USACE Omaha District
Palo Seco Mega Mobile Power Generation
Rapid Disaster Infrastructure Program

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Presenter Title: USACE Contingency Program Manager
Date of Presentation: 10 July 2018
Discussion Topics

- Puerto Rico Power Grid
- Palo Seco Power Generation
- Temporary Power Justification
- USACE Execution and Results
Background
Puerto Rico
Power Grid
Isolated Electrical System

- Isolated System is an island or territory which generates its own power electricity, but doesn’t have the infrastructure to import or export it.

- Interconnected System has transmission links to other islands or territories and are capable to import or export the power required in their area.
Puerto Rico Electrical System Distribution

- Generating Station
- Generating Step-Up Transformer
- Transmission Lines: 230kV, 115kV & 38 kV
- Transmission Customer: 115kV & 38kV
- Distribution Substation
- Industrial Customer: 13kV to 4.16kV
- Commercial Customer: 13kV to 4.16kV
- Residential Customer: 13kV to 4.16kV
Puerto Rico Electrical System Transmission

- Voltage Transmission Levels: 230/115/38 kV

- 178 Power Transmission Stations
- 38 kV Lines: 1,375.6 miles
  - 63.2 miles underground
  - 54.7 miles submarines
- 115 kV Lines: 700.5 miles
  - 36.7 miles underground
- 230 kV Lines: 412.7 miles

- Voltage Distribution Levels: 13.2/8.32/7.2/4.16 kV
- 347 Distribution Substations
Puerto Rico Electrical System
Installed Capacity - 6,092.3 MW

- AEE (4,877.1 MW)
  - Steam – 2,892 MW
    - Bunker C – 2,072 MW
    - Natural Gas – 820 MW
  - Combined Cycle – 1,032 MW
    - Gas – 720 MW
    - Steam – 312 MW
  - Gas (Diesel) – 853.4 MW
    - Turbinas a Gas – 378 MW
    - Cambalache – 247.5 MW
    - Mayagüez – 220 MW
    - Vieques/Culebra – 7.9 MW
  - Hidro – 99.7 MW

- PPOA (1,215.2 MW)
  - Cogeneration
    - EcoEléctrica – 507 MW
    - AES – 454.3 MW
  - Renewable Systems – 253.9 MW
    - Wind – 102 MW
    - Solar – 147.1 MW
    - LandFill – 4.8 MW
Background

Palo Seco Steam Plant
GEOGRAPHICAL LOCATION
Palo Seco Steam Plant Generation Capacity

UNIT 1 - 85 MW
  65 MW max

UNIT 2 - 85 MW
  generator repairs

UNIT 3 - 216 MW
  150 MW max

UNIT 4 - 216 MW
  generator repairs

Palo Seco Rated Generation – 602 MW
Reliable Power Generation – 0 MW

0%
Why Temporary Power
TRANSFER requirements (may – sep 2018)

NORTH PR

POWER DEMAND CURRENT: ~1500 MW

POWER DEMAND SUMMER 2018: ~1900 MW

POWER CAPACITY = 644 MW

TOTAL POWER TRANSFER 1344 MW

SOUTH PR

Puerto Rico Electric Power Authority

POWER DEMAND CURRENT: ~700 MW

POWER DEMAND SUMMER 2018: ~900 MW

POWER CAPACITY = 2842 MW

Puerto Rico Electric Power Authority
TRANSFER requirements (may – sep 2018)

Puerto Rico Electric Power Authority

TRANSFER CAPACITY

230 KV complete
115Kv complete
Incomplete transmission line
USACE Execution
### Purpose Funding

| Award Task Order | $35,250,000 | 7-Oct-17 | $35,185,591 |
| Mod TO for overruns (gas, taxes, site prep) | $1,000,000 | 7-Nov-17 | $2,948,755 |
| Mod TO for O&M through 28 Feb 2018 | $28,500,000 | 3-Dec-17 | $25,207,359 |
| Mod TO for O&M through 19 Mar 2018 | $9,000,000 | 21-Feb-18 | $7,863,125 |
| Mod TO for O&M through 18 April | $14,000,000 | 18-Mar-18 | $11,863,209 |
| Mod TO for O&M through 18 May | $14,000,000 | 11-Apr-18 | $12,265,494 |
| Mod TO for O&M up to 18 July | $30,000,000 | 19-May-18 | $26,182,186 |
| | | | $15,833,387 |
| **Subtotal** | **$130,750,000** | | **$121,515,719** |

