Problem - Current System
Canal-Spanning Solar Projects (CS) versus Land-Based Solar Projects (LS)
Addressing Concerns from the Bureau of Reclamation

Fundamental Considerations Associated with Placing Solar Generation Structures at Central Arizona Project Canal

Central Arizona Project, Arizona Lower Colorado Region
Modularity vs Lowest LCOE 'Levelized Cost Of Energy'

Fig. 1001- Basic Structure
Fig. 1002- Spaceframe Structure
Fig. 1003- Thin Shell Structure
Fig. 1004- Thin Shell sawtooth Structure
Fig. 1005- Tension Structure
Fig. 1006- Bowstring Structure
Fig. 1007- Bowstring sawtooth Structure
Construction Sequencing
modular, fast, safe
Canals Deliver Water First and Foremost

Canal-Solar cannot get in the way of canal operations and maintenance.
Operations and Maintenance
Drag-chain sequencing
under Canal-Solar
Emergency Removal

Simulating a canal breach

emergency repair process
Canal Access

Emergency access

- Cows
- Couches
- Cars
The Bisbee Science Lab Prototype: Two sets of solar panels, one over dry land and another over a pond, with an open pond in the forefront of the image.
Techno-Economic Research

Approach to using SAM for the Canal-Spanning and Land-Based Models

Front-end Inputs
- Construction Cost
- Transmission Infrastructure
- Regulation Cost

Annualized Inputs
- Land Lease Cost
- Transmission Loss
- Performance Ratio

Canal Co-Benefits
- Water Savings
- Aquatic Biotic Growth

Outputs
- NPV: Net Present Value
- LCOE: Levelized Cost of Energy

CSSP Cost Reductions
CSSP Cost Premiums
1.9% boost (21 GWh) in generation valued at approximately 2,300,000/year
SRP’s Dirty Footprint
85.7% Thermo-Electric
68.2% Fossil Fuels
31.8% Non-Fossil Fuels

Power
2,540 AF/year of thermoelectric water consumption offset
by Canal-Solar PV generation
valued at approximately $7,600,000/year

Key
TE fuel type
SRP Mix Percentage
water use/MWh
total water use/TE fuel type/year

SRP 2020 and EIA data

85.7% Thermo-Electric
68.2% Fossil Fuels
31.8% Non-Fossil Fuels

Coal
23.1%
540 gal/MWh
11,353 AF/year

Natural Gas
45.1%
696 gal/MWh
40,699 AF/year

Other
4.0%

Renewable
10.3%

Nuclear
17.5%
755 gal/MWh
12,776 AF/year
Water

80.6% shading
3,100 AF/year saved
valued at approximately $9,200,000/year

Status Quo:
6,400 AF/year water loss
$47,300,000 (30.6%) annual savings
Land

Utility Scale Solar: Silver-Bullet solution or another PROBLEM?
Land

Utility Scale Solar: Silver-Bullet solution or another PROBLEM?
Land
716 MW nameplate PV capacity

1.12 ac/MW Canal-Solar on dual use land versus 8.8 ac/MW Land-Based on virgin land

7.8x increased density over Land-Based Solar
Land

716 MW
nameplate PV capacity

1.12 x greater
nameplate capacity
than Apache Coal Plant
in Willcox
Land

10.8 square miles equivalent utility-scale Land Use
Utility-Scale Solar SRP service area SRP transmission line @ SRP’s average retail electricity rate of $0.1092/kWh
Summary
SRP Canal-Spanning Solar Panels

Power
• 132 miles of canal = 716 MW
• Generates nearly 1,300 GWh/year (Power for approximately 240,000 people annually)
• 900,000 metric tons of Co2 emissions offset per year

Water
• Saves 2,580 AF/year of water from TE offset
• Saves 3,070 AF/year of water from evaporation reduction
• Water for 34,500 people annually
• Algae treatment savings of $47m/year to water ratepayers

Land
• 6,900 acres (10.8 square miles) virgin land saved compared to utility-scale solar
• Density ratio: 8.8 ac/MW average for six SRP LBSP projects vs. 1.12 ac/MW for CSSP (7.8x area)
The figures stated in this presentation are estimates based off of models and lab data and are prospective in nature and may change as the science improves and our climate changes. Many of these models are novel to this project and still a work in progress. Research funded in part from DoE cooperative agreement DE-SC0020022 and have SBIR protected rights.
Gila River Indian Community: Innovation in Water Management

David H. DeJong, Ph.D.
Director, Pima-Maricopa Irrigation Project
The Gila River Indian Community in central Arizona:

Akimel O’otham (Pima)

and

Pee Posh (Maricopa)
GRIC has developed innovative water partnerships and management
Solar over Canal Project: Goal is to make GRIIDDD the first green irrigation district in the world
I-10 Solar over Canal Project:

Army Corps of Engineers (Tribal Partnership Program agreement), GRIC, & Bureau of Reclamation funded
I-10 Solar-over-Canal Project

Design
- 1,624 solar panels covering 50,896 SF (962’ x 53’)
- 29 frames each with 56 panels
- Designed to minimize O&M impacts
- Generate 876 kW or 1,677,460 kWh (1,667 MWh) generating power valued at $174,456

Water savings
- Limited evaporation losses (5.4 AF/YR)
  135 AF over 25 years
- Thermoelectric water savings (2.57 AF/YR)
  64 AF over 25 years
- Total is 7.98 AF/YR or 199 AF over 25 years
### Casa Blanca Canal Solar Project

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<tr>
<th>Canal Width (FT)</th>
<th>Canal Length (FT)</th>
<th>Area (SF)</th>
<th>DC Output based on 14W per SF (KW)</th>
<th>DC Output based on 16W per SF (KW)</th>
<th>DC Output based on 17W per SF (KW)</th>
<th>AC Output based on 14W per SF (KWH) per year</th>
<th>AC Output based on 16W per SF (KWH) per year</th>
<th>AC Output based on 17W per SF (KWH) per year</th>
<th>AC Output based on 16W per SF (KWH) dollars/per year ($)</th>
<th>AC Output based on 17W per SF (KWH) dollars/per year ($)</th>
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*Diagram of Casa Blanca Canal Solar Project*
Purpose:
To restore an economically-viable agricultural economy and
With the smallest carbon footprint