

2010 Rocky Mountain AWWA and WEA Conference in Keystone, Colorado

Pueblo Adds Green Power to James R. Dilorio WRF

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Background of Pueblo WRF

- Old Rock Media TF Plant Built in 1930s
- Newer TF/SC Plant Built in Late 1980s
- Maximum Month Capacity:
 - 19 mgd
 - 34,910 ppd of BOD
 - 147,000 people
- Ammonia and Nutrient Removal Project:
 - Provide for Ammonia Removal
 - Pre-Position for Future Nutrient Rules
 - Switch from Gaseous Cl_2/SO_2 to UV Disinfection

Genesis of Solar Power Project

- City Wanted to Offset Additional Power:
 - UV Disinfection
 - Air for Full Nitrification
- Mitigation Measures Included in Design:
 - High-Speed/Single-Stage Turbine Blowers
 - First-Stage Denite for Energy Recovery
 - Use Old Plant as Site for Solar Panels
- Green-Reserve ARRA Funding via SRF Program

SRF and ARRA Requirements

- CDPHE Loan & Prioritization Programs
- Accelerated CDPHE Deadlines for:
 - PER for SRF Loan Application
 - Process Design Report
 - Detailed Design Review
 - Award of Construction Contracts
- CDPHE/ARRA Front End Conditions:
 - DBE Participation (CDPHE/ARRA)
 - Davis-Bacon Wage Rates (ARRA)
 - Buy American (ARRA)

Black Hills Energy Renewables Program

- Renewable Rebate = \$2 per DC watt up to 100 kW
- Maximum Rebate of \$200,000
- Renewable Energy Credit Payment = \$115 per megawatt-hour
- New Bi-Directional Utility Service Meter
- Review and Approval of Design & Installation
- 20-Year Contract

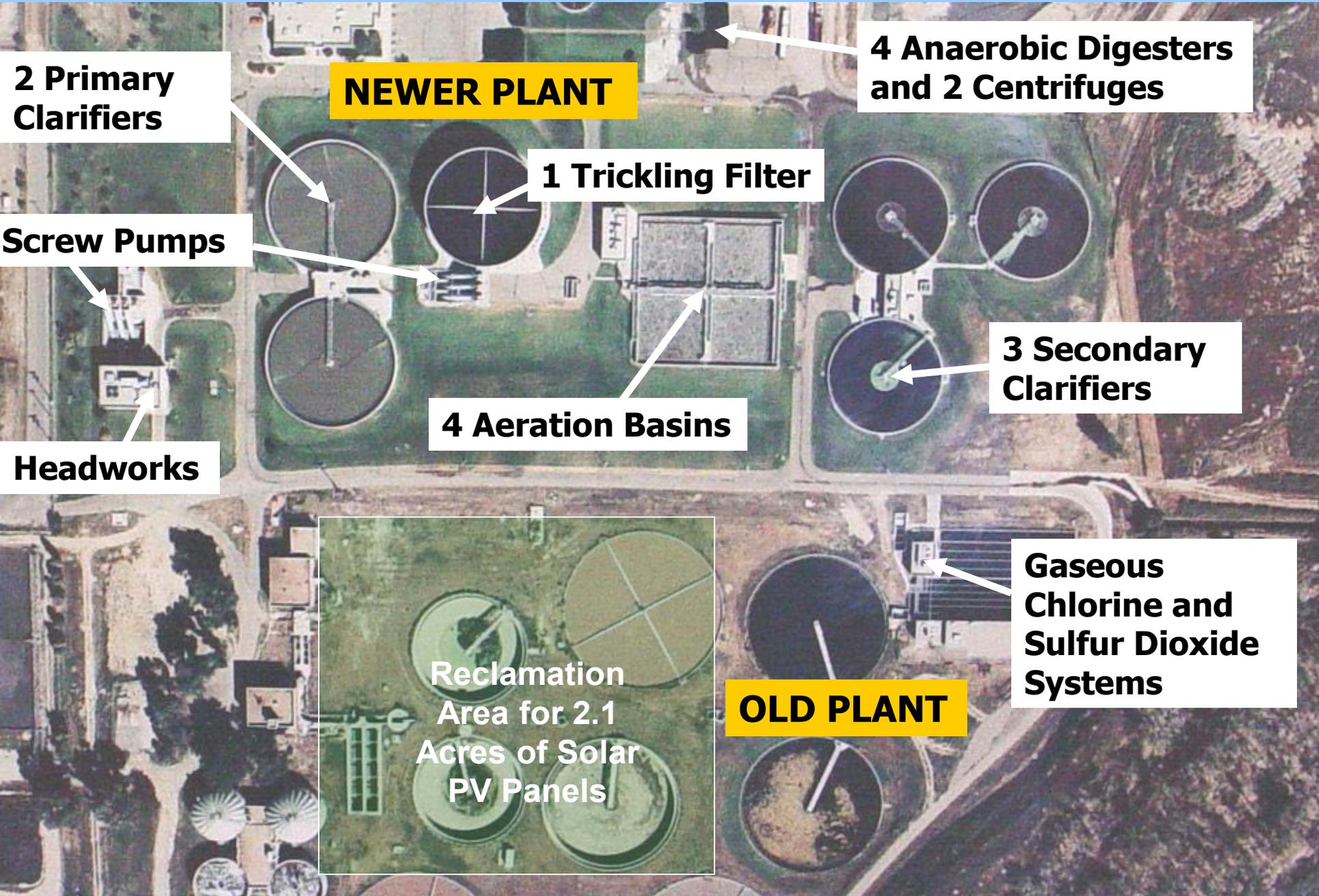
Basic Parameters of Solar Power Project at the Pueblo WRF

