Navajo Generation Station – NREL Phase 2 Study
Northern Arizona University
Tribal Solar Working Group

Kevin Black, Sr.
Program Manager
Energy Development
Bureau of Reclamation
Phoenix Area Office
Agenda

• Navajo Generating Station
  • Background
  • Proposed Action – Purpose and Need
  • Environmental Impact Statement
• National Renewable Energy Lab (NREL) Phase II Study
  • Stakeholder Outreach
  • Scope of Work
  • Baseline
  • Glidepaths
  • Milestones and Final Report
• Questions
Navajo Generating Station Programs (NGSP)

Russ Callejo
General NEPA, ESA, NHPA Compliance
- General Environmental Matters
- Navajo Generating Station – Kayenta Mine Complex Environmental Impact Statement
- Programmatic Agreement
- Biological Assessment
- Tribal Consultations
- Los Angeles Department of Water & Power Divestiture Environmental Compliance
- Nevada Energy Divestiture Environmental Compliance

Kevin Black
Program Manager
Energy Development
- Joint Federal Agency Working Group Coordination
  - Tribal Clean Energy Development
  - NREL II Study
- Technical Working Group Agreement
  - Implementation
    - Appendix “C”
    - Qualifying Projects Catalog
    - NGS Roadmap & Glidepath Development
- NGSP Coordination
  - NGS Environmental Program
  - Operation & Maintenance

Ron Smith
General Engineering & Operating Committee Responsibilities – Generation & Transmission
- Lease Amendment & Coal Supply Agreement Negotiations
- Los Angeles Department of Water & Power Divestiture
- Nevada Energy Divestiture
- Technical Working Group Appendix C Implementation Technical Support
- NGS-KMC EIS Technical Support
- General Technical Support

Coordination | Collaboration | Communication | Cooperation

Environmental Program
Energy Development Program
Operations & Maint. Program
NGS Background

- 2,250 MW coal-fired power plant on lands leased from the Navajo Nation near Page, AZ
- Congress authorized construction of the CAP in 1968, including federal participation in the NGS
- Federal share in NGS is 547 MW
  - ~360 MW for CAP pumping
  - ~187 MW for surplus
- Federal NGS power surplus to CAP load is sold at market rates; revenues assist in CAP repayment and Indian water settlements under Arizona Water Settlement Act
- Coal used by the NGS is exclusively supplied by the Kayenta Mine, located on lands leased from the Navajo Nation and Hopi Tribe
NGS Proposed Action

- NGS lease and right of way grants begin to expire in December 2019; significant permit revision application for Kayenta Mine under review by OSMRE

- Proposed Action: Obtain necessary Federal approvals to continue the NGS and Kayenta Mine from 2020 through 2044

- Purpose and Need (P&N) for Reclamation: Secure, after 2019, a cost-effective reliable source of power and energy that would be continuously available to operate the CAP, and generate surplus revenues

- Any action alternatives considered must meet the P&N

- Notice of Intent (NOI) to prepare a single Environmental Impact Statement (EIS) was published in May 2014.
Federal Actions

- Approval of Plant Site Lease Amendment (BIA)
- Issuance of Grants of ROW and Easements for Plant, Railroad, and Transmission Lines on Navajo Reservation (BIA)
- Conversion of Revocable/Special Use Permits to §323/§169 Grants of ROW (BIA)
- Issuance of Southern and Western Transmission ROWs off Navajo Reservation (BLM, USFS)
- Issuance of ROW for Water Intake off Navajo Reservation (NPS)
- Water Service Contract Renewal through 2044 (Reclamation)
- Kayenta Mine Permit Revision for mining post-2019 (OSMRE)
- Coal Supply Agreement post-2019 (Reclamation)
EIS Target Milestones

National Environmental Policy Act
Environmental Impact Statement Process

<table>
<thead>
<tr>
<th>Milestones</th>
<th>Target Schedule</th>
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<tbody>
<tr>
<td>Notice of Intent</td>
<td>May 16, 2014</td>
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<tr>
<td>Public Scoping Period</td>
<td>May 16, 2014 – August 31, 2014</td>
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<tr>
<td>Develop Draft EIS</td>
<td>Summer 2014 – Summer 2016</td>
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<tr>
<td>Draft EIS Publication and Public Comment Period</td>
<td>Summer 2016</td>
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<tr>
<td>Develop Final EIS</td>
<td>Summer 2016 – Summer 2017</td>
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<tr>
<td>Final EIS Publication and 30-Day Wait Period</td>
<td>Summer 2017</td>
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<tr>
<td>Record of Decision Publication</td>
<td>Fall 2017</td>
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= Public review opportunity

We are here
Reclamation/Dept. of Energy Interagency Agreement

- Technical Assistance
  - Clean Energy Development Planning
- NGS KMC EIS
- NREL II Study
Joint Statement by DOI, DOE, EPA (2013)

