

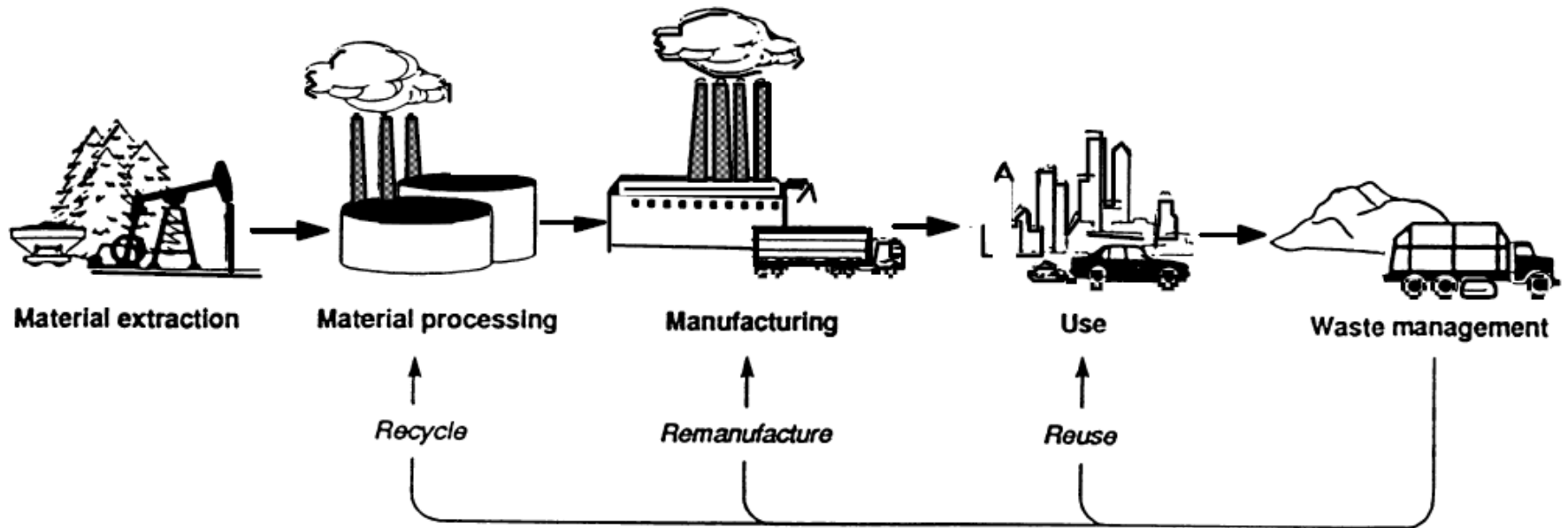


Peak  
Alliance  
for a Sustainable Future

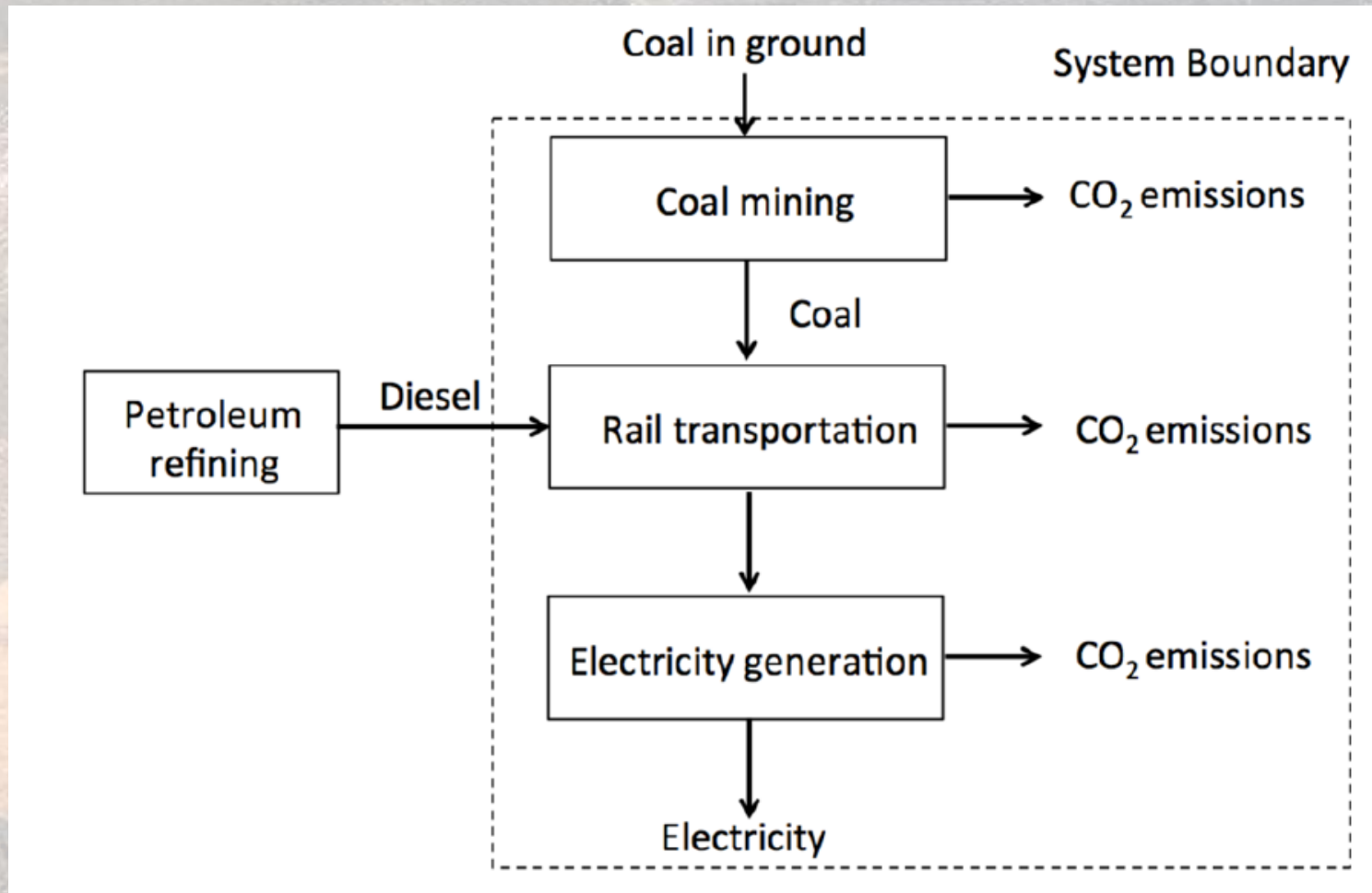
# Measuring Environmental Impact: Assessing alternative energy resources