- Minimum 200 kW of DC with Two, 100-kW Bid Alternatives
- Demo & Reclamation of 2.1 Acres of the Old Plant:
 - One Influent Mixing Basin
 - Three Primary Clarifiers
 - One Rock Media Trickling Filter
- City Opted for Base Bid Plus One Add Alternative:
 - Fixed Tilt PV Panels Using Thin Poly-Crystalline Cells
 - 309 kW of DC Production at Standard Conditions
 - 264 kW of AC Production Expected at Field Conditions
 - 375 kW Inverter Sized for Moderate Expansion of Initial System
 - 465,000 kWh per Year of AC Is Minimum Specified Production
 - 350,000 kWh per Year Needed to Offset UV Disinfection

Solar Power Project Summary

- Milender-White was Low Bidder (Out of 8)
- \$2.2 Million for 309 kW of DC Production:
 - \$745,000 for Siliken PV Panels (San Diego, Calif.)
 - \$200,000 for Satcon Inverter (Fremont, Calif.)
 - \$450,000 for Demo and Site Reclamation
 - \$225,000 for Panel Appurtenances (Racking, Ballasts)
 - \$180,000 for Remainder of Electrical Equipment
 - \$400,000 for Installation and Contractor O & P
- \$1.5 Million Zero Percent SRF Loan via ARRA
- Substantial Completion on July 23, 2010 (On Schedule)

Existing James R. DiIorio WRF



NEWER PLANT

4 Anaerobic Digesters and 2 Centrifuges

2 Primary Clarifiers

1 Trickling Filter

Screw Pumps

3 Secondary Clarifiers

4 Aeration Basins

Headworks

Gaseous Chlorine and Sulfur Dioxide Systems

OLD PLANT

Reclamation Area for 2.1 Acres of Solar PV Panels





























50°C WIRE SUNLIGHT RESISTANT 77 MAY 11 10-D

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Small white label with illegible text.



BLUE OAK
PV PRODUCTS

PHOTOVOLTAIC
DC DISCONNECT
AND POWER SOURCE

BLUE OAK
PV PRODUCTS

WARNING

CAUTION: This device is used to disconnect the photovoltaic array from the power source. It is used to disconnect the array from the power source during maintenance or in the event of a fire. It is used to disconnect the array from the power source during maintenance or in the event of a fire.

ON OFF

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Satcon™

POWER GENERATOR



ON OFF



UTILITY INTERACTIVE

MODEL	PVS-375	DATE	Apr-10
SER. #	99496A	ENCL.	3R
WEIGHT	3510 LBS	COOL. G	AIR FORCED
FACTORY	BURLINGTON, OH	MAX. AMBIENT TEMP	50° C
INPUT		OUTPUT	
V (MAX.)	600V DC	NO. # OF PHASE	3
V (RANGE)	300V DC-600V DC	POWER FACTOR	>0.99
I (MAX)	1227A DC	V (RANGE)	422V-528V
<small>(WITH FIELD ADJUSTABLE TRIP POINTS FOR VOLTAGE AND FREQUENCY)</small>		F (RANGE)	59.3Hz-60.5Hz