• Long-term goals
  • Clean, affordable and reliable power
  • Affordable and sustainable water supplies
  • Sustainable economic development
  • Minimize negative impacts on those who currently obtain significant benefits from NGS

• Complete NREL Phase 2 report to formulate and analyze clean energy alternatives to NGS

• NREL Phase 2 Study to inform NGS Road Map
NREL PHASE ONE STUDY

NREL Phase 1 (Jan. 2012)

• Driven by EPA notice of intent to issue BART rule for NGS
• Examined NGS history, operation characteristics, role in CAP rates, role in water settlement
• Provided initial analytical benchmarks based on cost of NO\textsubscript{x} mitigation

NREL Phase 1 supplement (April 2012)

• Characterization of renewable resource potential that could contribute to an NGS replacement portfolio
Technical Working Group Agreement

• Proposed “better-than-BART” alternative for reducing NO$_x$ emissions
• Additional federal commitments
  • Clean energy
  • Carbon reduction
• Proposed framework for NREL Phase 2 Study
  • Identified tribal and non-tribal constituencies
  • A study to inform a NGS Roadmap
NREL Phase 2 Study

- Stakeholder Outreach & Study Scope
- Baseline analysis
  - How is the Southwest electricity sector changing independent of what might happen with NGS?
  - Rationale: current costs are not a valid standard for evaluating any NGS future
- Formulation and Analysis of glidepath options
  - “Appraisal level” rather than project-specific
  - Knowledge base for federal decision support
# Phase 2 Study: Baseline

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<tr>
<th>Baseline</th>
<th>Sectoral trends</th>
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<tr>
<td></td>
<td>Technology costs, policy environment, and operational advances; how utilities are responding (IRPs)</td>
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<tr>
<th>Technical modeling</th>
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<tr>
<td>Quantify the likely changes in new capital investment (fixed costs) and production costs (variable costs) for electricity</td>
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<th>Economic modeling</th>
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<tr>
<td>Forecast how current sector-wide fixed cost and variable cost trends will affect the Arizona economy</td>
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</table>
RPM-AZ focuses on 1,342 nodes within 5 BAs (APS, SRP, TEP, WALC, NEVP), and 31 BA zones for the rest of the Western Interconnection.
What is a “Glidepath”? 

• Multi-component strategy for transitioning federal interest in NGS to clean, low-emitting energy sources
  o Tests selection and timing of new technologies
    – NOT selection of specific projects within a technology category
  o Allows for some transitional operation of NGS, provided the glidepath achieves the federal goals

• Does not preclude operating NGS without federal participation

• Analysis of possible actions
Phase 2 Study: Glidepath Options

Glidepath options

**Utility-scale clean energy strategies**
Appraise technically feasible options for providing CAP electricity, appraise impacts relative to baseline

**Expansion Capability**
Appraise the feasibility of upsizing the utility-scale options to provide surplus power

**Impacts on NGS Constituencies**
Evaluate the economic impacts of glidepath options; appraise local projects that could reduce disruptive effects
Several Glidepath Analyses

• Questions for each glidepath analysis
  o How will cost of component technologies change over time, and at what point might the technology become economically competitive?
  o How effectively does the glidepath portfolio contribute to federal goals?
  o What types of federal participation might make a glidepath more feasible or competitive?
Portfolio Diversity
Technology Components

• Different combinations of
  o Utility-scale PV near CAP transmission
  o Geothermal
  o Wind power
  o Concentrating solar power (CSP)
  o CSP thermal augmentation of an existing NGS unit
  o Natural gas
Time Factor: Changes in Technology Costs

High/Low Cost Trajectories for Solar, Natural Gas Generation

2015$/MWh (levelized)

2015 2020 2025 2030

Opportunity focus for PV

Opportunity focus for CSP
Scope and Attributes

- Glidepath must comprise enough utility-scale projects to provide power to Central Arizona Project (CAP)
  - Frames a glidepath’s size and focuses the analysis
  - Assumption: CAWCD may but need not select glidepath resources for CAP power
- Must be economically competitive
  - If not competitive for CAP, won’t be competitive elsewhere
- Investigate potential of up-sizing to provide surplus energy
Local Development

• Glidepath analysis will also appraise local energy-related strategies to minimize negative impacts and promote sustainable economic development for NGS Affected Tribes such as
  o Energy projects to improve local water delivery
  o Distributed solar
  o Upsizing utility-scale project to provide power for local tribal use
Elements of NGS Phase 2 Study

Baseline conditions

Federal NGS Clean Energy Options

- CAP water tribe impacts
- Navajo Nation impacts
- Hopi Tribe impacts
- CAP NIA* impacts
- Impacts on surplus power sales

