty, NGCC or CT thermal generation units at ALF could supply much of the dynamic reactive power needs associated with 600 MW of dependable capacity supplied by off-site renewable energy generation.

Second, as evaluated by TVA,[8] TVA could build reactive power compensation to provide up to 200 MVArs at ALF. One option, synchronous condensers, offers the most dynamic reactive power response in a weak grid situation, or at a slightly lower cost, power electronics such as statcoms or SVCs could be installed. The cost of this equipment would be relatively small compared to the cost of new generation (whether gas-fired or renewable energy). For example, at $85 per kVAr,[9] a SVC would provide reactive power equivalent to generation operated at a power factor of 0.95 for a cost of less than $30 per kW. In comparison with costs of new generation capacity exceeding $1,000 per kW, the reactive power supply cost is less than 3%.

c. Completion within the timeframe required by TVA for the ALF project

The Draft EA describes TVA's concern that transmission upgrades to utilize renewable energy resources as the *sole* replacement generation technology may require as 8 to 10 years to develop. TVA thus regards renewable energy resources as infeasible responses to the purpose and need of the project.[10] This may be a reasonable conclusion for the scale of renewable energy contemplated in Alternative F (e.g., utilizing as much as 2 GW of solar power at a 68% net dependable capacity factor). However, this conclusion is not reasonable with respect to less cumbersome transmission needs associated with renewable energy projects providing only a portion of the total need. TVA could reasonably constrain the eventual size and locations of solar projects used to partially meet the need for the ALF project based on available or easily developed transmission capacity.

Solar projects are typically relatively quick to develop, particularly when developed on brownfields or agricultural lands with poor or non-arable soil conditions. As such, these projects can meet the schedule needs for ALF.[11] Although wind projects typically take longer to develop than solar projects, developers often proceed through a substantial portion of the project development process

[8] TVA evaluated reactive power compensation in Alternative G of the Draft EA and did not describe any site or operational concerns which made this technology unreasonable.
[9] Black & Veatch, "Transmission Capital Costs," prepared for Western Electricity Coordinating Council (August 2012).
[10] Draft EA at 25.
[11] *See* Attachment 1 for more discussion.

without making the project "visible" to utilities or the public. It is entirely possible that wind developers have projects nearing the public phase in the West Memphis area that have not yet come to TVA's attention. For example, Apex Clean Energy recently announced the Volunteer Wind project in Gibson County, TN, a bit more than 100 miles northeast of Memphis. If suitable projects to meet TVA's needs are currently in the development pipeline, then these projects could be built to meet the timeframe needs of TVA. TVA should explore the possibility that near-term wind projects may be under development in near proximity to the ALF site.

In the event that renewable energy development must be completed after the generation at ALF is completed and brought online, TVA may have additional real power resources available within its existing system or in the market that could bridge the gap until suitable renewable generation near ALF is brought online, assuming excess transmission capability would permit this supply. Since the reactive power supply can be delivered on schedule using new generation plus reactive power compensation devices, this may provide sufficient support to TVA's transmission system during any gap that may need to be bridged as the renewable energy development and any associated transmission enhancements are completed.

TVA may have reasonably determined that it needs to make a decision to proceed with construction of a combined cycle plant by August (or thereabouts) of 2014. If TVA determines that a portion of the need can and should be met with resources other than combined cycle units, then it does not need to select and proceed with those technologies with the same urgency. For example, TVA could determine that 600 MWs of real power and associated reactive power could be met through a combination of CT unit, reactive power compensation solutions, solar projects and wind projects. A final decision on the feasibility of a renewable energy plus reactive power solution to meet all or some part of that 600 MWs need could be made several months later, after further studies and plans are completed. If at that time it is determined that the CT units are the only feasible solution, then the shorter development time associated with CT units (relative to CC units) would still enable them to be completed within TVA's timeframe for the ALF project. The time required to technically evaluate and develop specific plans for renewable energy can be accommodated within TVA's timeframe.

d. The Draft EA unfairly excludes partial renewable energy replacement options based on unsupported claims associated with cost, performance and land requirements.

TVA's finding that the capital costs of renewable energy generation render it unviable is wholly unsupported by evidence and contrary to recent decisions by utilities and regulators across the country.[12] Beginning in 2011 to the end of 2013, the average installed cost for utility-scale solar projects dropped by 50%. Current costs for utility-scale solar PV projects has dropped to about $1,500/kW, with levelized costs reaching as low as $50-55 per MWh, as illustrated in Figure 2.[13] TVA should revisit cost assumptions in the Draft EA for solar installations to reflect the most recent costs and cost projections it has obtained in its resource planning process, as discussed in Attachment 1.

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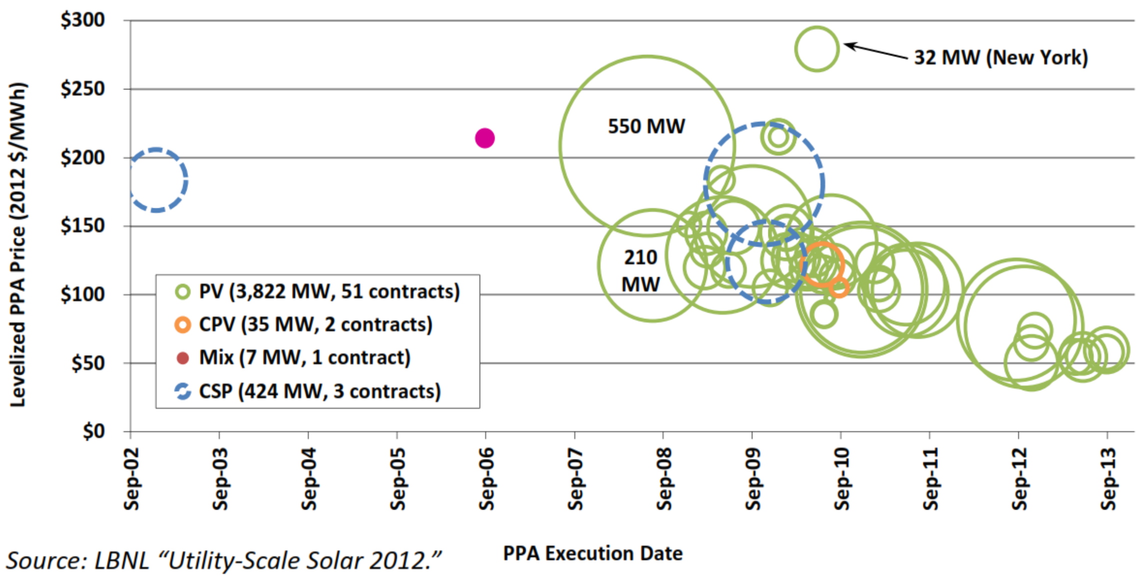
[12] Draft EA at 25.

[13] Ryan H. Wiser, "Historical Trends in the Cost of Wind and Solar in the U.S.," Lawrence Berkeley National Laboratory, presentation to Renewable Energy Market and Technology Training (May 2014).

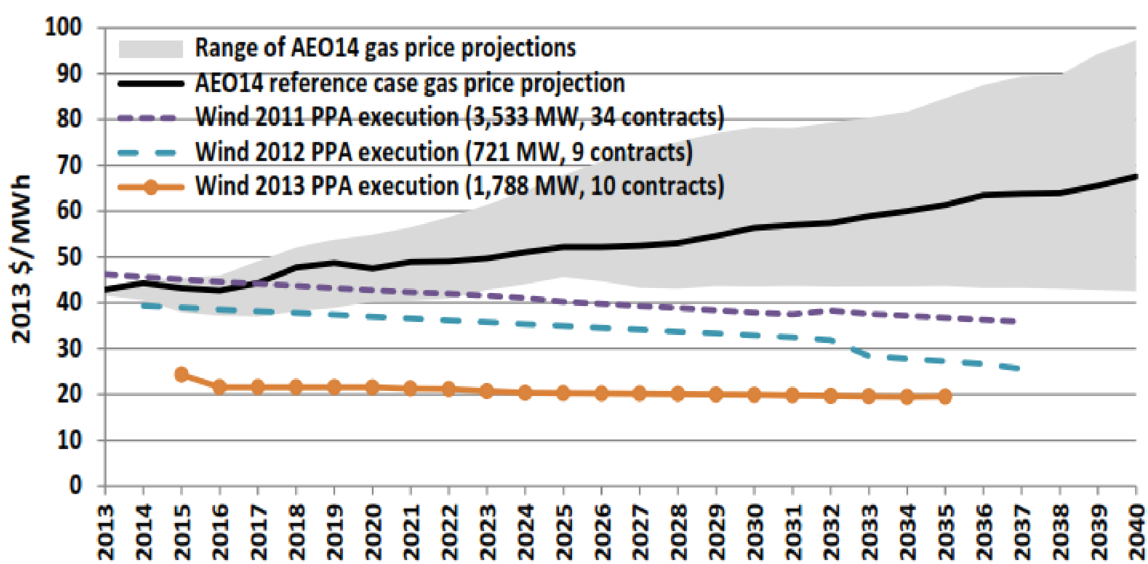
Figure 2: Cost of Solar PPAs Approaching $50 per MWh



Source: LBNL "Utility-Scale Solar 2012."

