Appendix

a) SGDP and SGIG Project Cost and Savings

SGDP, SGIG Project costs last updated March 2014

Smart Grid Demonstration Project: Current (March 2014) Total of all Costs

	Capital	Expense
Avista	$12,526,223	$2,270,874
Cost Share Partners	$2,621,511	$1,396,515
DOE	$14,222,469	$2,853,385
Total	$29,370,203	$6,520,774

Smart Grid Demonstration Project: Projected Costs

	Capital	Expense
Avista	$12,975,300	$2,619,307
Cost Share Partners	$2,621,511	$1,396,515
DOE	$14,684,469	$3,605,385
Total	$30,281,280	$7,621,207

Smart Grid Investment Grant: Current Total all costs. Spokane construction is complete

	Capital	Expense
Avista	$22,558,414	$288,094
Cost Share Partners	$0	$0
DOE	$19,860,366	$140,384
Total	$42,418,780	$428,478

Savings last updated March 2014*

$100.00/customer outage hour (a)
$90.00 reflects loaded serviceman hourly rate and trip time of 1.5 hours (b)
*Note – energy efficiency gains are not included in the saving below.

Task	Number of Events or Operations	Minutes	Savings
Fault detection, Isolation and Restoration	6	183,331	$305,552 (a)
Remote Switching to Restore Outage	3	59,227	$98,712 (a)
Placing Hot Line Hold status via DMS	685		$92,475 (b)
Remote Switching	224		$30,240 (b)
AMI Connect/Disconnect	6,416		$365,262 (b)

CO2 Reduction

Assumes average trip to be 10 miles

Task	Number of Events or Operations	Trip Miles	CO_2 Reduction (Tons)
Remote Hot Line Hold	685	6,850	457
Remote Switching	224	2,240	149
AMI Operations	6,416	1,385,861	92,391

Project Summary

Avista Utilities and a consortium of partners intend to leverage the smart grid demonstration project assets already installed in Pullman, WA as part of the Pacific Northwest Smart Grid Demonstration Program (SGDP). $35M has been invested in equipment, automation systems, communication systems, advanced metering infrastructure, security and process refinement to provide for increased reliability, energy efficiency, customer engagement, and transactive energy response.

Energy efficiency is a top business objective for both Avista and WSU. The systems in Pullman, WA provide combinational power factor correction and voltage regulation while lowering the voltage to reduce both losses and loads. The stated business case for the SGDP was for a 1.86% reduction overall. The early results imply as much as 4% savings is possible. However, of the 6 feeders that supply WSU, one is subjected to cyclical loads that cause a 4 volt drop, negating the savings potential. A battery is an ideal solution to flatten the peak and minimize the number of operations for voltage regulators. Additionally a four-quadrant inverter can maintain unity power factor which allows for maximum voltage reduction while in discharge mode. We propose a Vanadium Flow Battery (VFB) and associated inverter with 1MW of power an energy capability of 3.2MWh.

This battery can be leveraged for not only this localized load problem on the feeder, but can be "dispatched" for power supply use. There are numerous "use cases" listed in the business case for this project. Each use case will be evaluated for effectiveness, coincident opportunity, constraints, and performance. The battery will be commanded through Avista's distribution management system (DMS) and Energy Management System (EMS) as "*dispatched"* events. Day-ahead schedules, renewable energy availability, anticipated power costs, local constraints, local loads, battery management and system needs will be evaluated in a multi-variant set of equations to determine battery operation. This approach is unique in that transmission and distribution operations can both command the distributed resource installed on the distribution system with prioritization based on optimal value achieved.

The EMS and DMS will be configured and if necessary code modified by the respective vendors to provide modeling, simulation and operating tools for use with energy storage systems. Budget has been reserved for this effort to insure automated operation is not only possible but implemented for this solution.

The consortium intends this battery to integrate with renewable energy projects, both solar and wind, so that unanticipated changes in supply or prediction of such changes can be mitigated with this battery. We intend to demonstrate the dispatch of the energy storage resource from our distribution and bulk power operation centers with sophisticated valuation and control methodologies. Finally, this battery installation will improve reliability on the intended substation and feeder while reducing the cost of intermittent or distributed energy resources.

The project, as designed, will establish engineering standards that allow for deployment at other substation or line locations throughout the Avista service territory. The project site location can accommodate additional battery strings for higher energy and capacity as results indicate the need. Additionally the project will create assessment tools that can be used to evaluate one or more uses cases either singularly or coincidently. Coupled with previous infrastructure upgrades, the project provides for development, integration and testing of most any use case imagineable.

Consortium partners are Pacific Northwest National Laboratory (PNNL), Washington State University (WSU), and UniEnergy Technologies (UET), all located in Washington.