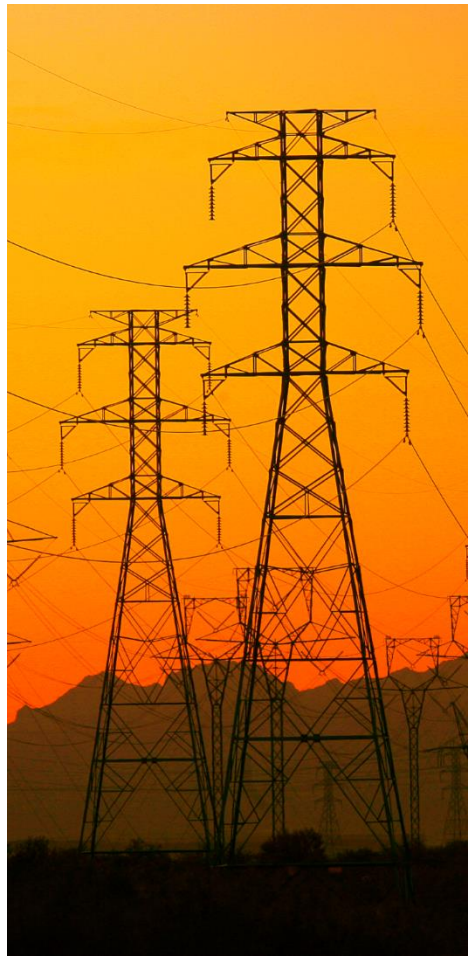
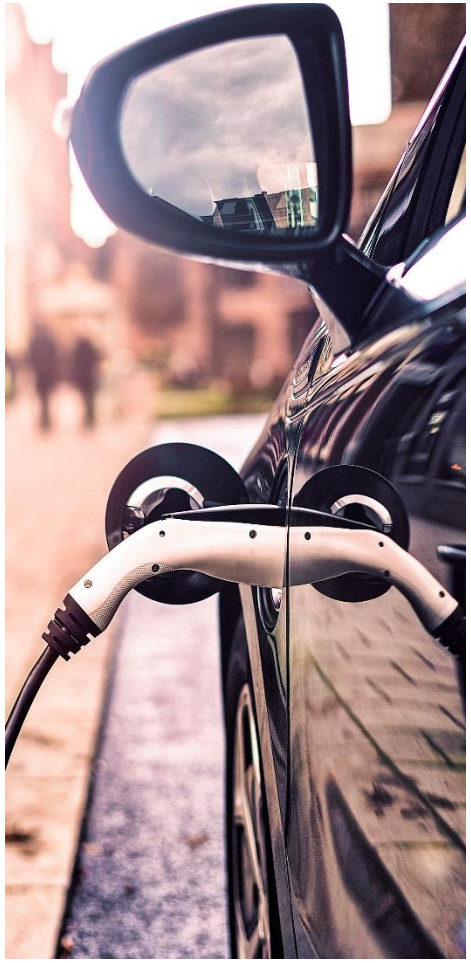


TEP Integrated Resource Plan

Advisory Council Meeting

Tucson Electric Power

June 20, 2019

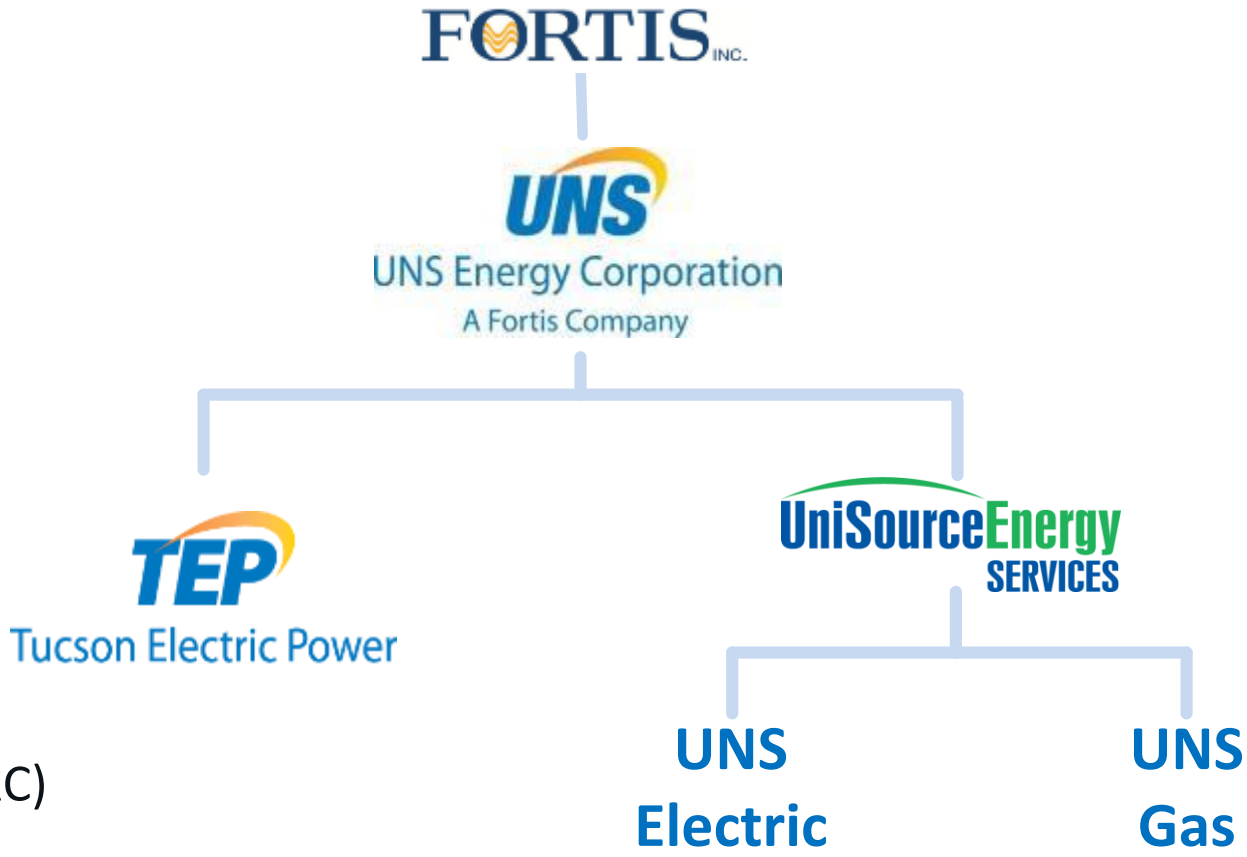
TEP's Supply-Side Resource Portfolio

JEFF YOCKEY
DIRECTOR, RESOURCE PLANNING

Tucson Electric Power

Corporate Overview

- Investor Owned
- Vertically Integrated
- Jurisdictional Regulation
  - Arizona Corporation Commission (ACC)
  - Federal Energy Regulatory Commission (FERC)