Similarly, estimates of wind power costs developed in TV-RIX for use in TVA's resource planning process indicate that those costs are also dropping. As illustrated in Figure 3, wind PPAs signed in 2013 averaged just over $20 per MWh, often with capacity factors in excess of 50%.[14] While there is no recent price history for wind PPAs near Memphis, even if the capacity factors for wind projects were as low as 40%, the resulting increase in PPA prices could be as little as 25%. Even if the cost of wind PPAs to TVA were double that of recent contracts, they would likely be less costly than the average forecast cost to operate either a combined cycle or a combustion turbine natural gas plant.

Figure 3: Cost of Recent Wind Projects Approaching $20 per MWh, Lower than Projected Natural Gas Prices



[14] *Id*.

Even if PPA contracts for wind development near Memphis are significantly higher, TVA's finding that the required amount of land for renewable energy generation makes it not viable is wholly unsupported by evidence.[15] While it is true that the total combined footprint of solar and wind projects would be greater than the proposed natural gas plant, it does not follow that the associated impacts would be much greater. Building a smaller natural gas plant results in limiting the potential environmental impacts, including air pollution, greenhouse gas emissions, and water consumption. Furthermore, by reducing the fuel requirements at ALF, the upstream environmental consequences such as land development required to build natural gas wells are reduced. The Draft EA does not contain sufficient information to reach the conclusion that the total land use impacts associated with renewable energy development are greater than the environmental impacts associated with building, obtaining fuel, and operating the maximum 1,400 MW natural gas power plant described in the Draft EA. In fact, TVA recently issued a draft programmatic environmental assessment that outlines how solar power development can proceed with no significant or acceptable environmental impacts.[16]

TVA's finding that the intermittent nature of solar and wind generation would have to be compensated with backup generation or energy storage technology is unsupported by its recent research in support of the forthcoming integrated resource plan. TVA's method for establishing the net dependable capacity of renewable energy provides an effective method for matching the on-peak output that may be depended upon during peak periods. For example, only very rarely (fewer than 5 peak hours per year), is the output of a well-sited system of solar power facilities expected to fall below 68% -- and even during those few hours, it is not the case that the output falls to zero, but merely to a value below 68%. In fact, it is far more often the case that during peak hours the output of the solar power facilities will (in the aggregate) exceed the expected net dependable capacity rating.

By sizing renewable energy facilities based on net dependable capacity, rather than nameplate capacity, TVA can ensure that it will have sufficient capacity to meet its peak needs. By far, the majority of the hours in which solar and wind power generate energy that falls below expectation are hours in which system demand is well below annual peak and TVA has extensive amounts of available capacity. For example, even though TVA only plans to have capacity reserves that are 15% above the forecast annual peak demand, during over 95% of the hours of the year TVA's unutilized capacity represents 25% to 70% in excess of actual hourly demand.

Once the dependable capacity rating of renewable energy is taken into consideration, any further reference to needs for backup generation or energy storage technology are simply red herrings. The output of wind and solar generation facilities can be forecast to a high degree of accuracy. This information can be integrated into system operational practices and used to schedule the availability and dispatch of other generation resources to ensure that power needs are met.

TVA's findings regarding the 8 to 10 year timeframe to provide infrastructure for delivery of 1,400 MW of generation from power purchase agreements are not applicable to the smaller renewable energy collection and transmission system described above. We have been told that development of 500 kV infrastructure is the primary driver behind the 8 to 10 year development pathway. The

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[15] *Id*.

[16] *See* TVA Solar Photovoltaic Projects Draft Programmatic Environmental Assessment.

development of numerous small (less than 100 MW) solar power projects in all directions from Memphis would not be suitably matched to new 500 kV infrastructure. Upgrades to existing transmission and development of short segments of lower voltage infrastructure (up to 161 kV) can occur on substantially shorter timeframes.

In the event that new transmission lines are required for smaller renewable energy projects, one viable option would be to build 161 kV transmission lines and tie them into the existing ALF switchyard. Similarly, wind power development in West Memphis could be collected and delivered using 161 kV transmission lines.[17]

d. Environmental Benefits of Increased Use of Renewable and Energy Efficiency Resources

The Draft EA is also insufficient by failing to acknowledge the reduction of long-term environmental impacts of generation through additional energy efficiency and renewable energy projects that are not feasible within the timeframe for construction of a new natural gas plant. Although building such projects would not necessarily reduce the environmental impact associated with construction of a new gas plant, these projects would reduce the need for increased generational output of the plant over its operating life. Renewable energy and energy efficiency reduce air pollution, carbon emissions, water consumption and waste generation, not to mention reduction of upstream environmental impacts associated with production of natural gas (effects of which are not discussed in the Draft EA).

III. TVA's Analysis of Alternatives in the Draft EA is Insufficient and Excludes Reasonable and Viable Alternatives

Similar to arguments made by Clean Energy Commenters on previous TVA NEPA documents, we believe the Draft EA excludes reasonable alternatives that should have been included in TVA's analyses, and includes an improper "no-action" baseline. TVA excluded reasonable alternatives that would meet the Purpose and Need for the project due to insufficient analysis and improper assumptions. The omission of reasonable alternatives violates one of the main purposes of the NEPA process, which is "to inform decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment."[18] As discussed further in an attachment, Clean Energy Commenters ask TVA to amend its Draft EA to include the analysis of the four numerated issues mentioned above. [19]

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[17] We are not suggesting that TVA expand the scope of this analysis to assume (or reject) any specific locations for wind development or a new transmission line crossing the Mississippi River. As there are multiple renewable energy resource options available to TVA, project-specific considerations should be addressed as those projects are specifically considered by TVA. However, with respect to transmission connections crossing the Mississippi River, it is our understanding that TVA has longstanding concerns about the limited number of cross-river ties that supply inter-regional connectivity for reliability purposes. It is possible that a West Memphis wind project could provide an opportunity to address TVA's longstanding reliability concerns.

[18] *Natural Res. Def. Council, Inc. v. Fed. Aviation Admin.*, 564 F.3d 549, 556 (2d Cir. 2009) (internal quotation marks and alteration omitted).

[19] *See* ATTACHMENT 2: Insufficiencies within the Draft EA

Respectfully submitted,

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ATTACHMENT 1:
UTILITY-SCALE SOLAR PHOTOVOLTAIC DEVELOPMENT IN THE TENNESSEE VALLEY

The following information is intended to provide insights into the opportunities and considerations of large (20-40 megawatt alternating current (“MWac”)) utility-scale solar photovoltaic (“PV”) development in the Tennessee Valley as an alternative partial replacement generation option for the Tennessee Valley Authority (“TVA”) Allen Fossil Plant. This information is separated into five categories:

1. TVA Solar Resource and Availability Analysis
2. Land Area Requirements
3. Current and Projected Costs
4. Project Schedule Considerations
5. Solar Jobs and Economic Development

1. TVA Solar Resource and Availability Analysis

The Southern Alliance for Clean Energy (“SACE”) contracted Clean Power Research (“CPR”) to produce hourly simulations for two PV fleets - a fixed-tilt fleet and a 1-axis tracking fleet - based on 26 locations throughout TVA’s service territory. Each PV system was 1 MWac, and simulations were run for each hour of 1998-2013 using CPR’s Solar Anywhere Resolution (approximately 10 km x 10 km x 1 hour resolution). These data were supplied to TVA through its Tennessee Valley Renewable Information Exchange (“TV-RIX”).