2010 8

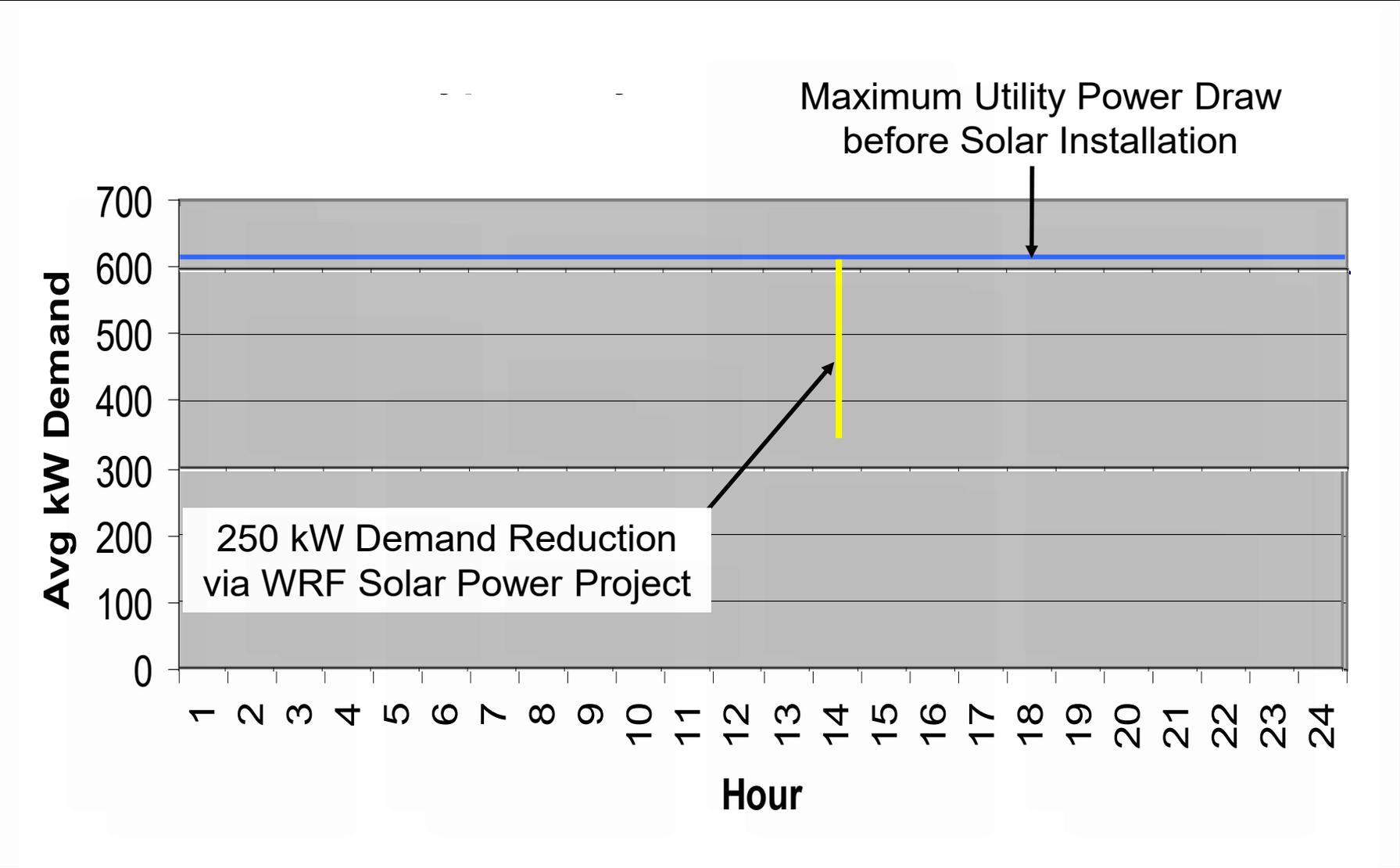
Preliminary Results

- 250 to 260 kW of Peak AC Power During Jul-Aug
- 66,876 kWh of AC Produced in First 40 Days
- 581,000 kWh of AC per Year (Based on NREL's PVwatts)
- 25% Higher than Minimum Specified Production
- 66% Higher than Needed to Offset UV Power Use
- 13% of Existing Power Use for Entire WRF
- 8-10% of Future Power Use for Entire WRF

Financial Summary

- \$2.2 Million Construction Cost
- \$200,000 Renewable Rebate from BHE
- \$66,000 per Year in REC Payments from BHE
- \$40,000 per Year in Reduced Utility Bills from BHE
- \$75,000 per Year for Zero Percent SRF Loan for 20 Years
- \$31,000 per Year Positive Cash Flow

Utility Power Draw after Solar Project Installation



Pueblo Solar Project Fun Facts

- 1344 Fixed Tilt PV Solar Panels by Siliken
- 60 Poly-Crystalline Cells per Panel
- 38° South Latitude, 180° Azimuth, 30° Panel Tilt
- 14.2% Sun to Electricity Capture Efficiency
- 230 watts DC per Panel
- Total 309 kW DC Power
- Total 264 kW of AC Power

Pueblo Solar Project Fun Facts

- Each Panel = 65" x 39" x 1.57" and 42 Pounds
- 14 Panels in Series = One String
- 12 Strings (168 Panels) Feed Each Combiner Box
- Panels Designed for 1" Hail Traveling at 52 mph
- Warranty and Guarantees:
 - 5-Year Materials and Workmanship
 - 90% of Initial Output after 10 Years
 - 80% of Initial Output after 25 Years

Federal Taxpayer Support of Coal Industry

- **Direct Spending on R&D Projects**
- **Tax Credits, Deductions, and Exemptions**
- **Low Interest Loans**
- **Loan Guarantees**
- **Loan Forgiveness**
- **Discounted Royalty Fees on Federal Lands**
- **Health Care and Environmental Costs**