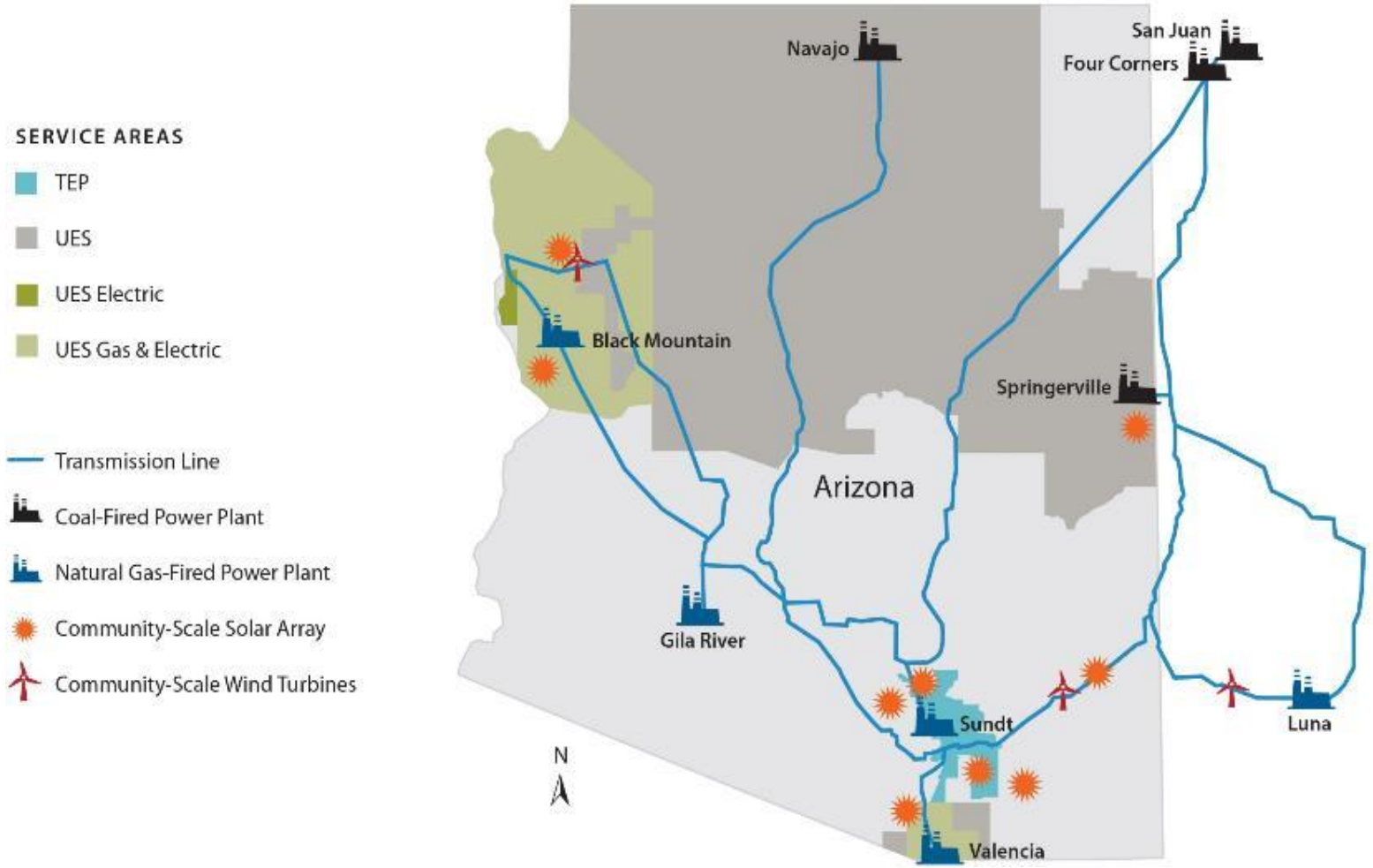
Service Territories and Resources

TEP
Tucson Electric Power
1892-2017
125 YEARS OF SERVICE

- 424,000 customers
- 1,500 employees
- Avg. years of service: 11

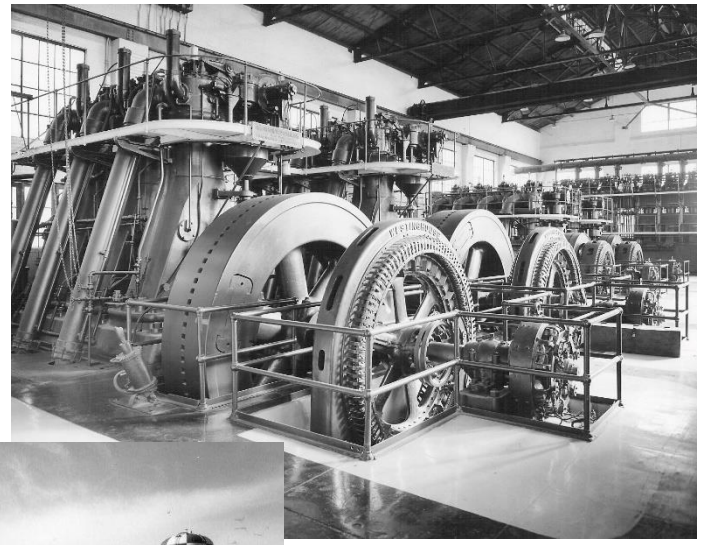
UniSourceEnergy
SERVICES

- 162,000 gas customers
- 95,000 electric customers
- 350 employees
- Avg. years of service: 11