With the CPR data, SACE was able to develop annual capacity factors and dependable capacity factors (using TVA’s prescribed method) for each of the 52 simulated PV systems and ultimately analyze PV’s potential with regards to TVA’s power system. The results exceeded both SACE’s expectations as well as estimates historically used by TVA.

The top ten location sites produced an annual capacity factor (“AC”) of 23.1% for tracking systems, and 20.4% for fixed systems. The dependable on-peak capacity factors for these top ten locations were 67.9% for the tracking systems and 52.3% for the fixed systems. Across all 26 locations, fixed systems had a capacity factor of 20.1% and a dependable on-peak capacity factor of 49.7%.

Figure A1-1: Solar Production, Estimated Using Data from Clean Power Research

Top Ten Sites (Aggregated)	Tracking	Fixed Axis	Fixed Valley-Wide
Capacity Factor (AC), Annual	23.1 %	20.4 %	20.1 %
Dependable On-Peak Capacity	67.9 %	52.3 %	49.7 %

SACE also applied the CPR data to examine a range of solar PV penetration levels. Consistent with studies done in other regions, there is expected to be a decline in the solar on-peak dependable capacity value as penetration levels increase. TVA has not yet accepted a method for forecasting how such a decline would change on-peak dependable capacity values. Nevertheless, our analysis indicated that the current level of solar penetration (less than 100 MWac) is too small to affect these values, but the reduction could become significant when solar achieves 10% of peak load or roughly 300 times its current capacity (3,000 MW).

SACE also evaluated the potential for operational concerns to develop, as renewable energy resources play an increasing role on TVA's system. For example, SACE evaluated one-hour and three-hour average ramp rates. Examining the impact of hypothetical solar generation over more than a decade of TVA's system load data, its generation ramp rates would not have been impacted beyond what would be considered "typical" until solar goes above 4,000 MW (13% of peak load). In fact, the ramp *up* rates for TVA's system actually decline between 1,000 to 3,000 MW of solar power. Beyond 4,000 MW, the number of "typical" hours does not decrease by more than 10% until 7,000 – 9,000 MW of solar are added to the system.

The "top ten" sites below were selected to represent sites with both strong annual capacity factors as well as exceptional dependable capacity ratings. Based on our findings regarding how dependable capacity ratings will be affected as solar power is scaled up on the TVA system, SACE would interpret these findings as follows. Note that in general, utility-scale systems (typically over 20 MWac) would be connected at transmission voltage although there may be a number of situations in which interconnection to local power company or large customer distribution systems may be ideal.

- Approximately 1 to 2 GW of single-axis (or dual-axis if economical) tracking, utility-scale solar systems should be installed in the general region identified by the "top ten" sites – essentially TVA's western region. The first several hundred MW of such systems could be targeted in the vicinity of Memphis to address the needs in the Draft Environmental Assessment, with remaining systems dispersed either along transmission or near other load centers.
- Approximately 1 to 2 GW of fixed axis, utility-scale solar systems installed across the TVA service territory based on annual capacity factor ratings and other potential locational benefits to the grid or region.
- Approximately 1 to 2 GW of fixed axis, distribution-connected solar systems. This would include a combination of residential, commercial rooftop and other smaller systems at varying scales and locations within distribution systems. If optimized in coordination with local power companies, these systems could help reduce line losses and defer distribution system maintenance and upgrades.

While our analysis is not definitive, this mix represents the direction in which we anticipate TVA will find an optimal mix of solar performance, cost and interconnection characteristics. While our analysis is not sufficient to fully optimize these features, we believe it provides sufficient evidence to demonstrate that there is no single technology, location or scale of solar development that TVA should select to the exclusion of all others.

Figure A1-2a: Performance of Hypothetical Solar Projects at "Top Ten" Sites Based on Clean Power Research Data

"Top Ten" Sites	State	Fixed Systems		Tracking Systems	
		Capacity Factor	Dependable Capacity	Capacity Factor	Dependable Capacity
Caledonia CC	MS	20.7%	50.6%	23.4%	68.2%
Cordova	TN	20.3%	49.6%	23.0%	62.9%
Gleason Plant CT	TN	20.1%	52.2%	22.7%	67.0%
Lagoon Creek CT-CC	TN	20.4%	53.3%	23.1%	71.1%
Magnolia Plant CC	MS	20.3%	50.0%	23.0%	65.1%
Memphis	TN	20.4%	53.7%	23.2%	68.4%
Murray	KY	19.9%	52.1%	22.5%	67.8%
Oxford	MS	20.6%	52.4%	23.4%	66.4%
Starkville	MS	20.7%	49.9%	23.5%	64.8%
Tupelo	MS	20.6%	51.1%	23.3%	67.8%

Figure A1-2b: Performance of Hypothetical Solar Projects at Other 16 Sites Based on Clean Power Research Data

Other 16 Sites	State	Fixed Systems		Tracking Systems	
		Capacity Factor	Dependable Capacity	Capacity Factor	Dependable Capacity
Philadelphia	MS	20.8%	49.0%	23.6%	61.1%
Muscle Shoals	AL	20.2%	48.5%	22.8%	63.8%
Chickamauga	GA	20.2%	46.0%	22.7%	63.6%
Cleveland	TN	20.2%	45.8%	22.7%	64.3%
Knoxville	TN	20.2%	44.2%	22.6%	59.4%
Huntsville	AL	20.0%	46.6%	22.5%	61.1%
Johnsonville Plant	TN	20.0%	49.4%	22.5%	65.0%
Watts Bar Plant	TN	20.0%	46.2%	22.4%	61.7%
Chattanooga	TN	19.9%	45.8%	22.4%	60.5%
Oak Ridge	TN	19.9%	46.3%	22.3%	62.1%

Hopkinsville	KY	19.8%	48.2%	22.3%	61.6%
Johnson City	TN	19.7%	39.5%	22.0%	51.5%
Nashville	TN	19.7%	45.7%	22.2%	58.4%
Murfreesboro	TN	19.7%	45.5%	22.2%	59.2%
Bowling Green	KY	19.6%	43.3%	22.1%	57.7%
Paradise Fossil Plant	KY	19.6%	45.7%	22.1%	58.6%

2. Land Area Requirements

For illustrative purposes, we are using an estimate of about 8 acres of "total" land required per MWac of solar power. However, land requirements for large utility-scale PV projects vary greatly due to factors such as spacing, module efficiency, tracking versus non-tracking configurations, and case-by-case site boundaries or property limitations.

Figure A1-3: Total vs Direct Land

Land requirements for PV can be separated into two categories, "total land use" and "direct land use." "Direct" impacts (as shown in Figure A1-3) would be those that result in disturbed land due to physical infrastructure (such as solar arrays, access roads, substations, and service buildings). The "total" area, however, includes both the direct land use *and* the land enclosed by the site boundary that is essentially unused and may often be used for other purposes such as water retention, conservation easements, or unrelated utility purposes such as storage of materials and vehicles.

Our analysis of land requirements emphasizes projects in the 20-40 MWac size range, generally considered on the larger end of utility-scale PV development. (To date, hundred-megawatt scale projects have been built primarily in the western part of the country.) Very large projects may face greater development challenges, including greater environmental sensitivities and more-stringent permitting requirements, along with increased interconnection and transmission hurdles.[1]

[1] Bolinger, M. and S. Weaver. (2013) "Utility-Scale Solar 2012: An Empirical Analysis of Project Cost, Performance, and Pricing Trends in the United States. Lawrence Berkeley National Laboratory (LBNL). Found at: http://emp.lbl.gov/publications/utility-scale-solar-2012-empirical-analysis-project-cost-performance-and-pricing-trends

An analysis conducted by the National Renewable Energy Laboratory ("NREL") found that projects over 20 MWac in size had "total" capacity-weighted average land area requirements of 7.5 acres per MWac for fixed-tilt PV systems and 8.3 acres per MWac for 1-axis tracking systems.[2] On a generation-weighted average basis, fixed-tilt systems produced 1 GWh-yr for every 3.7 acres, whereas 1-axis tracking systems required 3.3 acres per GWh-yr.