*non-Indian agriculture
Activities intersecting with baseline tasks

- Phase 2 options analysis
- Same baseline, emphasis on 2019 implementation
- Same baseline, geographical focus on Indian Country
- EIS analytical support (baseline applicable to 2019)
- Tribal clean energy support (baseline applicable to Indian Country)
- Interior commitments (baseline applicable to CO₂ reduction, new clean energy)
- Baseline analysis
NREL 2 Study Tasks

- Task 1 – Baseline Conditions
- Task 2 – Sectoral Trends
- Task 3 – Glidepath Options
- Task 4 – Potential for Surplus Power
- Task 5 – Impacts
Task 1: Baseline conditions

• Model current trends with respect to:
  o New power plant additions
  o Fuel/variable cost of generating power
  o Economic impacts

• Two bookends for the baseline analysis
  o Full shutdown of NGS in 2020
  o Full operation of NGS to 2044 (consistent with TWG Agreement)
Task 2: Sectoral trends

- What systemic changes are affecting the results seen in Task 1?
  - Future technology costs
  - Public policies

- How are Arizona utilities planning for the future?
  - New plants
  - Purchased power
  - Plant retirements
Task 3: Analysis of glidepath options

- One glidepath may include more than one technology
  - Federal share of NGS may provide transitional power
- Utility partnership in a glidepath is not necessary, but is not precluded

Federal NGS Clean Energy Options

- Will take into account:
  - TWG milestones
  - Future cost trajectories, other sectoral factors identified in Task 2
NGS Transmission Facilities and CAP Pumping centers

The Tonopah Desert Recharge Project (TDRP) is a direct recharge project located in western Maricopa County. Construction began in 2004 and the project began full-scale operations in January 2006.

- Basin infiltration area = 207 acres
- 19 infiltration basins
- Annual Permeated Volume is 150,000 AFYR
- Average infiltration rate is 4-5 feet per day
- Not to exceed 2 million AF CAP water over 20 years

Map Features:
- CAP Pumping Plants
- Geothermal Facilities
- Geothermal Potential Sites
- Geothermal Potential Lines
- Geothermal Power Projects
- White Sands Coal Plant
- White Sands Nuclear Plant
- White Sands SMR Plant
- Proposed Facilities

Area contains 2,521 acres with slope of 5 degrees or less
- Total Photovoltaic Potential is 350 MW
- Concentrating Solar Potential is 104 MW

Area contains 5,447 acres with slope of 5 degrees or less
- Photovoltaic Potential is 382 MW
- Concentrating Solar Potential is 88 MW

Area contains 678 acres with slope of 5 degrees or less
- Photovoltaic Potential is 75 MW
- Concentrating Solar Potential is 135 MW

Area contains 636 acres with slope of 5 degrees or less
- Photovoltaic Potential is 17 MW
- Concentrating Solar Potential is 121 MW

Area contains 239 acres with slope of 5 degrees or less
- Photovoltaic Potential is 4 MW
- Concentrating Solar Potential is 44 MW
Pre-commercial resource options

• Defined as no on-line commercial development to date, but target of significant R&D
  o Future is speculative, in that there is no commercially validated market data to provide analytical inputs comparable to options that are currently commercial
  o NREL Phase 2 will review status, but will not analyze as a potential glide path option

• Clean coal
  o Review the current status of research and development
  o Identify factors affecting the suitability of NGS and the Kayenta Mine as locations for demonstration projects or technology research

• Small modular reactors
  o Review the current status of research and development
Task 4: Potential for Surplus Power

- Analysis of how glidepath options examined in Task 3 might be up-sized to provide surplus power for market sales
  - Results could help federal agencies formulate proposals to Congress for expanded authorization
Task 5: Impacts

• For each option identified in Task 3, break down the impacts on NGS constituencies

• Appraise local energy development approaches that could minimize disruption, enhance water delivery, and otherwise promote sustainable development
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<tr>
<th>Stakeholder outreach and scoping</th>
<th>COMPLETE</th>
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<tr>
<td>Technical memoranda — baseline topics*</td>
<td>Q1–Q3 2015</td>
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<tr>
<td>Technical memoranda — glidepath topics</td>
<td>Q1–Q4 2016</td>
</tr>
<tr>
<td>Final published report</td>
<td>Q1 2017</td>
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<tr>
<td>Social media outreach</td>
<td>Q1–Q2 2017</td>
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Phase 2 Informs the Federal Road Map

Phase 2 Study
By NREL
Is a knowledge base*
(analysis of options)

Road Map
By Federal Government
Is a set of decisions
(selection of options)

*Phase 2 Study will not decide any specific project or federal action
With NREL’s Phase 2 study as a knowledge base, federal agencies will decide on actions to achieve goals.

**Federal goals**

- Clean, affordable, reliable power
- Affordable, sustainable water supplies
- Sustainable economic development
- Minimize negative effects on tribes, others who receive benefits from NGS
Questions?

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