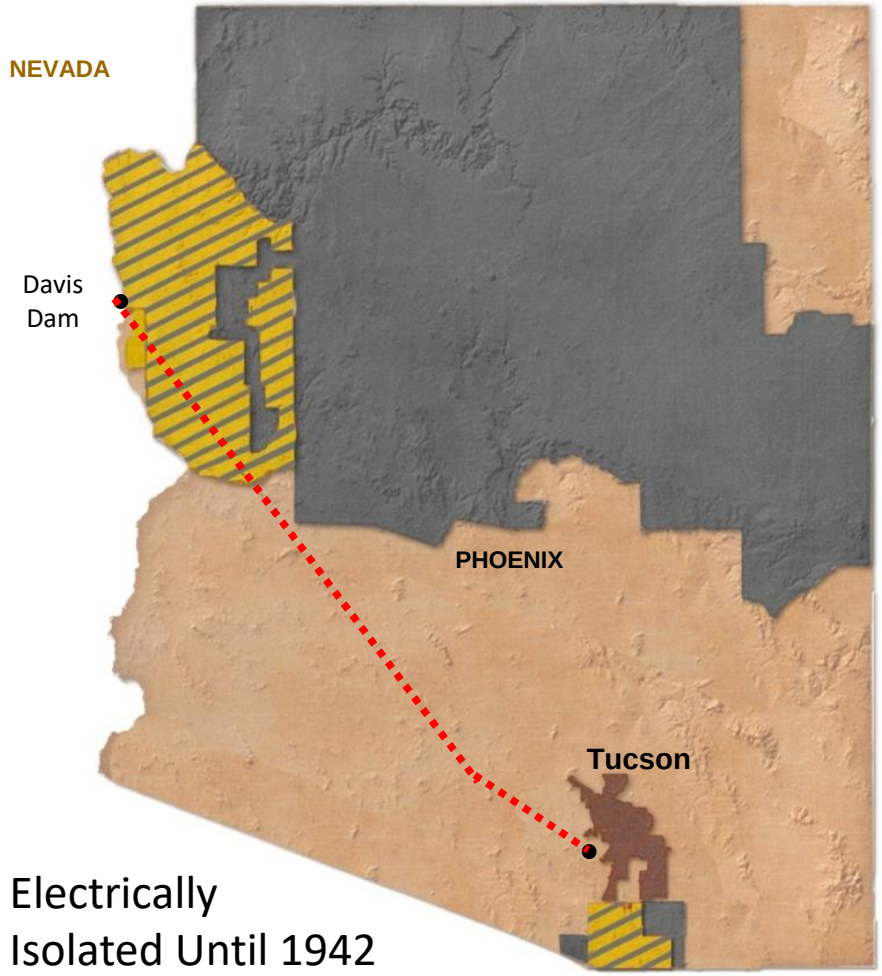


A Bit of History

220 W. 6th Street

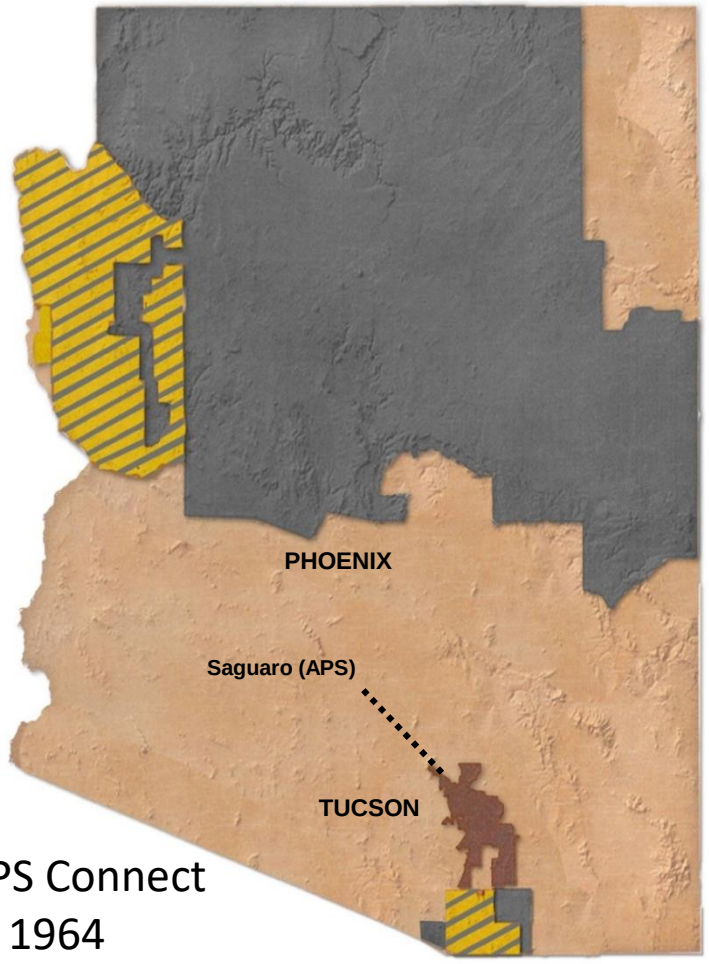


DeMoss Petrie

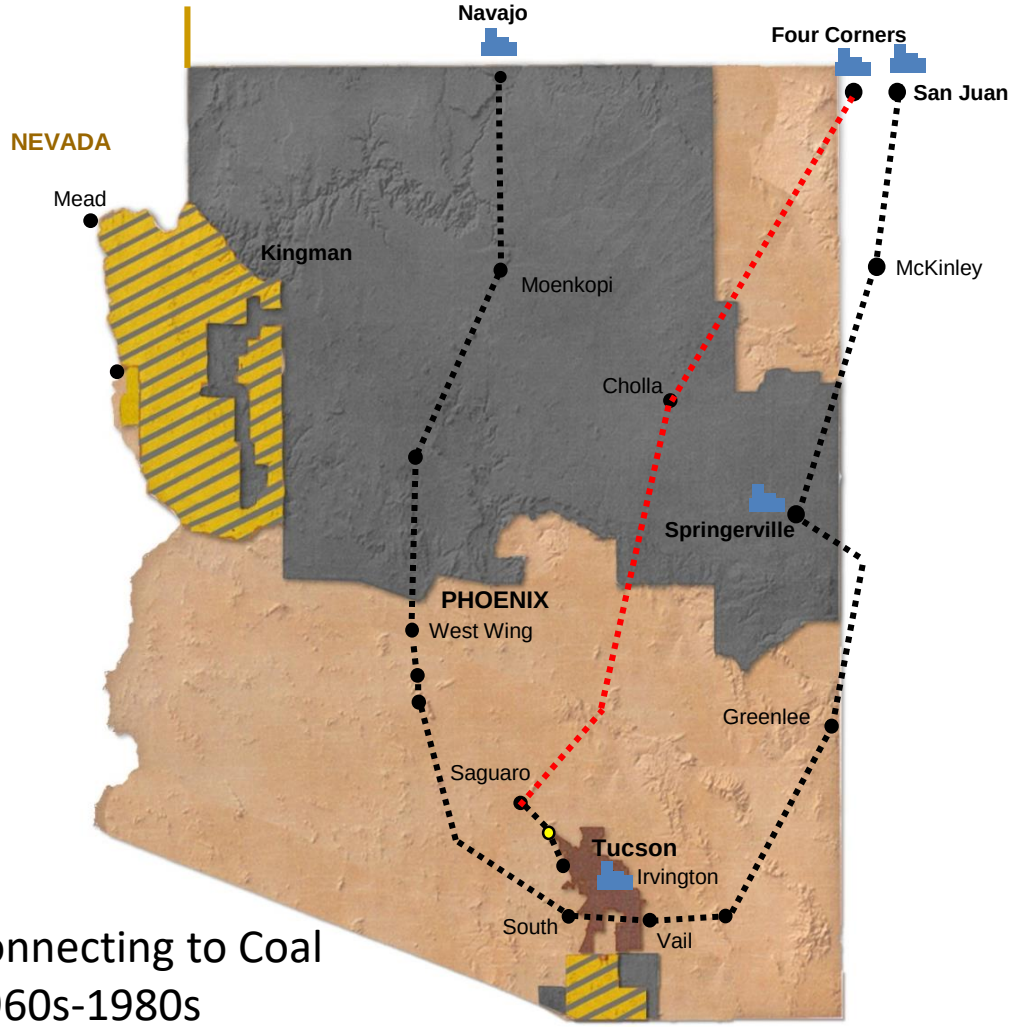


Electrically
Isolated Until 1942

Connecting to the Western Grid



TEP and APS Connect Systems in 1964



Connecting to Coal 1960s-1980s

Coal Resources

Springerville Generating Station

Four Corners Power Plant

San Juan Generating Station

Resource-	Unit Capacity (MW)	Ownership Percentage	TEP Capacity (MW)	Year In Service	Retirement Date	Fuel Supply	Environmental Controls			
							SO_2	NOx	PM	Hg
Four Corners 4 (TEP)	785	7%	55	1969	Jul-2031	Navajo Mine (New Mexico), Jul. 2031	WFGD	SCR	FF	WFGD, FF, CaBR2
Four Corners 5 (TEP)	785	7%	55	1970	Jul-2031	Navajo Mine (New Mexico), Jul. 2031	WFGD	SCR	FF	WFGD, FF, CaBR2
San Juan 1 (TEP)	340	50%	170	1976	Jun-2022	San Juan Mine (New Mexico)	WFGD	SNCR	FF	ACI
Springerville 1	387	100%	387	1985	Dec-2045	El Segundo (New Mexico), Dec. 2020	SDA	LNB SOFA	FF	ACI, $CaBR_2$
Springerville 2	406	100%	406	1990	Dec-2050	El Segundo (New Mexico), Dec. 2020	SDA	LNB SOFA	FF	ACI, $CaBR_2$

| ACI – Activated Carbon Injection | $CaBR_2$ – Calcium bromide (added to coal) | FF – Fabric filter (Bag House) | LNB SOFA – Low NOx burners - Separated over fire air |
| SDA – Spray Dryer Absorber | SCR – Selective Catalytic Reduction | SNCR – Selective non-Catalytic Reduction | WFGD – Wet Flue Gas Desulfurization |

H. Wilson Sundt Generating Station

- Diverse mix of technologies
  - Steam turbines
    - Two units to retire in 2020
  - Combustion turbines
    - Black start capable
  - Landfill gas
  - Solar thermal
- Direct connection to Kinder Morgan pipeline
- “Type 2” non-irrigation water use rights

Resource- Counterparty	TEP Capacity (MW)	Year In Service	Retirement Date	Fuel(s)	NOx Controls
H Wilson Sundt ST3	104	1962	Dec-2032	Natural Gas & Fuel Oil	LNB
H Wilson Sundt ST4	156	1967	Dec-2048	Natural Gas	LNB SOFA
H Wilson Sundt CT1	25	1972	Dec-2027	Natural Gas & Fuel Oil	None
H Wilson Sundt CT2	25	1972	Dec-2027	Natural Gas & Fuel Oil	None

| LNB – Low NOx Burner | LNB SOFA – Low NOx Burners - Separated Over Fire Air |

Natural Gas Combustion Turbines

North Loop

DeMoss Petrie

Resource- Counterparty	TEP Capacity (MW)	Year In Service	Retirement Date	Fuel(s)	NOx Controls
DeMoss Petrie	75	2001	Dec-2046	Natural Gas	DLN1
North Loop 1	25	1972	Dec-2027	Natural Gas & Fuel Oil	None
North Loop 2	25	1972	Dec-2027	Natural Gas & Fuel Oil	None
North Loop 3	25	1972	Dec-2027	Natural Gas & Fuel Oil	None
North Loop 4	21	2001	Dec-2046	Natural Gas	Water injection

| DLN1 - Dry Low NOx Burner | NA – Not Applicable |

Natural Gas Combined Cycle

Gila River Generating Station

Luna Energy Facility

Resource	Unit Capacity (MW)	Ownership Percentage	TEP Capacity (MW)	Year In Service	Retirement Date	Fuel Supply	NOx Controls
Gila River Unit 2*	550	100%	550	2001	Dec-2048	Kinder Morgan/ Transwestern	SCR
Gila River Unit 3	550	75%	413	2001	Dec-2048	Kinder Morgan/ Transwestern	SCR
Luna Energy Facility	555	33%	185	2006	Dec-2051	Kinder Morgan	SCR

