

Recap of Q&A from January 25 Carbon Free Power Project Meeting

Los Alamos County

March 6, 2018



UAMPS OVERVIEW

- UAMPS is a joint action agency organized in 1980 operating 16 energy services projects
- LAC has entered into the UAMPS Joint Action Agreement (JAA) which provides a basic foundational governance structure for UAMPS as a project-based entity
- The JAA provides flexibility to accommodate the membership needs and autonomy while structuring UAMPS' projects so there are no cross-defaults between the projects

UAMPS GOVERNANCE

- **Member's UAMPS representative**
 - Each member appoints a UAMPS representative by a governing board resolution to act on their behalf
 - Tim Glasco is the UAMPS Representative for LAC and Steve Cummins is the UAMPS Alternate Representative
- **Project Management Committees (PMC)**
 - Operation of each UAMPS project is under the direct supervision of a PMC comprised of representatives of the participants in the project
 - LAC has a vote on the CFPP
 - Each participant in the project has a vote and can call for a weighted vote of its entitlement share
 - Currently, LAC is the fourth largest participants in the CFPP
 - PMC makes recommendations to the Board

UAMPS GOVERNANCE (CONT.)

- **Board of Directors**
 - Directors represent UAMPS members that are public agencies and have entitlement shares in UAMPS' projects
 - Tim Glasco, is a UAMPS Director for the CFPP Project
 - Board accepts or rejects PMC recommendations
- **Management**
 - The General Manager reports directly to the Board and is responsible for administering staff activities and carrying out policy directives of the Board
 - The staff advises and makes recommendations to the best of their knowledge to the PMC and Board and implements their decisions

PLAN OF FINANCE OBLIGATION PERCENTAGE

Phase 1

- March 31, 2019, \$6 Million cap, as per the amended Budget & Plan of Finance, a participant can unilaterally exit the project
- Possible outcomes if:
 - PMC chooses to terminate the project at this point, 100% reimbursement of \$1.5M of \$6M cap
 - PMC chooses to proceed and LAC takes the off-ramp, LAC pays a maximum of $8/150 * \$1.5 M = \$80k$ and a minimum of $8/600 * \$1.5 M = \$20k$
 - Another participant picks up our share, the cost for the next phase could be \$0
- Continuing in the project past the \$6 M cap, the next off-ramp is at the end of the current phase or per the conditions of Section 204 (a) of the Power Sales Contract
- March of 2019, LAC will need to accept the maximum exposure through the end of the phase if they don't take the off-ramp unless there is another amendment to the Budget & Plan of Finance.

CONTRACTUAL RELATIONSHIP

- UAMPS enters into a take-or-pay sales contract obligating each member to pay its share of debt service, O&M, and wheeling costs regardless of output
- UAMPS issues debt (allows members to bring their own money in lieu of all or part of the debt) to finance the project
- Cost of debt is determined by the members credit who will establish a Rate Covenant to cover such obligation
- Participant agrees to charge and collect rates for electric service that produce revenues sufficient to meet its payment obligations under the Power Sales Contract and other obligations payable from such revenues (Rate Covenant)
- Payments are made solely from each Participant's electric system revenues and, after the commercial operation date of the Project, as an operating expense of the Participant's electric system

CONTRACTUAL RELATIONSHIP

- Step-up obligation, non-defaulting Participants can be required to take a portion of a defaulting Participant's Entitlement Share, subject to a maximum increase over the term of the Power Sales Contract of 25%
- Step-up obligation is invoked when a participant defaults on a contractual obligation, different from a participant withdrawing at the end of a phase
- Participants are limited to an entitlement share of 25% (150MW) which limits the maximum exposure of LAC
- UAMPS has never had a default under any of its Power Sales Contracts since its inception in 1980
- A defaulting participant is not relieved of its liability for payment of any amounts in default and UAMPS will enforce its right of recovery through lawsuit or other action necessary or appropriate to enforce any covenant, agreement or obligation of the participant under the contract