Figure A1-4: Direct and Total Land-Use Requirements by PV Tracking Type (Projects over 20 MW)

Land-Use Measured	Tracking Type	Capacity-weighted average area requirements (acres/MWac)	Generation-weighted average area requirements (acres/GWh-yr)
Direct	Fixed	5.8	2.8
Total	Fixed	7.5	3.7
Direct	1-axis	9.0	3.5
Total	1-axis	8.3	3.3

**A lack of data for "direct" land use for numerous systems, and the inclusion of several very large PV installations (over 100 MW), skewed some of these results.*

On a *capacity* basis, 1-axis tracking systems require about 13% more land than fixed-tilt systems. On a *generation* basis, however, the same system would require about 15% less land. In other words, 1-axis tracking systems may require more land per MWac, but generate more energy per acre than fixed-tilt systems.[3] It is feasible for a single project to include a combination of fixed and 1-axis tracking systems.

To provide visual perspective of the potential scale that 20-40 MWac PV installations would have in the western TVA service territory, we created several maps with hypothetical projects illustrated at scale. Locations were selected considering information developed during the CPR data project described above.

As discussed in our comments, we are recommending that TVA consider supporting the development of approximately 635 – 880 MWac of solar projects within about 50 miles of Allen Fossil Plant, respecting any constraints that may be imposed by the need to avoid significant transmission upgrades. Each hypothetical installation is either 20 MWac or 40 MWac and is assumed to require a "total" land area of about 7.9 acres per MWac, as described above. In Figure A1-5, we've mapped out 760 MWac of hypothetical solar projects (representing a midpoint between our recommended 635 – 880 MWac above) covering 9.4 square miles that are dispersed over a region that covers about 4,000 square miles. One advantage of dispersing the projects is that on partly cloudy days, small storms would only impact a small portion of the projects at any one time.

[2] Ong, S.: Campbell, C.; Denholm, P.; Margolis, R.; Heath, G. (2013) "Land-Use Requirements for Solar Power Plants in the United States." Golden, CO. NREL. Found at: http://www.nrel.gov/docs/fy13osti/56290.pdf
[3] 1-axis tracking system can generate up to 12%-25% more energy per acre than fixed-tilt systems, Drury et al. 2012.

Figure A1-5a: How 760 MW of Hypothetical Solar Power Projects Could be Sited Near Memphis

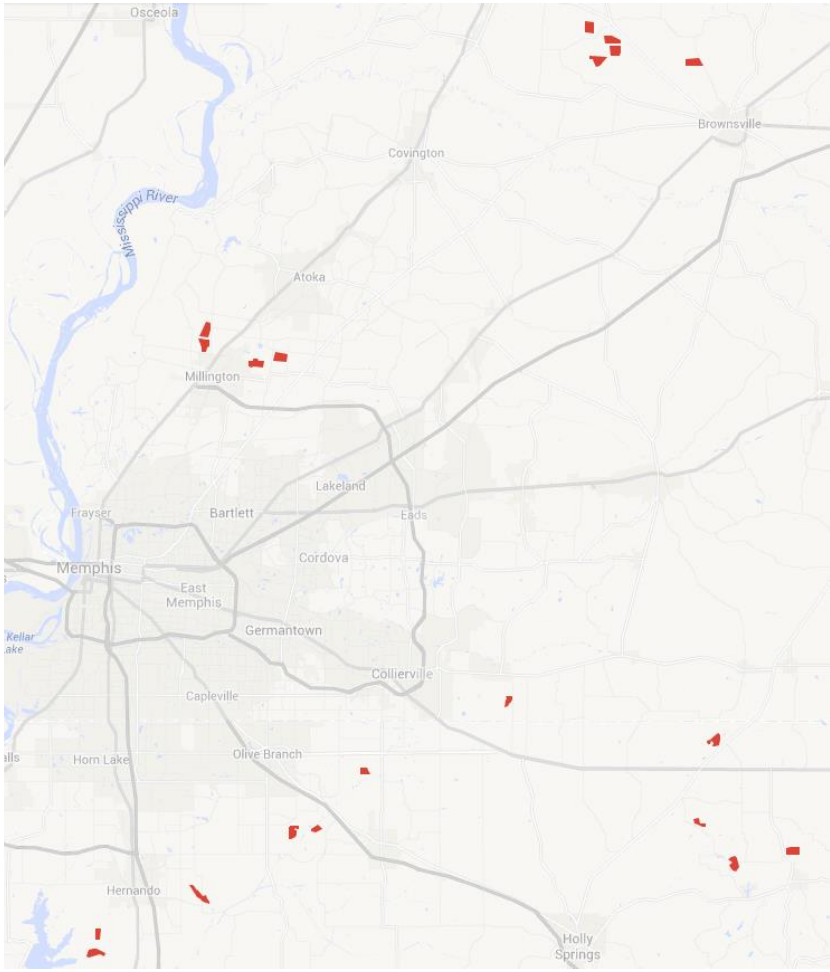
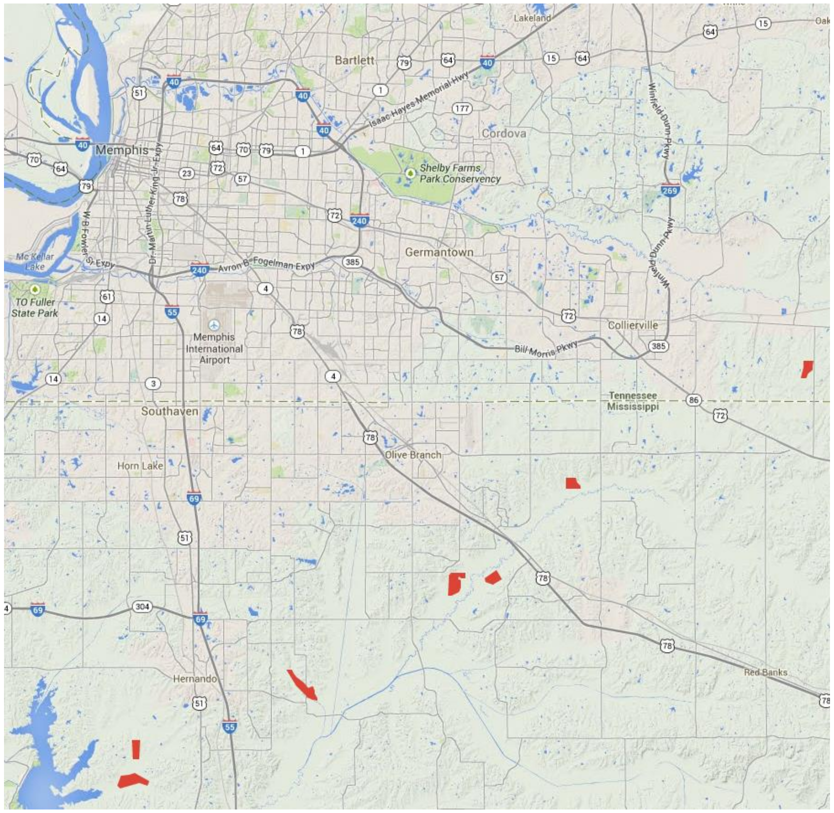
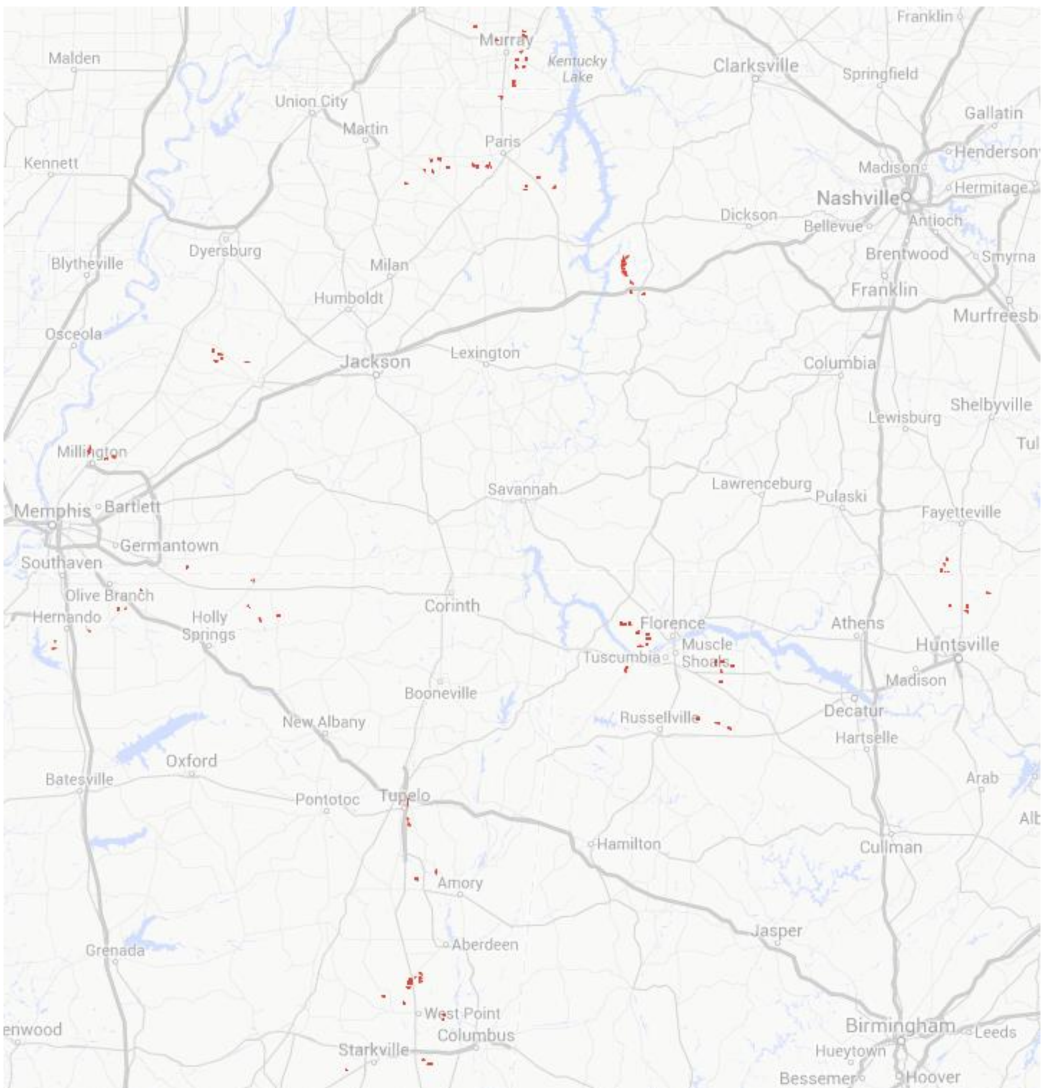