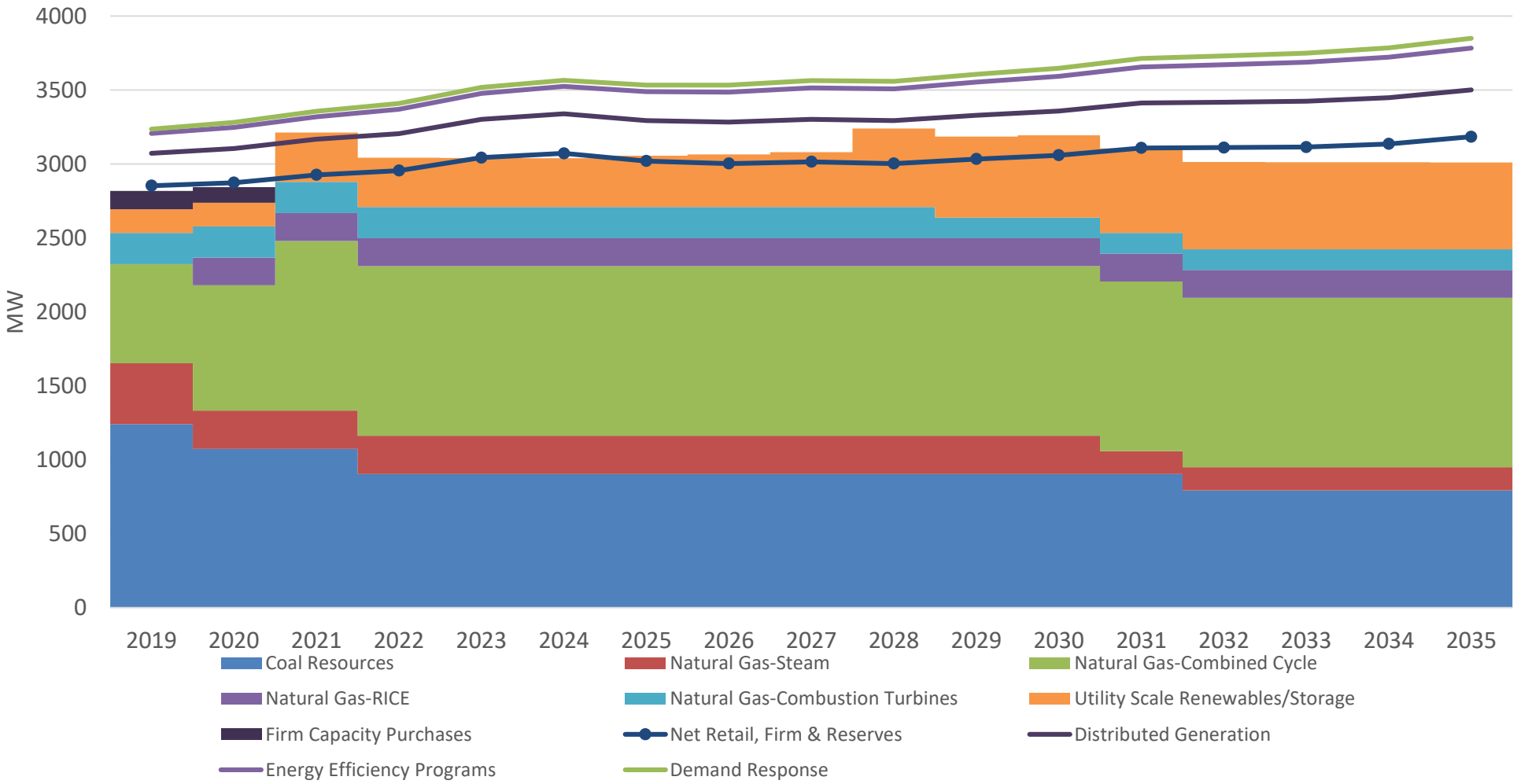
*TEP intends to purchase the unit before the end of this year

| SCR – Selective Catalytic Reduction |

Renewable Resources

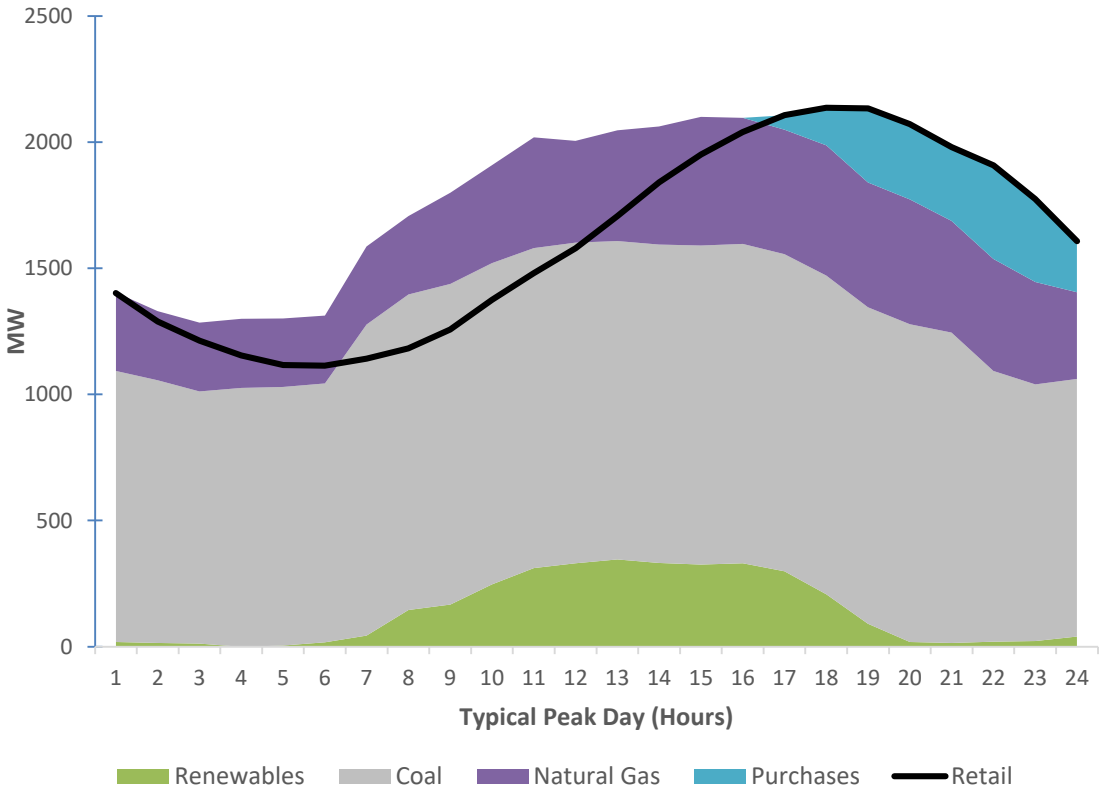
	Utility-Scale Fixed Solar PV	Utility-Scale Tracking Solar PV	Utility-Scale Wind	Rooftop Solar PV
ZERO Emissions				
Capacity Factor	23%	31%	27%	23%
Net Peak Coincidence (individual resources)	34% (declining)	63% (declining)	23%	34% (declining)
2019 Capacity MW_{AC}	46	150	80	240