CONTRACTUAL RELATIONSHIP

- PMC has complete and comprehensive decision-making authority over the Project, including
 - Approve each Budget and Plan of Finance and all Project Agreements,
 - Review the results of each run of the Economic Competitiveness Test,
 - Review and authorize all financings,
 - Review and determine whether to submit the COLA, and
 - Determine whether the Project is feasible or whether it should be terminated or suspended

CONTRACTUAL RELATIONSHIP

- The CFPP Power Sales Contract will become effective with no less than a 150 MW subscription
- The PMC will approve new participants in the Project and will determine the buy-in contribution
- At the February 20th PMC meeting, there was more discussion on the buy-in formula with a general consensus of the members to minimize the buy-in amount so we don't discourage new participants from joining, as long as the original participants are made whole
- UAMPS staff will make a proposal to the PMC on how to accomplish this effort at the next CFPP meeting

CONTRACTUAL RELATIONSHIP

- During the Licensing Period, Participants may withdraw from the Project or reduce their Entitlement Shares:
 - If the PMC approves an amendment to the Budget and Plan of Finance that increases the maximum amount of Development Costs that may be incurred during either phase of the Licensing Period
 - Pursuant to the amended initial Budget and Plan of Finance there will be an amendment required to take the Project past March 31, 2019 if the PMC moves forward with the Project
 - Upon the PMC's approval of the updated Budget and Plan of Finance for the second phase of the Licensing Period; this occurs immediately prior to the start of licensing phase 2
 - Upon the PMC's approval of the definitive Budget and Plan of Finance at the Completion of Development
- If the participant's governing body determines to withdraw/reduce for any reason, costs incurred to the date of withdraw/reduce must be repaid to UAMPS within 12 months of the withdraw/reduce
 - Unless, LAC's entitlement share is sold to another participant



Licensing Phase One

- Begins on the Effective Date of the PSC
- Estimating, design and engineering work under the Development Agreement and analyzing each run of the ECT
- Completion of definitive Project Agreements,
- Contracting with prospective Participants, co-owners and third-party power purchasers to achieve full subscription for all Project Output
- Preparation, submission and processing of the COLA
- Updates to the Budget and Plan of Finance, finalization of all Project costs
- Scheduled to be completed June 2020

LAC Option(s)

- ✓ LAC will have the option to reduce its entitlement or withdraw from the Project if the budget and plan of finance is amended
 - ✓ An amendment of the Budget and Plan of Finance will occur around 3-31-19 (or sooner with additional subscription and/or cost share)
- ✓ LAC will have the option to reduce or withdraw from the Project at the end of Phase 1
 - ✓ Governing board approval



Reduce or Withdraw



Licensing Phase Two

- Begins with the submittal of the COLA to the NRC and is completed with the receipt of the NRC License
- Updates to the Budget and Plan of Finance, finalization of all Project costs
- 39 month review
- Scheduled to be completed Q2 2023 upon the receipt of the NRC License



Reduce or Withdraw

LAC Option(s)

- ✓ LAC will have the option to reduce its entitlement or withdraw from the Project if the budget and plan of finance is amended
- ✓ LAC will have the option to reduce or withdraw from the Project at the end of Phase 2
- ✓ *Governing board approval required to move forward with Construction, Operations and Decommission Phases*



LAC Approval Required



Construction Period

- Construction of the Project to the Commercial Operation Date (COD)
- 32 months
- Scheduled to be complete 2027



Operating Period

- COD to end of operating life of the Project
- Up to 80 years



Decommission Period

- to complete decommissioning of the Project

Overall EPC Overnight Plant Costs

(\$1,000,000)

ITEM	2014 Dollars
Power Modules (FOAK Cost plus Fee, Transportation, & Site Assembly)	\$ 848
Home Office Engineering and Support	\$ 144
Site Infrastructure	\$ 60
Nuclear Island (RXB, RWB, MCR)	\$ 538
Turbine Island (2 buildings with 6 turbines each)	\$ 350
Balance of Plant (annex, cooling towers, etc)	\$ 225
Distributables (Temp. Bldgs., Field Staff, Const. Equip., etc.)	\$ 545
Other Costs	\$ 185
Total Overnight Price	\$ 2,895

