

SMUD Solano 4

**Cumulative Impact Study and Mitigation Solution Results
for
2018 Vestas V136 and V150 Wind Turbine Layouts**

6 September 2018

Background

- **During the Windfarm RePower Group meeting on April 21, 2016, Westslope presented the results of an RLOS analysis and cumulative impact study for the Solano 4 wind project:**
 - **“RLOS analysis and qualitative review of radar data shows that existing 59 Kenetech wind turbines do not interfere with the Travis AFB radar**
 - **RLOS analysis and cumulative impact study indicates that Solano 4 will interfere with the Travis AFB radar**
 - **Incremental drop in primary Pd over the WRA predicted at 0.3% below 4,000 feet MSL and 0.4% below 10,000 feet MSL**
 - **Cumulative impact of other existing wind projects and Solano 4 predicted to decrease the primary Pd on the AT controllers’ displays by 4.8 percent below 4,000 feet MSL and 4.4 percent below 10,000 feet MSL**
 - **Within the 5% Pd tolerance set forth under the CRADA in 2010**
 - **One occasional false primary track on the AT controllers’ display**
 - **Effects not expected to be significant and should be manageable for a small 17 turbine project**
 - **No impacts to the secondary radar co-located with Travis AFB DASR”**

Change in Wind Turbine Technology

- **Solano 4 wind project in 2016 consisted of 17 Vestas V117 wind turbines at a blade-tip height of 488 feet AGL**
 - Located on the SMUD Roberts and Collinsville properties
- **2018 Solano 4 wind project consists of either 22 Vestas V136 wind turbines at a blade-tip height of 493 feet AGL or 19 Vestas V150 wind turbines at a blade-tip height of 591 feet AGL**
 - New version of Solano 4 proposes wind turbines located on the SMUD Roberts and Collinsville properties (Solano 4 West) and at the Solano 1 repower site (Solano 4 East)
- **Same as the 2016 V117 wind turbines, the 2018 V136 and V150 wind turbines will be within radar line-of-sight of and will interfere with the Travis AFB DADR**
- **Westslope updated the 2016 cumulative impact study to account for the Solano 4 V136 and V150 layouts using the same method used under CRADA No. 10-002**



Solano 4 West: Roberts and Collinsville Properties



wind

Solano 4 West: Roberts and Collinsville Properties

2018 Cumulative Impact Study Results

- **Results show that the primary Pd out of the Travis AFB DASR over the WRA will decrease by 0.3 percent for the V136 layout and by 0.2 percent for the V150 layout below 4,000 feet MSL and 10,000 feet MSL**
 - Less than predicted for the 2016 Solano 4 V117 wind turbines
- **Similar trend is expected for the primary Pd on the AT controllers' display based on the findings of CRADA No. 10-002's Radar Working Group**
- **Cumulative impact of existing wind projects and 2018 Solano 4 West wind project predicted to be within the 5% primary Pd tolerance set forth under the aforementioned CRADA**

Project	No. of Wind Turbines	Below 4,000 feet MSL		Below 10,000 feet MSL	
		Pd Drop	Cumulative Pd Drop	Pd Drop	Cumulative Pd Drop
Shiloh III	52	-1.3%	-1.3%	-1.2%	-1.2%
Montezuma I	16	-0.2%	-1.5%	-0.2%	-1.4%
Solano Phase 3	55	-1.3%	-2.8%	-1.3%	-2.7%
Montezuma II	37	-0.6%	-3.4%	-0.5%	-3.2%
Shiloh IV	50	-0.4%	-3.8%	-0.6%	-3.8%
Solano 4 (2016) vs. Solano 4 (V136) and Solano 4 (V150)	16 12 10	-0.3% -0.3% -0.2%	-4.1% -4.1% -4.0%	-0.4% -0.3% -0.2%	-4.2% -4.1% -4.0%