Preliminary Loads and Resources 2020

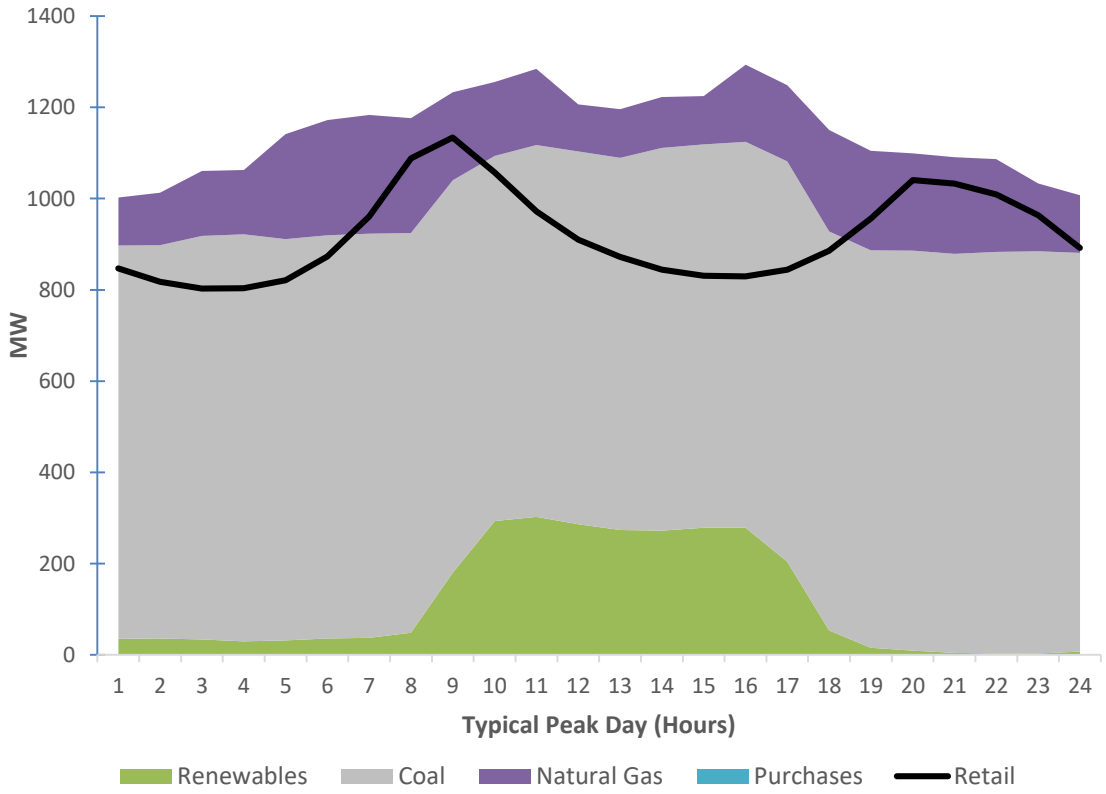


Daily Dispatch Profiles

Example Summer Day Dispatch



Example Winter Day Dispatch



New Resources

- Oso Grande Wind
- Wilmot Energy Center Solar and Battery Storage
- Borderlands Wind
- Reciprocating Internal Combustion Engines at H. Wilson Sundt Generating Station
- Gila River Power Station Unit 2

New Resources

LEE ALTER
LEAD SUPPLY-SIDE PLANNER

MIKE SHEEHAN
SR. DIRECTOR, FUELS AND RESOURCE PLANNING

TEP
Tucson Electric Power

New Renewable Resources: Wilmot and Borderlands

Wilmot Solar Energy Center

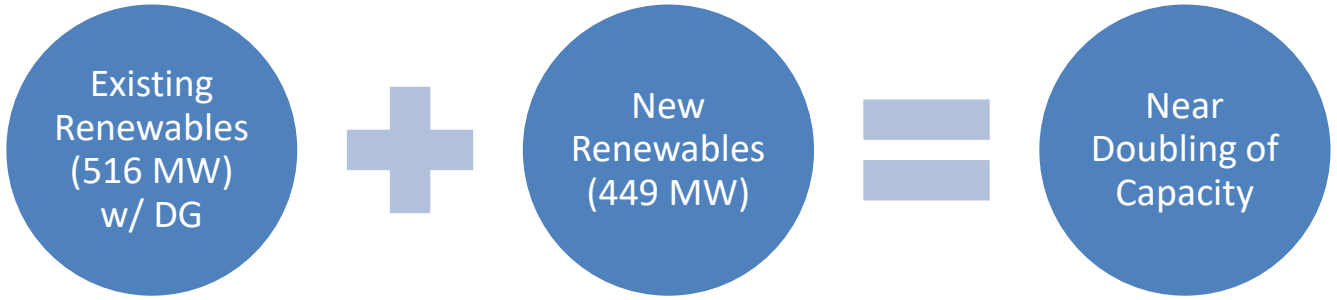
- 100 MW single-axis tracking Solar PV
- 30 MW 4-hour battery
- Interconnects to our local 138kV system
- New substation; support future development
- Operational by end of 2020

Borderlands Wind

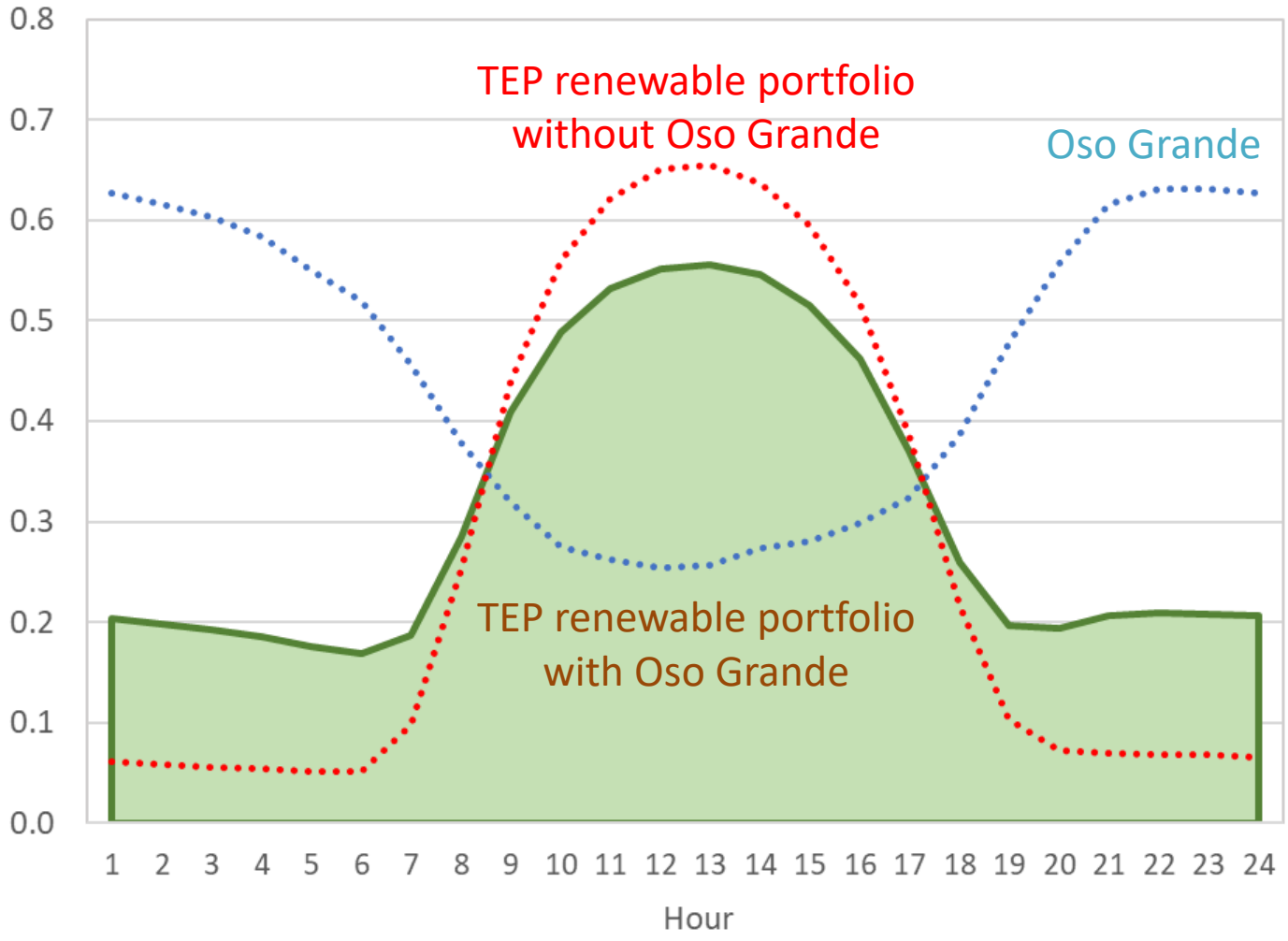
- 99 MW in Catron County, NM
- 40 – 2.47 MW GE turbines
- Interconnects to the 345kV system near Springerville Generating Station
- Utilizes existing transmission
- Operational by end of 2020