\$ 5,078 per kWe net

LEVELIZED COST OF ENERGY (LCOE)

- One of the big selling points for this reactor is the fact that it can be built in a factory rather than on-site and that two-thirds of the components are not needed, reducing the cost of the reactor compared to the current large 1,000 MW reactors.
- The \$65/MWH leveled cost of electricity (LCOE), which is the cost of electricity over the debt service of 40 years, is based upon our detailed facility cost estimate, and is comprised of the following cost components:
 - capital (engineer-procure-construct) (48.3%)
 - operations and maintenance (30.9%)
 - fuel (12.1%)
 - waste (1.3%)
 - decommissioning (1.0%)
 - owner's costs to deployment (6.4%)

LEVELIZED COST OF ENERGY (LCOE)

- Capital costs comprise nearly half of the LCOE. The capital costs include systems, buildings, labor, design, procurement, site preparation, and financing costs incurred prior to the start of operations. While the NuScale design has fewer systems than a large gigawatt size design, the costs of these fewer systems is not a significant contributor to the overall capital costs. For example, a simple two-third reduction in system costs will not result in a two-third reduction in the LCOE.
- The U.S. Energy Information Administration's (EIA) 2017 annual analysis comparing the LCOE of different generation technologies using 2016 data presents an LCOE for advanced (large) light water reactors at \$99/MWh.

PRICE TARGET

- The LCOE of not-to-exceed \$65/MWH in 2018 is a price target and is based on the economic competitiveness test (ECT) in the Engineering, Procurement and Construction (EPC) Development Agreement
- The overnight capital costs \$ of 2.9B will continue to be finalized at the completion of the Class 1 estimate which will be known prior the execution of the EPC Contract with Fluor
- The EPC Development Agreement will be finalized if the CFPP passes the ECT

DOE COST SHARE

- Since 2014, DOE has been providing 50% of the cost share
- Looking for half of the remaining \$700M to be covered by DOE cost share, yet to be secured
- The \$1.4B achieves design finalization for the NuScale module, completes a Class 1 cost estimate, and reviews the manufacturing supply chain readiness

DOE ON-GOING PARTICIPATION

- UAMPS sees DOE as a key partner moving forward, through the jump lease agreement, continued technical partnership and cost sharing
- Developments here will be a key part in the decision to proceed past \$6M
- UAMPS will continue working with WAPA to market to federal loads over the next few months. DOE would enter into a Power Purchase Agreement, as approved by the PMC
- DOE's and UAMPS' relationship would be contractual and DOE would not be a member of UAMPS with project voting rights

NUCLEAR TAX CREDIT – FEBRUARY 9TH

- The U.S. Congress passed a budget deal that included the extension of the Advanced Nuclear Production Tax Credit (ANPTC)
- The passed language provides for the first 6,000 MW of new nuclear to qualify for the credit, based on a first-come basis for new reactors that come online.
- Currently, the Vogtle AP1000 project in Georgia is anticipated to be the first project to qualify, utilizing approximately 2,200 MW for its two 1,100 MW units. 4,800 MW would remain available for new reactors that come online, such as the CFPP
- Allows UAMPS to transfer tax credits to financial institutions, expanding the market/buyers of these credits.