Pd drop out of the ASR-11 over the WRA

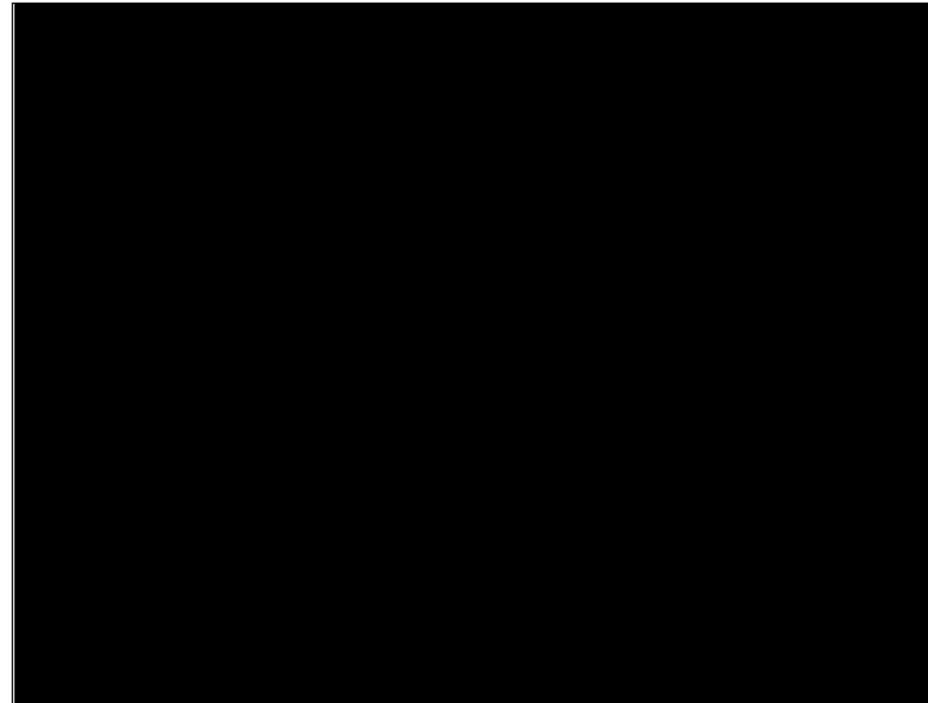
Description	Below 4,000 feet MSL	Below 10,000 feet MSL
Pd tolerance set forth by CRADA's Operations Working Group	5%	5%
Cumulative Pd drop		
Solano 4 West (2016) vs. Solano 4 West (V136) and Solano 4 West (V150)	-4.1% -4.1% -4.0%	-4.2% -4.1% -4.0%
Difference in Pd out of the ASR-11 and on the AT controllers' displays	-0.6%	-0.3%
Remaining Pd margin		
Solano 4 West (2016) vs. Solano 4 West (V136) and Solano 4 West (V150)	0.3% 0.3% 0.4%	0.5% 0.6% 0.7%

Remaining Pd margin over the WRA

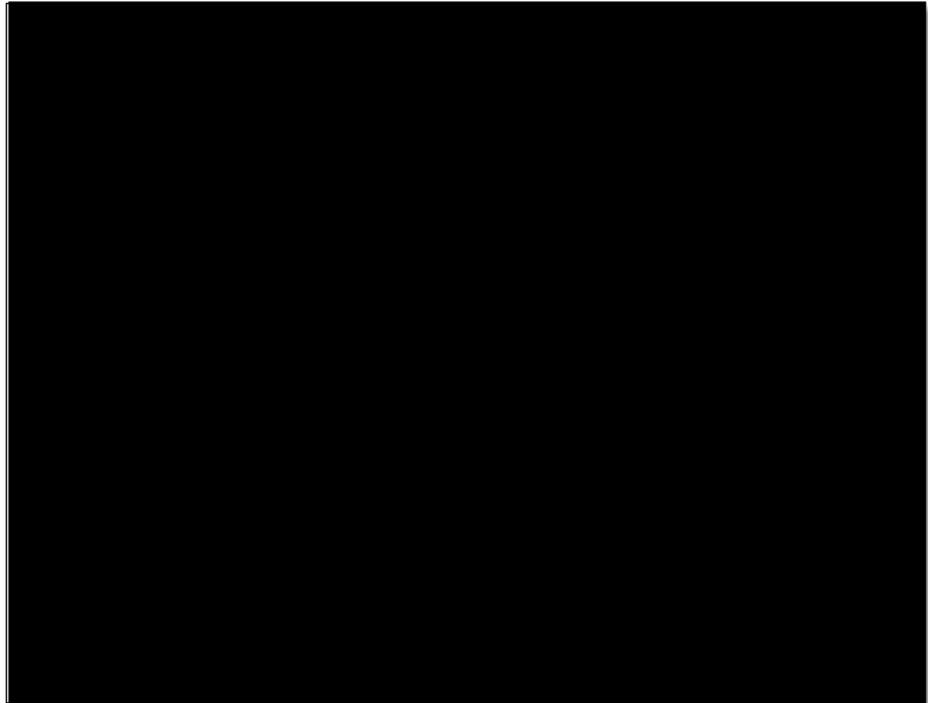
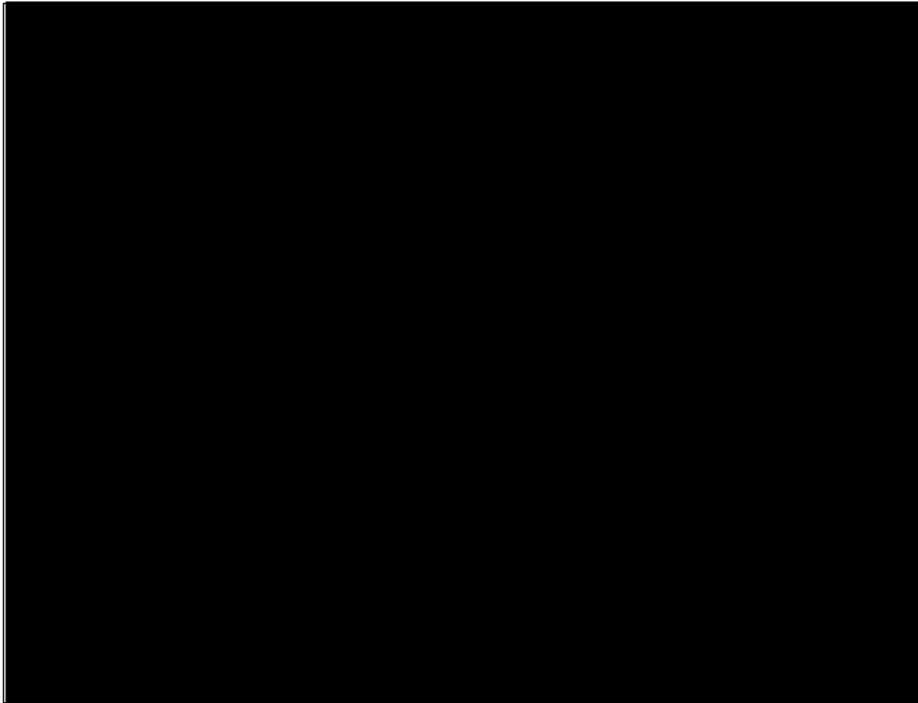
Mitigation Solution