New Renewable Resources: Oso Grande

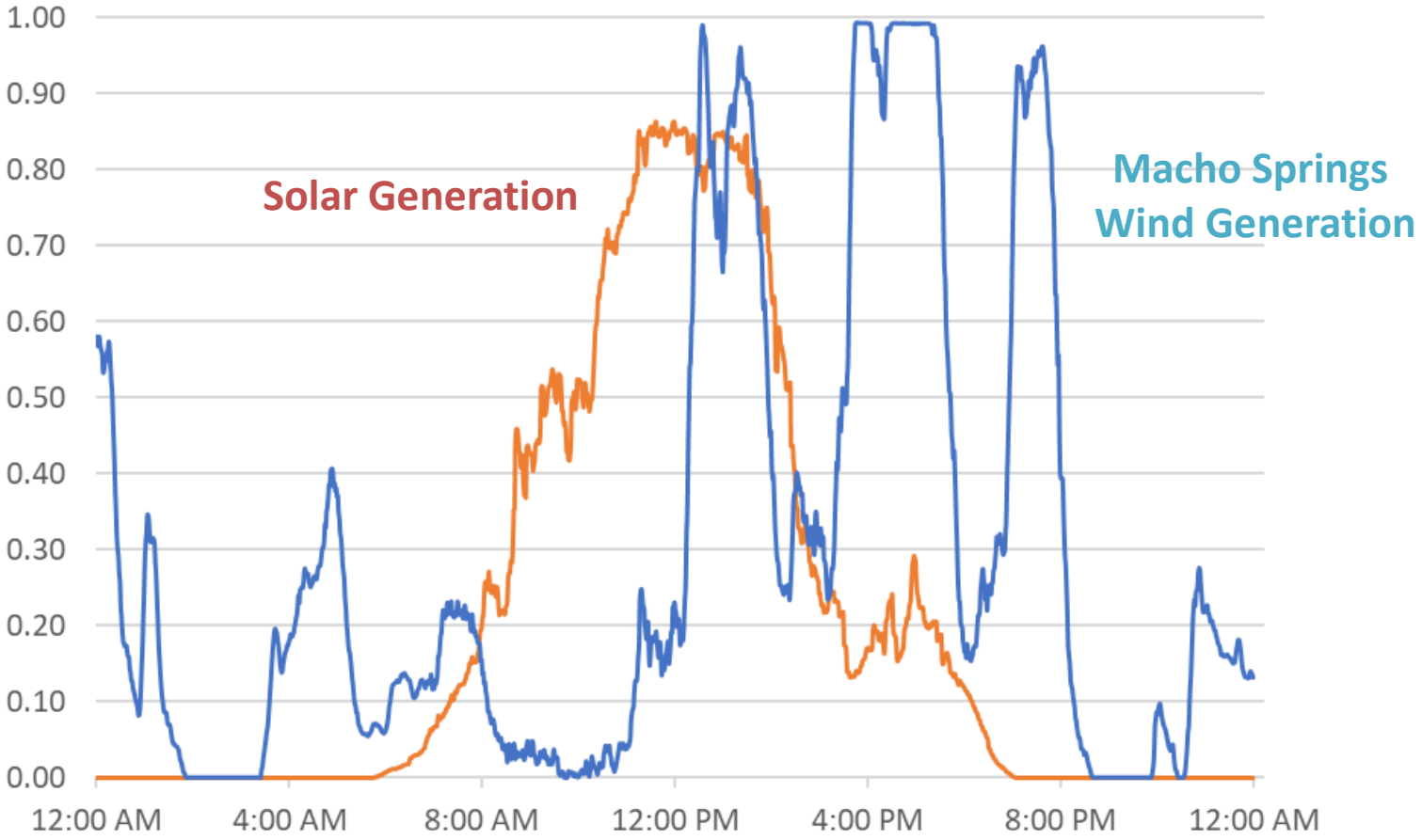
- 250 MW of high-quality wind in southeast NM (capacity factor of 45%)
- Capital cost of $370M, or $1,500/kW
- Operational by end of 2020
- Qualifies for federal production tax credit
  - Reduces levelized generation cost from 4.6 to 2.4 ¢/kWh
- Complements solar energy production