Figure A1-5b: Closeup on Memphis, Placing Projects in Context of Urban Scale



Looking forward, we anticipate that TVA might develop up to 4,000 MW of utility-scale solar over the next decade. Figure A1-6 illustrates a hypothetical build out of such systems, consisting of 20-40 MWac size projects concentrated in the western TVA service territory. The hypothetical sites would cover a land area of about 50 square miles total, representing less than 0.1% of TVA's 80,000 square miles of service territory; in this illustration they are "concentrated" in a diamond-shaped portion of the Valley covering about 32,000 square miles.

Figure A1-6: How 4,000 MW of Hypothetical Solar Power Projects Could be Sited on Less than 0.1% of TVA's Service Territory

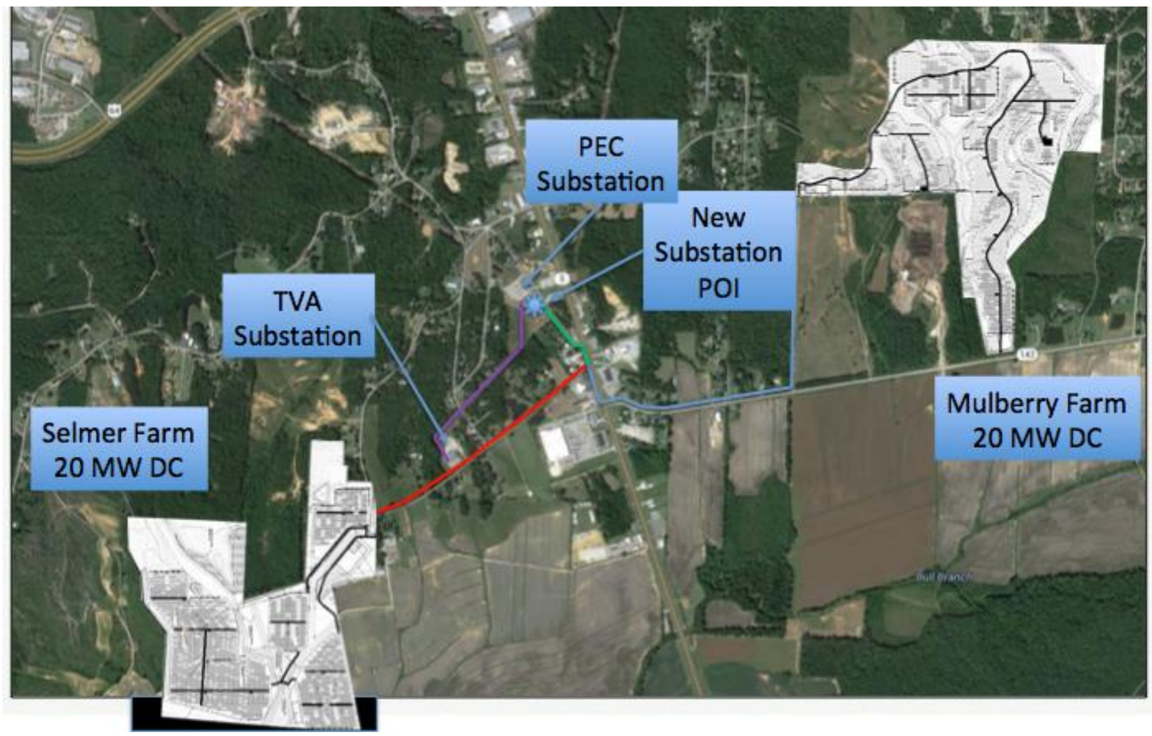


Case Study – Strata Solar Farms in McNairy County

The largest PV project currently being developed through TVA's Renewable Standard Offer ("RSO") program is the pair of 20 MWdc fixed-tilt installations developed by Strata Solar, LLC. These projects are currently under construction at the 168-acre

Mulberry and 158-acre Selmer solar farms, about 90 miles east of Memphis. These sites use an average "total" land area of 9.6 acres per MWac and about 5.5 acres per GWh-yr. Although slightly higher than the national average, these values are within the range documented by NREL. As depicted below, this acreage encompasses the *entire area* that Strata purchased even though not all land was needed for the actual solar arrays.

Figure A1-7: Strata Solar: Selmer / Mulberry Farms – Town of Selmer, McNairy County, TN



TVA's Final Environmental Assessment for this project found no major physical disturbances would occur on the sites after construction,[4] as the majority of both sites consist of undeveloped land.[5] Construction is anticipated to take about seven months to complete.[6]

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[4] AECOM. (2013) "Final Environmental Assessment: Strata Solar Farm Project, McNairy County, Tennessee." Prepared for Tennessee Valley Authority. Submitted by Strata Solar, LLC. Prepared by AECOM. Found at: http://www.tva.com/environment/reports/strata/Strata_Solar_Final_EA.pdf

[5] Only about 5 acres of wooded area would be completely cleared on Mulberry (4 acres for construction and 1 acre for shading [i.e., nearby trees would be removed to prevent casting shadows on the PV panels]), and approximately 17.5 acres would be cleared on the Selmer site (11.5 acres for construction and 6 acres for shading).