### Power Source

<table>
<thead>
<tr>
<th>Power Source</th>
<th>Rated Capacity MW</th>
<th>Operationa I Capacity MW</th>
<th>Actual Power Generation MW</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam Unit 1</td>
<td>85</td>
<td>70</td>
<td>0</td>
<td>Structural repairs ongoing</td>
</tr>
<tr>
<td>Steam Unit 2</td>
<td>85</td>
<td>70</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Steam Unit 3</td>
<td>216</td>
<td>180</td>
<td>~150-160 (limited)</td>
<td>Structural repairs made. Boiler iteratively falls due to pin holes.</td>
</tr>
<tr>
<td>Steam Unit 4</td>
<td>216</td>
<td>180</td>
<td>0</td>
<td>Structural &amp; system repairs needed</td>
</tr>
<tr>
<td>Gas Unit #1-6 (each)</td>
<td>22</td>
<td>20</td>
<td>0-20</td>
<td>1-3 units operational, but unreliable.</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>734</strong></td>
<td><strong>620</strong></td>
<td>~150-220</td>
<td></td>
</tr>
<tr>
<td>USACE Mega Unit 1</td>
<td>37</td>
<td>28</td>
<td>28-30</td>
<td>Operational 98.8% of the time</td>
</tr>
<tr>
<td>USACE Mega Unit 2</td>
<td>37</td>
<td>28</td>
<td>28-30</td>
<td>Operational 97.5% of the time</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>74</strong></td>
<td><strong>56</strong></td>
<td><strong>56-60</strong></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>808</strong></td>
<td><strong>676</strong></td>
<td><strong>206-280</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Pre-Hurricane Maria

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>Unit 2</th>
<th>Project Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1</td>
<td>Unit 2</td>
<td>Project Total</td>
</tr>
<tr>
<td>Oct-17</td>
<td>1,003</td>
<td>1,013</td>
</tr>
<tr>
<td>Nov-17</td>
<td>18,521</td>
<td>19,712</td>
</tr>
<tr>
<td>Dec-17</td>
<td>19,239</td>
<td>19,954</td>
</tr>
<tr>
<td>Jan-18</td>
<td>20,111</td>
<td>19,756</td>
</tr>
<tr>
<td>Feb-18</td>
<td>16,281</td>
<td>15,965</td>
</tr>
<tr>
<td>Mar-18</td>
<td>19,039</td>
<td>18,756</td>
</tr>
<tr>
<td>Apr-18</td>
<td>19,043</td>
<td>16,786</td>
</tr>
<tr>
<td>May-18 (As of 2018)</td>
<td>19,978</td>
<td>17,911</td>
</tr>
<tr>
<td>June-18</td>
<td>16,799</td>
<td>16,571</td>
</tr>
<tr>
<td><strong>Totals to Date</strong></td>
<td><strong>150,016</strong></td>
<td><strong>146,427</strong></td>
</tr>
</tbody>
</table>

### Administration Personnel

- 1 On Site USACE
- 4 Reachback -Omaha
- 1 TF Power

### Contract

- ~$121M Contract

### Ports

- USACE generates power
- PREPA owns the power and its distribution on their grid
- PREPA provides USACE direction
  - start, stop, mode (base, fixed, frequency)
  - concurrence for schedule downtime.

### Exit Strategy

- PREPA purchases Mega generators
- PREPA utilizes alternative temporary power generation source
- PREPA determines the grid is stable enough and Mega generators are no longer needed

### Installation, Commissioning, Operations

- 23 Calendar days between Omaha notification of FEMA Mission Assignment and fully operational
  - 6 Oct 2017 – 29 Oct 2017
  - Barge and Air freight all major componentry, materials, supplies, equipment
  - Maintain applicable safety, quality, technical standards

### Operations

- Cumulative power production during 179 days O&M: 296,443 MWhrs
- Daily average: 51.5 MW
- Operational 24/7, 98.15% of scheduled time

### Roles

- USACE generates power
- PREPA owns the power and its distribution on their grid
- PREPA provides USACE direction
  - start, stop, mode (base, fixed, frequency)
  - concurrence for schedule downtime.

### Purpose: Increase grid stability

- Reduce blackouts due to insufficient power generation
- PREPA Steam Units 1, 2, 3, & 4 intermittent or out of operation
- Add 50-60MW to grid

### FEMA Mission Assignment to USACE

- Mobile Power Generation 50-60MW net output, continuous
  - Verbal MA: 6 Oct 2018
  - Written MA 28 Oct 2018
Palo Seco Site (10/11/17)
GAS Turbines arrive in PR (10/13/18)
Demolition of Palo Seco Pad (10/13/17)
Site Preparation Palo Seco (10/14/17)
Site Preparation Palo Seco (10/14/17)
Pad Subbase Preparation (10/16/17)
Pad Subbase Preparation (10/17/17)
Placement of Gas Turbines on Pad (10/17/17)
Fuel Line Installation (10/18/17)
Equipment Installation (10/19/17)
Inter-Connect Cable Installation
(10/20/17)
Mechanical Equipment Set (10/20/17)
Fuel Tank D-1 Repair (10/20/17)
Fuel Tank D-1 Repairs (10/20/17)
Grounding Installation (10/21/17)
Fuel Filter Skid (10/21/17)
Tank Liner Repair (10/21/17)
Fuel Transfer Skid (10/21/17)
Medium Voltage cable Installation
10/22/17)
Medium Voltage Cable Installation
(10/23/17)
Secondary Electrical Installation (10/24/17)
Control Cable Installation (10/24/17)
First Fire (10/24/17)
Working Protective relay (10/25/17)
Pressure test Fuel Line (10/25/17)
Electrical Tie – In to Palo Seco Transformer
10/26/17

BUILDING STRONG®
Equipment Commissioning 10/29/17
Final Equipment Layout (04/15/19)
Palo Seco Steam Plant