TEP Renewable Energy Generation Profiles



Renewable Energy Generation, 5/12/2019

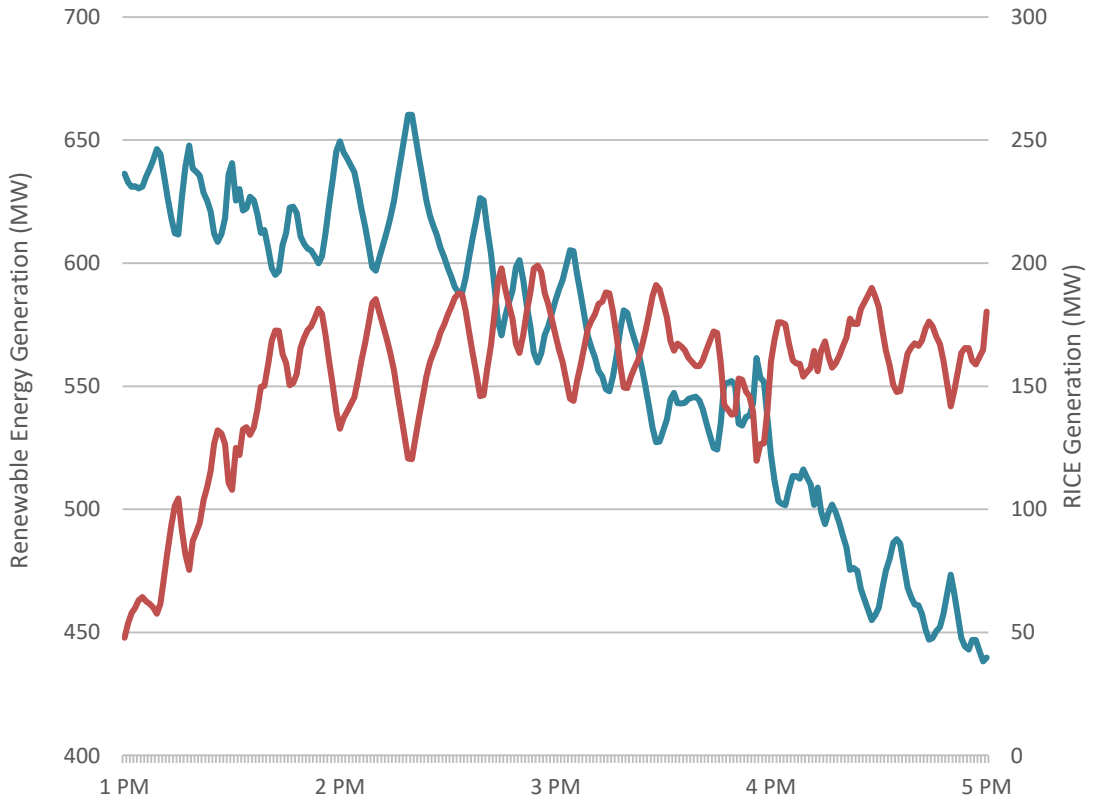


New Thermal Resources: Sundt Energy Modernization Project

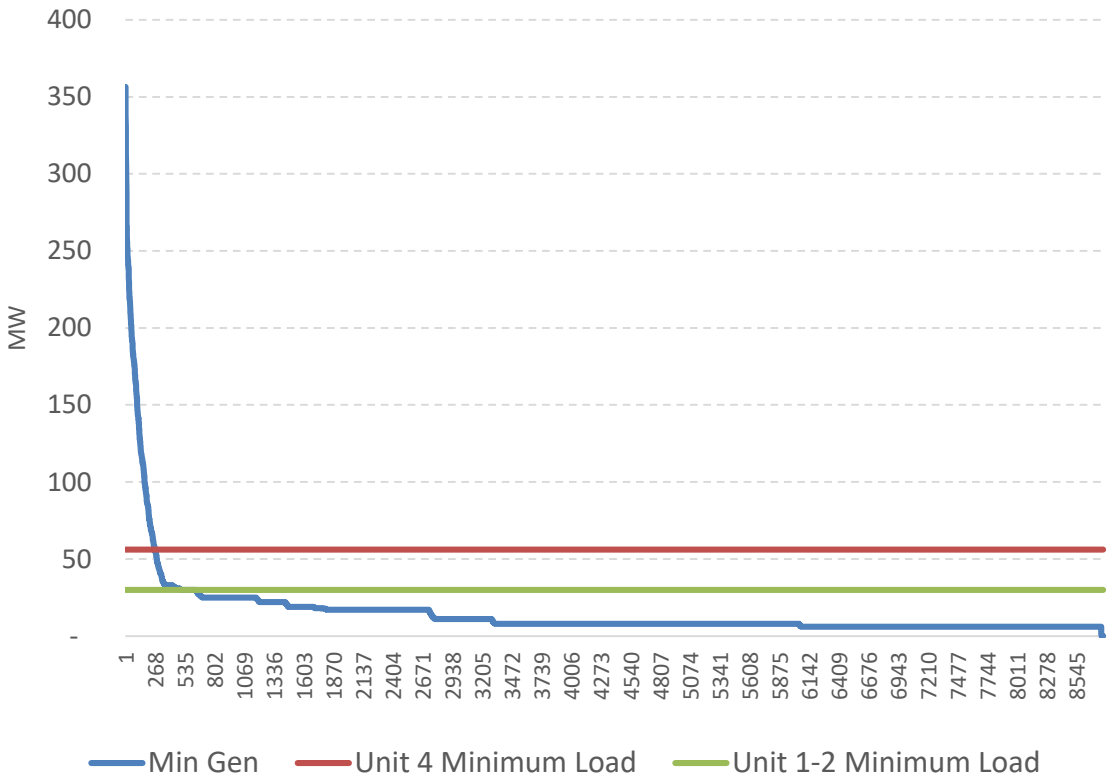
- 10 reciprocating internal combustion engines (RICEs) at Sundt Generating Station
- 182 MW of fast-start, fast-ramping capability
- Cost-effective, reliable means of integrating high levels of renewable energy
- Capital cost of $160M, or $850/kW
- Operational by 1st quarter of 2020
- Replacing 162 MW of aging generation (circa 1960)