[6] During operation, the operator will either mow vegetation among the solar arrays or allow sheep to graze on the fenced sites.

3. Current and Projected Costs

Trends in utility-scale PV demonstrate large, consistent declines over the past several years. From the beginning of 2011 to the end of 2013, the average installed cost for utility-scale projects dropped by 50% - from about $4 to below $2 per watt.[7] This was largely due to the rapid decline in the cost of a module and its associated components. As a result, utility-scale development has boomed along with investor confidence. In turn, utilities and regulators have begun to recognize PV as a legitimate economic investment and reliable generation resource.

Greentech Media ("GTM") reports that over 7 GW of utility-scale PV were operational in the U.S. as of the second quarter in 2014, and nearly double that amount is contracted with signed power purchase agreements ("PPAs"). [8] The recent and projected price points for PPAs provide additional evidence of the economic competitiveness of PV technology.[9] The first half of 2014 saw a continuation of this trend, with PPA pricing for new utility PV installations ranging between $50-$70/MWh (see Figure A1-8). The most recent price drops have been driven largely by the desire to complete projects prior to the Federal Investment Tax Credit ("ITC") dropping from 30% to 10% at the end of 2016. Even with this highly competitive landscape, developers have survived a low-price PPA environment by capitalizing on declining financing costs to earn attractive returns.[10]

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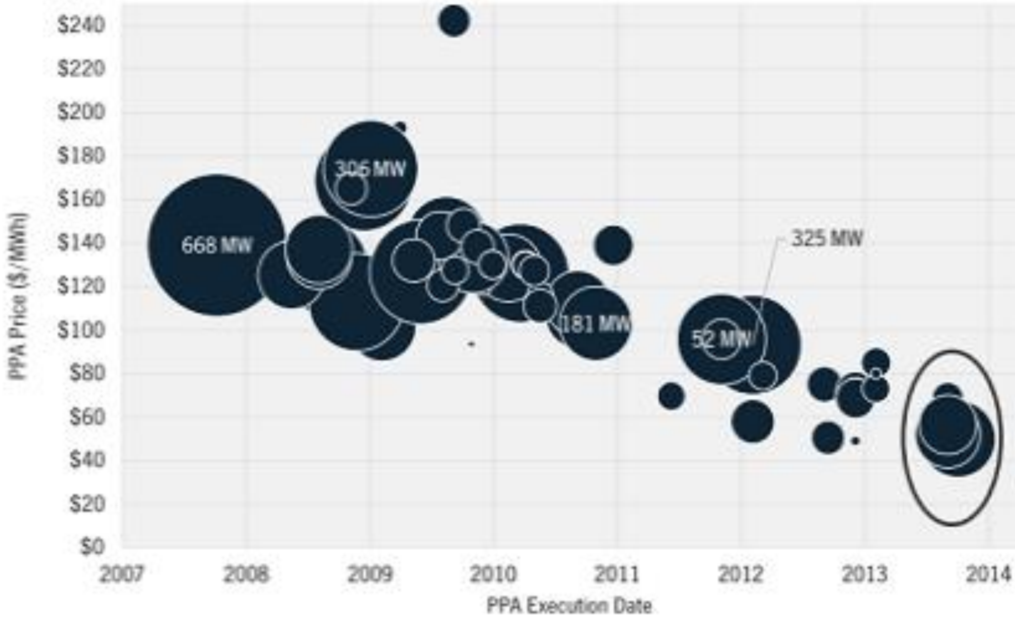
[7] Feldman, D.; Barbose, G.; Margolis, R.; Darghouth, N.; James, T.; Weaver, S.; Goodrich, A.; Wiser, R. (2013) "Photovoltaic System Pricing Trends: Historical, Recent, and Near-Term Projections. 2013 Edition." NREL & LBNL. Found at: http://emp.lbl.gov/publications/photovoltaic-system-pricing-trends-historical-recent-and-near-term-projections-2013-edi; SEIA-GTM. (2014). "Solar Market Insight Report 2013 Year in Review." Found at: http://www.seia.org/research-resources/solar-market-insight-report-2013-year-review

[8] Greentech Media (GTM). (2014a). *Five Things You Should Know About the U.S. Utility-scale PV Market*. Found at: http://www.greentechmedia.com/articles/read/Five-Things-You-Should-Know-About-the-US-Utility-Scale-PV-Market

[9] Over the past 6 years levelized PPA prices for utility-scale solar projects have fallen by an average of $25/MWh per year. In 2013 prices were as low as $50-$60/MWh (in 2012 dollars), and the highest coming in at only $85/MWh in Georgia, Bolinger & Weaver 2013; GTM 2014.

[10] GTM 2014a.

Figure A1-8: Solar PPA Prices by Contract Execution Year and System Size



For example, Austin Energy recently signed a PPA with Recurrent for a 150 MW PV project to be located in West Texas. The project was originally priced by SunEdison at "just below" 5 cents per kWh, but Recurrent earned the final contract due to more favorable contract terms.[11] The economics for a West Texas PV installation compared to an installation in the Tennessee Valley would be different for a number of reasons, primarily due to the capacity factor. We estimate the annual capacity factor (AC) of a 1-axis tracking PV system in West Texas to be about 26%.[12] Based on SACE's analysis, a capacity factor of 23.1% can be used for the top ten sites in the Tennessee Valley. Roughly speaking, a 4.9 cents per kWh project in West Texas with a 26% capacity factor would translate into a 5.5 cents per kWh project in Tennessee with a 23% capacity factor.

The approaching 2016 deadline for the reduction in the ITC will drive continued PPA price competitiveness in 2015. Although forecasts are mixed with regards to module prices, installed costs are expected to continue declining.[13] Lazard projects the installed cost for utility-scale crystalline PV installations to drop to $1,500/kW, representing a levelized cost of $54/MWh considering financing and tax implications.[14]

[11] GTM. (2014b) *Austin Energy Switches from SunEdison to Recurrent for 5-Cent Solar*. Found at: http://www.greentechmedia.com/articles/read/Austin-Energy-Switches-From-SunEdison-to-Recurrent-For-5-Cent-Solar

[12] . Solar Energy Industries Association (SEIA) (2014). "Solar in Texas." Found at: http://www.ercot.com/content/meetings/lts/keydocs/2014/0113/5._SEIA_Solar_in_TX_Presentation_(ERCOT_LTSA_Wkshp)-_1_13_14.pdf

[13] Most module costs forecasts show modest reductions with some potential subjectivity to tariff disputes, Feldman 2013.

[14] The unsubsidized levelized cost is estimated to be $68/MWh, Lazard. (2013) "Lazard's Levelized Cost of Energy Analysis – Version 7.0." Found at:

4. Project Schedule Considerations

In a recent project, SACE polled several PV developers with regards to typical schedule periods required for projects that are 20-40 MW or larger. There are many variables that contribute to the process of going from a response to a request for proposal ("RFP") to getting approved and constructing a project. The general sense is that this entire process will take about 1.5 years on average, and under the right circumstances less than a year.

Construction of a 20-40 MW project typically takes six months. This is subject to variables, but not as much as other stages of the development process. In an RFP process, for example, the time between RFP issuance and due date can be anywhere from 2 weeks to 3 months. A developer can move more quickly depending on whether the utility provided advance notice that allowed the developer to prepare for the RFP issuance.[15]

TVA's RSO program is not a typical RFP process as it involves posting rates and opening up the application door at the beginning of the year rather than seeking the best rates offered. Thus, developers can have a site selected and other details verified in order to apply almost immediately when TVA begins accepting applications. TVA being a quasi-federal entity, however, is subject to NEPA. The process of obtaining a Finding of No Significant Impact (FONSI) can delay interconnection and environmental work. As a result, in the case of TVA's short history of developing utility-scale solar, this process tends to take about two years.

5. Solar Jobs

Solar development is a job creator and economic growth engine. The Solar Foundation ("TSF") estimates that the U.S. solar industry employed over 142,000 Americans in 2013, which was 20% more than it employed in 2012.[16] Approximately 91% of those who meet TSF's definition of a "solar worker" spent 100% of their time working on solar.[17] In 2013, Tennessee had approximately 2,800 people working in the solar industry.