NUCLEAR REGULATOR COMMISSION LICENSES

- The Design Certification Application (DCA) is submitted to the NRC for the NuScale Module technology.
 - DCA was submitted to the NCR at the end of 2016
 - DCA is anticipated to be received in January 2021
- The Combined Construction and Operating Licensing Application (COLA) is a separate license to install the NuScale technology at the Idaho National Lab site

NUSCALE'S SMALL MODULAR REACTOR (SMR)

- NuScale is developing a unique SMR design that incorporates numerous first-of-a-kind (FOAK) components and systems which require comprehensive testing
- NuScale has a documented test program
- NuScale has developed a process for identifying required tests using a structured process based on identified risk areas, assessment of technology readiness, and risk-informed analysis of physical phenomena that influence plant performance
- Testing requirements are identified and detailed in a comprehensive reactor qualification test plan, which documents all testing and environmental qualification activities required as part of the design, certification, manufacture and commercial deployment of the NuScale SMR

NUSCALE TESTING

- 1:3 scale electrically heated prototype test facility
- Helical Coil Steam Generator testing
- Fuels testing at AREVA
- Critical Heat Flux testing
- Control Rod Assembly drop / shaft alignment testing
- Steam Generator Flow Induced Vibration (FIV) testing
- Control Rod Assembly Guide Tube (CRAGT) FIV

NUSCALE OPERATION CHARACTERISTICS

- The reactor is designed so that no fuel damage can occur on loss of flow “with or without” control rod insertion. In both cases, the fuel cladding temperature (i.e., core heat profile) drops below the normal operating temperature without the need for AC or DC power.
- The small NuScale core has a strong negative moderator coefficient of reactivity. So on loss of flow with failure to insert control rods, core power immediately drops to approximately 5% just from the impact of reactor physics. The design also has passive decay heat removal and emergency core cooling systems that can be used as needed. These safety systems do not require power to function. For more details, see the analysis included in Chapter 15 of our DCA available at <https://www.nrc.gov/reactors/new-reactors/design-cert/nuscale/documents.html>.
- Emergency valves in harsh reactor environment are driven to safe position by gravity, springs, or gas pressure on loss of power. Valves are contained outside of reactor vessel.

NUSCALE FUEL CYCLE

- The refueling cycle is every two years based on NRC's required inspection cycle. This could possibly go to four years if it can be demonstrated over time
- During the refueling operation, the NuScale Module is disassembled in the reactor pool to gain access to the lower portion of the reactor vessel where the nuclear fuel assemblies reside (collectively referred to as the "reactor core")
- During refueling operations, the lower reactor vessel and fuel assemblies always remain near the bottom of the pool covered by tens of feet of pool water, which serves as shielding from the radioactivity of the nuclear fuel
- While refueling, the upper portion of the reactor vessel and containment are moved to a separate dry dock area where maintenance and inspections can be conducted

WATER RIGHT ACQUISITION

- UAMPS is pursuing acquisition of water rights (purchase) from eastern snake plain aquifer in parallel with licensing period
- Hydrologist and water attorney to identify senior water rights holders to minimize curtailment risk
- Idaho Water Law - ground and surface water are conjunctively managed. UAMPS has identified sufficient areas that have zero-mitigation obligation e.g. no curtailment on use
- Water rights are factored into the cost estimate

WATER RIGHT ACQUISITION

- Water use depends on cooling technology:
 - Wet cooling 18k acre-ft/year
 - Dry cooling 4k acre-ft/year
 - Hybrid cooling somewhere in the middle
- PMC to decide on cooling technology, considering cost and water consumption. Working towards 18k acre-ft/year
- UAMPS will secure options on water rights through the Idaho regulatory process to ensure they can be transferred to the point of use
- Plan is to conclude this work before decision to submit COLA

REACTOR WATER POOL

- The reactor water pool will be replenished for evaporation during normal operation,
- During a power outage, no make-up water is needed to keep reactors cooled from decay heat
- The building environment is conditioned space

TRANSMISSION DELIVERY

- Transmission costs are not included in the not-to-exceed \$65 / MWH cost estimate
- To reduce pancaking transmission rates from Idaho to PNM, UAMPS has initiated preliminary discussions with WAPA on a displacement or exchange with federal hydro power
- LANL and PNM have plans to upgrade their transmission system to allow for additional import capacity. The timing for the upgrade will be determined by LANL's load growth and will be completed regardless of the CFPP