RICE System Benefits

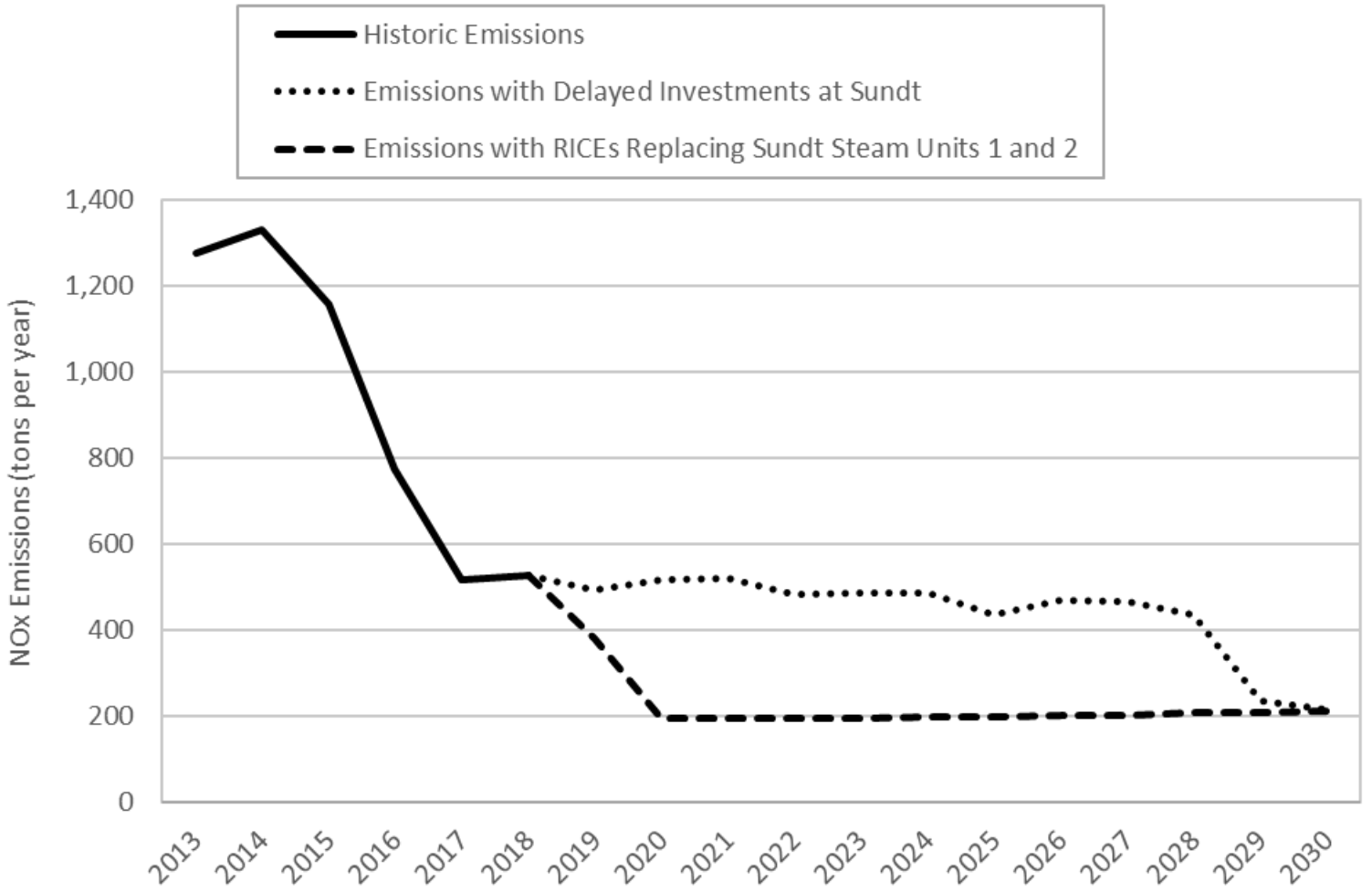
Renewable Integration



Reliability Must Run Benefit

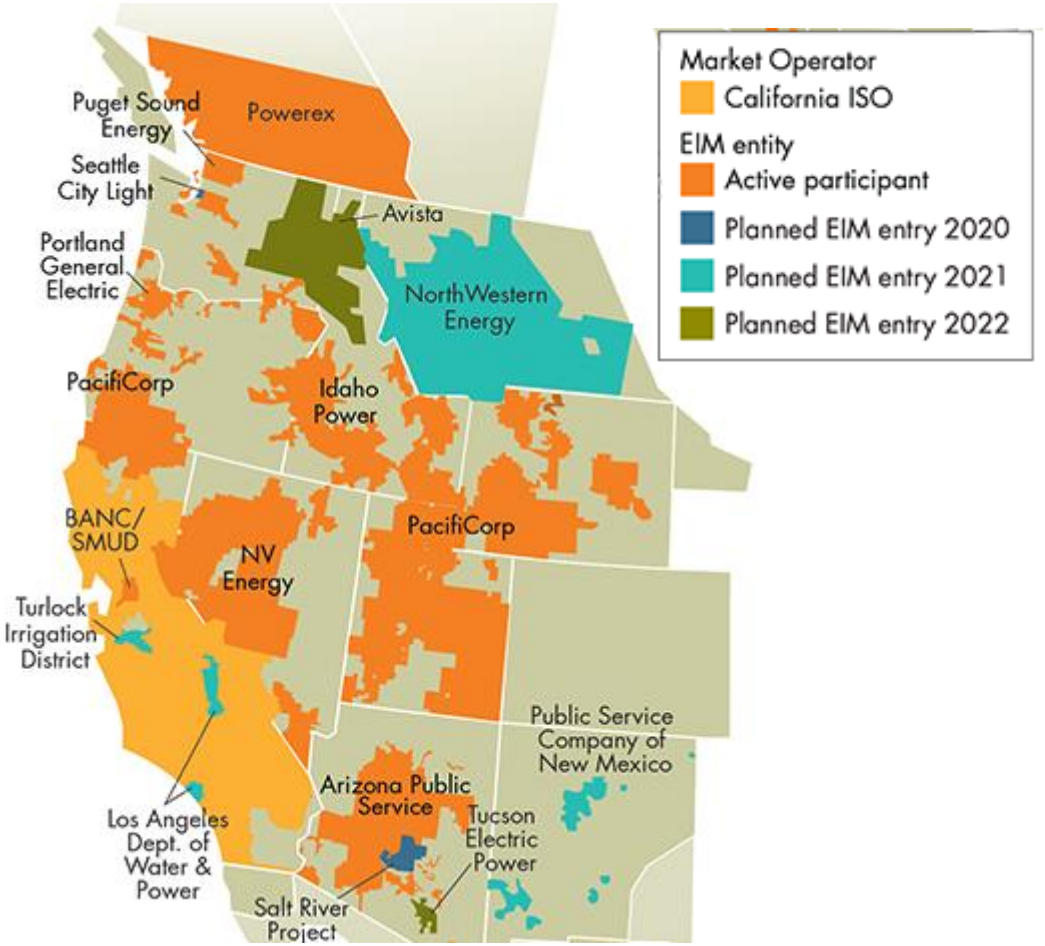


RICE Emissions Benefits



Energy Imbalance Market

- EIM Benefits Analysis by E3, November 2018
  - Update to study performed in 2016
  - Since then additional utilities have committed to EIM
  - Studied 2022
- Results
  - TEP benefits as a seller and a buyer
  - Total expected base benefits of $13M per year
- TEP to begin participating April 2022



TEP's Resource Transition

Projected Targets
Renewable Energy as Percentage of Retail Sales (Utility Scale + Rooftop Solar)

2018 — **13%**

277 MW AC – Utility Scale
250 MW AC – Solar DG
527 MW AC – Total

2021 — **28%**

728 MW AC – Utility Scale
298 MW AC – Solar DG
1026 MW AC – Total

2017
Battery Storage
20 MW

2018
Gila River Unit 2
550 MW

2019
Community Solar
5 MW

2020
Sundt Units 1 - 2
-160 MW

2020
Reciprocating Engines
182 MW

2020
Borderlands
99 MW

2020
Oso Grande
247 MW

Future Renewables and Energy Storage

2019

2020

2030

2015
Sundt Unit 4
-130 MW

2017
San Juan Unit 2
-170 MW

2019
Navajo Units 1-3
-168 MW

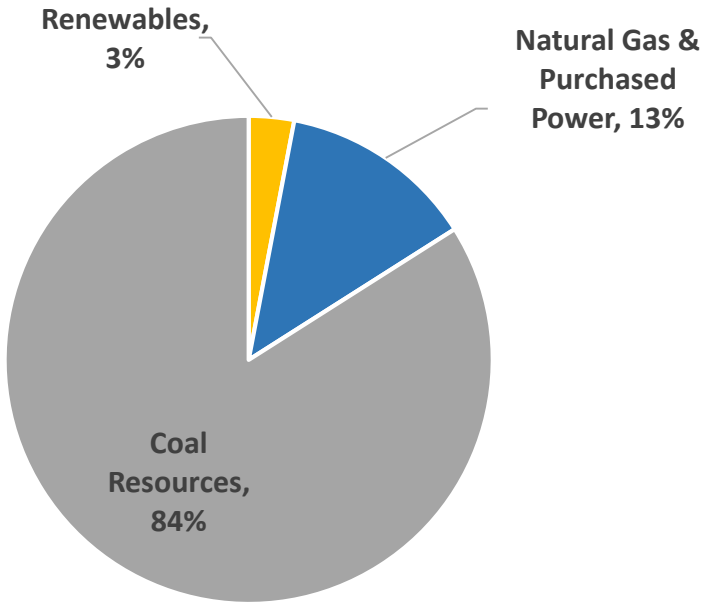
2020
Wilmot Solar
Solar 100 MW
Storage 30 MW

June 2022
San Juan Unit 1
-170 MW

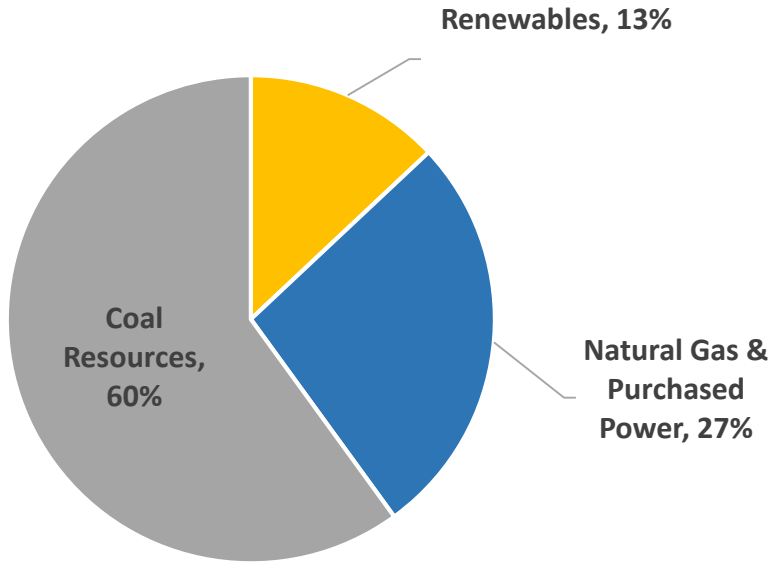
2031
Four Corners Power Plant
-110 MW

TEP's Decade of Resource Transition

2013
1541 MW Coal

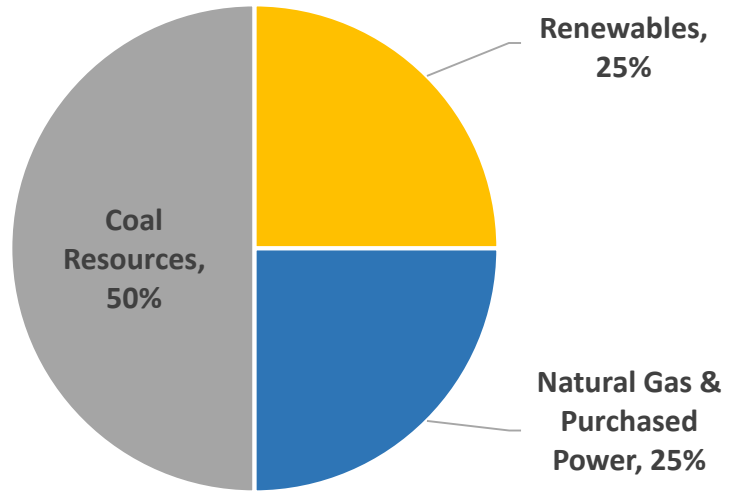


2018
1241 MW Coal



19% Reduction in Coal Capacity
300 MW

2023
903 MW Coal



41% Reduction in Coal Capacity
638 MW

Overview of Gila River Unit 2

Gila River Power Station – Unit 2

20-Year Tolling Power Purchase Agreement
TEP has Purchase Option for $300/kW

Operator: Salt River Project
Location: Gila Bend, Arizona
Unit Capacity: 550 MW

- Acquisition strategy developed in early 2016 in association with meeting compliance under the Clean Power Plan.
- TEP and Salt River Project partnered in effort to acquire the asset from a bankrupt merchant generator *($500M Savings vs. New Build).*
- Low turndown and fast ramping capabilities part of TEP's near-term strategy to cost effectively integrate higher level of renewables.
- 50% reduction in CO_2 emissions versus the equivalent generation from coal.
- Key part of TEP's CO_2 reduction strategy going forward.