The jobs quantified by TSF include most "direct" and "indirect" jobs in the solar industry, with the exception of some indirect jobs in the component and materials supply chain. Direct jobs are those that work directly in the supply chain, such as installers. Indirect jobs include those that support upstream and downstream solar supply chain needs, such as manufacturing steel used in a solar installation. A third category is induced jobs, which include any expenditure-induced effects on the general economy, such as increased activity at the local grocery store, etc. This last component is difficult to

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http://gallery.mailchimp.com/ce17780900c3d223633ecfa59/files/Lazard_Levelized_Cost_of_Energy_v7.0.1.pdf

[15] Something a developer could do in parallel, or even prior to, the issuance of an RFP is to prospect and gain some type of site control for a potential project, which could take several months.

[16] The Solar Foundation (TSF). (2014) "National Solar Jobs Census 2013." Found at: http://www.thesolarfoundation.org/research/national-solar-jobs-census-2013

[17] "Solar workers" are defined by TSF as those workers who spend at least 50% of their time supporting solar-related activities.

quantify, but can be a particularly valuable added benefit for local governments and distribution utilities.

Nationally, the solar industry now employees more people than coal mines.[18] Several studies also show that development of solar energy produces more jobs per unit of generation (i.e., job multiplier) than other forms of energy development.[19] This is due, in part, to solar being developed across a range of sectors: residential, commercial, and industrial.

A publicly available tool for estimating job creation and other economic impacts of solar development is NREL's Jobs and Economic Development Impacts model ("JEDI"). A quick model run assuming 38 installations of 20 MWac each (i.e., 760 MW total), results in over 4,300 jobs during the construction and installation period and over 200 jobs during the operating years.[20]

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[18] PolitiFact. (2014) "Sen. Sheldon Whitehouse says there are more U.S. jobs in solar industry than coal mining." Found at: http://www.politifact.com/rhode-island/statements/2014/jul/06/sheldon-whitehouse/there-are-already-more-american-jobs-solar-industr/

[19] Wei, M.; Patadia, S.; Kammen, D. (2010) "Putting Renewable and Energy Efficiency to work: How many jobs can the clean energy industry generate in the U.S.?" Found at: http://rael.berkeley.edu/sites/default/files/WeiPatadiaKammen_CleanEnergyJobs_EPolicy2010.pdf

[20] National Renewable Energy Laboratory (NREL (2014) Jobs and Economic Development Impacts (JEDI). Found at: https://jedi.nrel.gov/

ATTACHMENT 2:
INSUFFICIENCIES WITHIN THE DRAFT EA

I. LEGAL BACKGROUND

NEPA is "our basic national charter for protection of the environment."[1] Other environmental statutes focus on particular media (like air, water, or land), specific natural resources (such as wilderness areas, or endangered plants and animals), or discrete activities (such as mining, introducing new chemicals, or generating, handling, or disposing of hazardous substances). In contrast, NEPA applies broadly "to promote efforts which will prevent or eliminate damage to the environment."[2]

To accomplish this expansive goal, NEPA requires that government agency decision-makers consider and weigh the environmental consequences of proposed actions "at the earliest possible time to insure that planning and decisions reflect environmental values, to avoid delays late in the process, and to head off potential conflicts."[3] "[B]y focusing the agency's attention on the environmental consequences of a proposed project, NEPA ensures that important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast."[4]

Whereas the substantive environmental protection goals of the Act provide some flexibility and responsible exercise of agency discretion, "the Act also contains very important 'procedural' provisions—provisions which are designed to see that all federal agencies do in fact exercise substantive discretion given to them."[5] NEPA's procedural protections "are not highly flexible. Indeed, they establish a strict standard of compliance."[6]

The core duty under NEPA is for an agency to "[r]igorously explore and objectively evaluate all reasonable alternatives" to a proposed action.[7] This required alternatives analysis "should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice

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[1] 40 C.F.R. § 1500.1(a).
[2] NEPA § 2, 42 U.S.C. § 4321.
[3] 40 C.F.R. 1501.2; *see* NEPA § 102, 42 U.S.C. § 4332; *see also* 40 C.F.R. § 1501.1(a).
[4] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989); *see also Jones v. District of Columbia Redev. Land Agency*, 499 F.2d 502, 512 (D.C. Cir. 1974), *cert. denied*, 423 U.S. 937 (1975) ("NEPA was intended to ensure that decisions about federal actions would be made only after responsible decision-makers had fully adverted to the environmental consequences of the actions, and had decided that the public benefits flowing from the actions outweighed their environmental costs.").
[5] *Calvert Cliffs Coord. Comm., Inc. v. Atomic Energy Comm'n*, 449 F.2d 1109, 1112 (D.C. Cir. 1971), *cert. denied*, 404
U.S. 942 (1972).
[6] *Id.*
[7] 42 U.S.C. § 4332(2)(C); 40 C.F.R. § 1502.14(a).

among the options by the decisionmaker and the public."[8] Such analysis constitutes the "heart" or "linchpin" of the NEPA analysis,[9] and helps to ensure that each agency decision maker has before him and takes into proper account all possible approaches to a particular project (including total abandonment of the project), which would alter the environmental impact and the cost-benefit analysis. Only in that fashion is it likely that the most intelligent, optimally beneficial decision will ultimately be made.[10]

Courts have recognized that "[n]o decision is more important than delimiting what these 'reasonable alternatives' are,"[11] and have made clear that a wide net should be cast in identifying and exploring such alternatives. For example, the alternatives analysis must include a consideration not only of individual actions, but also of a combination of actions that could satisfy the purpose and need of the project.[12] In addition, "reasonable alternatives" should include feasible options even if they are "not within the jurisdiction of the lead agency."[13] And in order to ensure that the alternatives analysis is not hampered by a rigid concept of what is needed at the outset of the NEPA process, agencies must consider alternatives that meet only part of the stated purpose of the proposed action.[14] When an agency suggests that an otherwise achievable alternative is not "feasible" or "prudent," the agency must back up that assertion with specifics such as "cost studies, cost/benefit analyses, or other barriers that warrant a conclusion that [the proposed] alternatives are unreasonable, standing alone or in conjunction with other alternatives."[15]

The Draft EA fails to take a proper hard look at the alternatives available to TVA by ignoring combinations of resources and instead myopically focusing on one category of resources at a time in arriving at a preferred alternative. As explained above, this one-sided approach is improper under NEPA, and must be remedied in a final EA.

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[8] 40 C.F.R. § 1502.14.
[9] 40 C.F.R. § 1502.14; *Monroe Cty. Conservation Council*, 472 F.2d 693, 697-98 (2d. Cir 1972).
[10] *Calvert Cliffs' Coordinating Comm., Inc. v. Atomic Energy Comm'n*, 449 F.2d 1109, 1114 (D.C. Cir. 1971).
[11] *Simmons v. U.S. Army Corps of Engineers,* 120 F.3d 664, 666 (7th Cir. 1997).
[12] *Davis v. Mineta*, 302 F.3d 1104, 1121-22 (10th Cir. 2002) (finding that agency's failure to evaluate a combination of alternatives "represents one of the most egregious shortfalls in the EA")
[13] 40 C.F.R. § 1502.14(c); *see also* 46 Fed. Reg. 18,026, 18,027 (March 23, 1981) ("An alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable.").
[14] *North Buckhead Civic Ass'n v. Skinner*, 903 F.2d 1533, 1542 (11th Cir. 1990) ("A discussion of alternatives that would only partly meet the goals of the project may allow the decision maker to conclude that meeting part of the goal with less environmental impact may be worth the tradeoff with a preferred alternative that has greater environmental impact."); *Natural Resources Defense Council v. Morton*, 458 F.2d 827, 836 (D.C. Cir. 1972) ("[It is not] appropriate . . . to disregard alternatives merely because they do not offer a complete solution to the problem.").
[15] *Davis*, 302 F.3d at 1122.