589 wind turbines in operation in the Montezuma Hills

- Existing Solano Phase 1 wind project consists of 23 Vestas V47 wind turbines
 - 16 wind turbines at a blade-tip height of 242 feet AGL and 7 wind turbines at a blade-tip height of 291 feet AGL
- RLOS analysis conducted by Westslope shows that the Solano Phase 1 wind turbines are within RLOS and currently interfering with the Travis AFB DASR
- Reducing the number of wind turbines within radar line-of-sight of the Travis AFB DASR should reduce the cumulative impact on primary Pd
- 2018 Solano 4 East repower consists of either 10 Vestas V136 wind turbines at a blade-tip height of 493 feet AGL or 9 Vestas V150 wind turbines at a blade-tip height of 591 feet AGL



Solano Phase 1 Repower



Solano 4 East: Repower of Phase 1

2018 Cumulative Impact Study Results

- Westslope conducted a Monte Carlo simulation to determine whether the Solano 4 East repower V136 wind turbines or V150 wind turbines would negate the predicted primary Pd drop as a result of the Solano 4 West V136 wind turbines or V150 wind turbines
- Same assumptions used to predict the drop in Pd as the simulation method used under CRADA No. 10-002
- Results show that the primary Pd out of the Travis AFB DASR over the WRA will increase by 0.2 percent

Project	No. of Wind Turbines	Below 4,000 feet MSL	Below 10,000 feet MSL
		Pd Drop	
Solano 4 West (2016)	16	-0.3%	-0.4%
vs. Solano 4 West (V136)	12	-0.3%	-0.3%
and Solano 4 West (V150)	10	-0.2%	-0.2%
From previous slide for comparison purposes			
Solano 4 East (2016)	8	+0.3%	+0.3%
vs. Solano 4 East (V136)	10	+0.2%	+0.2%
and Solano 4 East (V150)	9	+0.2%	+0.2%

Pd drop out of the ASR-11 over the WRA

Combined

2018 Cumulative Impact Study Results

- **Westslope's simulations show the following:**
 - **For Solano 4 West, the primary Pd out of the Travis AFB DASR over the WRA will decrease by 0.3 percent for the V136 layout and by 0.2 percent for the V150 layout**
 - **For Solano 4 East, the primary Pd out of the Travis AFB DASR over the WRA will increase by 0.2 percent for both the V136 layout and the V150 layout**
- **Results show that the V136 layouts for both Solano 4 East and West areas will result in a 0.1 percent overall decrease in the primary Pd over the WRA**
- **Westslope does not expect that a 0.1 percent drop in the primary Pd over the WRA will result in a material difference to Travis AFB radar operations**
- **V150 layout for the Solano 4 East Repower will negate the Pd drop over the WRA as a result of the Solano 4 West V150 layout**

Conclusions

- **2018 Solano 4 East and West projects will replace 23 existing V47 wind turbines that are currently interfering with the Travis AFB DASR with either 22 Vestas V136 wind turbines or 19 Vestas V150 wind turbines**
- **Results show that the V136 wind turbines for both Solano 4 East and West will result in 0.1 percent decrease in the primary Pd over the WRA**
 - **Westslope does not expect that a 0.1 percent drop in the primary Pd over the WRA will result in a material difference to Travis AFB radar operations**
- **V150 wind turbines for the Solano 4 East will negate the Pd drop over the WRA as a result of the Solano 4 West V150 wind turbines**
- **False targets not expected to be significant and should be manageable for either 10 or 12 Solano 4 wind turbines**
- **No impacts to the secondary radar co-located with Travis AFB DASR**

Recommendations

- **File 2018 Solano 4 East and West wind turbines with the FAA to start the federal government OE/AAA process**
- **Formalize a Mitigation Response Team**
 - Further investigate the effects of replacing 23 Solano Phase 1 wind turbines with up to 22 Solano 4 East and West wind turbines
 - Determine whether radar effects will have an operational impact on Travis AFB's mission
 - Identify mitigation options
- **Mitigation options:**
 - SMUD to enter agreement to provide voluntary contribution to fund for an optimization update to the Travis AFB DASR