II. The Draft EA Mischaracterizes the "No Action" Alternative and Its Environmental Consequences, Rendering TVA's Alternatives Analysis Insufficient for NEPA Purposes

In order to determine whether a project has significant impacts, TVA must compare "the impact of the project" with "the impact absent the project."[16] For federal decisions on project proposals, "no action" means "the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward."[17] Every Environmental Assessment must include consideration of this "no action" alternative,[18] which serves as a baseline against which other alternatives are measured.[19] Here, absent the installation of additional pollution controls, TVA would not be able to operate ALF as a coal-fired plant beyond 2018.[20] TVA nevertheless compared the impacts of the Project to a no-action baseline of continuing to operate ALF indefinitely and without installing those additional air pollution controls—a meaningless exercise, given that under the 2011 Federal Facilities Compliance Agreement ("FFCA") and judicial consent decree (collectively, "EPA Clean Air Agreements") TVA must retire ALF by 2018 if it does not retrofit each coal Unit.[21] TVA was "required to account for the terms of the [EPA Clean Air Agreements] in crafting [its] no-action alternative; failing to do so violated NEPA."[22]

Under the terms of the EPA Clean Air Agreements, TVA must either retrofit ALF by installing flue gas desulfurization (FGD or "scrubber") systems on each Unit or retire the plant by December 31, 2018.[23] TVA's "no action" alternative, however, contemplates the

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[16] *Envtl. Def. Fund v. TVA*, 371 F. Supp. 1004, 1012 (E.D. Tenn. 1973), *aff'd*, 492 F.2d 466 (6th Cir. 1974).
[17] Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18,026, 18,027 (Mar. 23, 1981).
[18] See 40 C.F.R. § 1508.9(b); *Grand Canyon Trust v. U.S. Bureau of Reclamation*, 623 F. Supp. 2d 1015, 1028 (D. Ariz. 2009) ("NEPA regulations mandate consideration of a 'no action' alternative in an EIS, *see* 40 C.F.R. § 1502.14, strongly suggesting that such an alternative should also be considered in an environmental assessment.").
[19] Draft EA at 10; *Ctr. for Biological Diversity v. U.S. Dep't of Interior*, 623 F.3d 633, 642 (9th Cir. 2010).
[20] Draft EA at 1, 10.
[21] *See Kilroy v. Ruckelshaus*, 738 F.2d 1448, 1453-54 (9th Cir. 1984) (continuation of a disposal method would have violated statute and "a *consent decree* that forbids continuance of the existing outfall disposal," and therefore was not an "appropriate and reasonable benchmark").
[22] *Conservation Nw. v. Rey*, 674 F. Supp. 2d 1232, 1246 (W.D. Wash. 2009); *cf. Friends of Yosemite Valley v. Scarlett*, 439 F. Supp. 2d 1074, 1104-05 (E.D. Cal. 2006) (holding that agency could not rely on a comprehensive management plan to establish its "no action" alternative, when that plan had been invalidated); *Preserve Our Island v. U.S. Army Corps of Eng'rs*, No. C08-1353RSM, 2009 WL 2511953, at *16 (W.D. Wash Aug. 13, 2009) (holding that agency erred in conducting its "no action" alternative analysis where agency assumed that were the proposed permit not issued, an old dock would remain in place, continuing to degrade and leaching contaminants into the water, when in fact the terms of the expired State land lease required removal of the dock in question).
[23] *See* FFCA at 30-31; *see also* Draft EA at 1.

continued operation of ALF without additional pollution controls.[24] Emissions "would be controlled via the existing selective catalytic reduction units and burning low-sulfur coal,"[25] but TVA would not install the mandated FGD systems on each unit.[26] The "no action" alternative, therefore, disregards TVA's legally binding commitment to retrofit or retire ALF[27] and in so doing effectively obscures the proposed project's many significant impacts.

By using a fictional "no action" alternative as a baseline point of comparison for other alternatives, TVA evaded consideration of the many significant impacts that would result from the proposed project. A new CT/CC facility would emit significant quantities of pollutants, including carbon dioxide, carbon monoxide, nitrogen oxides, particulate matter, volatile organic compounds, and sulfur dioxide.[28] Although many of these pollutants cause serious health problems such as heart attacks, asthma, and developmental disorders, and can even lead to premature death, none of these adverse health effects was considered by TVA. Rather, based on the fiction that the plant could continue to operate as is after 2018, TVA claimed the proposed project's air emissions as a net benefit, averring that the preferred alternative "would result in a net emissions decrease of all regulated air pollutants except for [carbon monoxide]."[29]

In order to properly identify and evaluate these and other significant adverse effects on the human environment, TVA must revise its "no action" alternative to render it consistent with TVA's pre-existing and binding commitments for the facility, under

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[24] Draft EA at 9, 31.
[25] Draft Finding of No Significant Impact ("FONSI") at 1.
[26] Draft EA at 31 ("Under Alternative A, No Action, TVA would continue to operate the three ALF coal units . . . without implementing additional actions to reduce SO_2 emissions. As a result, air pollutant emissions would be unchanged . . . ."); *see also id*. at 19-23 (eliminating from further discussion, Alternative C, which entailed "continuing to operate the coal-fired facility at ALF and installing FGD systems . . . .").
[27] As even TVA admits, "TVA could not continue to operate the ALF units without violating the EPA Agreements." Draft EA at 31; *see also id*. at 10 ("Continuing to operate ALF in this configuration "would not comply with the EPA Clean Air Agreements . . . and would not meet the Purpose and Need for this proposed action."); *id*. at 2 (defining the Purpose and Need for the proposed project to include the "[r]educ[tion of] sulfur dioxide (SO_2) emissions at ALF in order to comply with the EPA Clean Air Agreements. . . ."); Draft FONSI at 1 ("[C]ontinuing to operate ALF in this configuration would violate the EPA Clean Air Agreements. Therefore, taking no action at ALF is not considered reasonable . . . .").
[28] Draft EA at 34, 38 (projecting, *inter alia*, that the proposed CT/CC facility will emit 3,830,000 short tons per year of carbon dioxide equivalent emissions; 760.7 tons per year ("tpy") carbon monoxide, 610.2 tpy nitrogen oxides, 193.8 tpy particulate matter; 134.1 tpy volatile organic compounds, and 114.8 tpy sulfur dioxide).
[29] Draft EA at 34; *see id*. at 29 ("Impacts to local and regional air quality would be beneficial from the development of the CT/CC facility, contributing to regional improvement in air quality."); *id*. at 37-38 (projecting a net reduction in carbon dioxide equivalent emissions from 5,394,000 to a projected 3,830,000 short tons per year). The Draft EA likewise claims that the preferred alternative provides a net benefit in terms of reducing surface water, aquatic ecology, and solid waste impacts. *See id*. at 29, 49-50, 68-69, 93-94.

which TVA cannot continue to operate the plant if it takes no action. The "no action" alternative should identify the sources of power TVA would access to replace Allen absent the proposed action, such as market power purchases, and describe the direct and indirect environmental impacts associated with relying upon such sources of power.

III. The Draft EA Fails to Recognize Benefits of Increased Renewable Energy Resources and Implementation of Energy Efficiency Measures

In addition, the Draft EA fails to acknowledge the reduction of long-term environmental impacts of generation through additional energy efficiency and renewable energy projects that are not feasible within the timeframe for construction of a new natural gas plant. Although building such projects would not necessarily reduce the environmental impact associated with construction of a new gas plant, these projects would reduce the need for increased generational output of the plant over its operating life. Renewable energy and energy efficiency reduce air pollution, carbon emissions, water consumption and waste generation, not to mention reduction of upstream environmental impacts associated with production of natural gas (effects of which are not discussed in the Draft EA).

Notably, proposed high voltage direct current ("HVDC") projects including the Clean Line and Pattern Energy projects would provide substantial power to meet demand that would otherwise be served by the Allen project. Designing the project to include less generation and greater availability of reactive power compensation produced at ALF would provide prudent anticipatory support to the development of highly cost-effective renewable energy generation projects.

For these reasons, the alternative analysis within TVA's Draft EA is insufficient and should be amended to include analysis of all reasonable alternatives, including our recommended portfolio based replacement approach, as well as further analysis of potential renewable energy replacement options available in and around the greater Memphis area.