# Life Cycle Assessment:

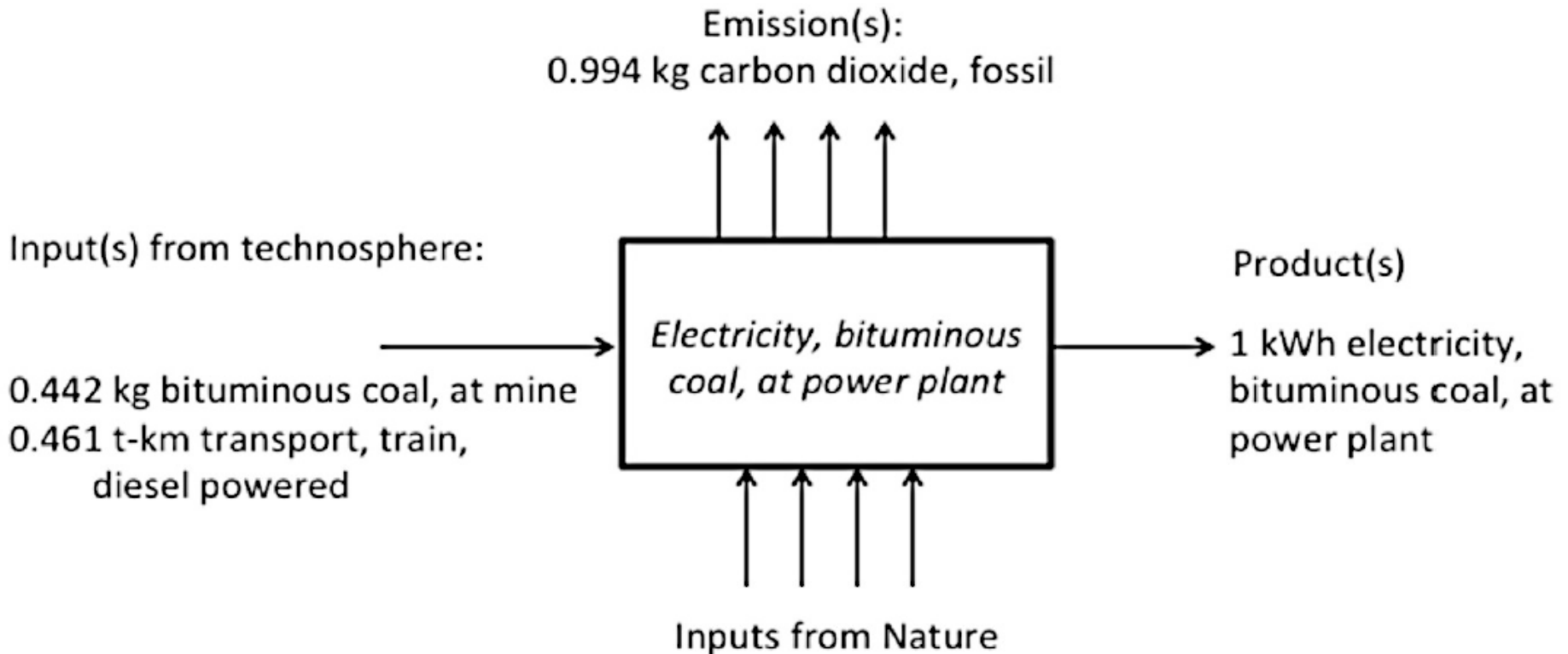
Quantitative Approaches  
for Decisions That Matter



# Coal Product System Diagram

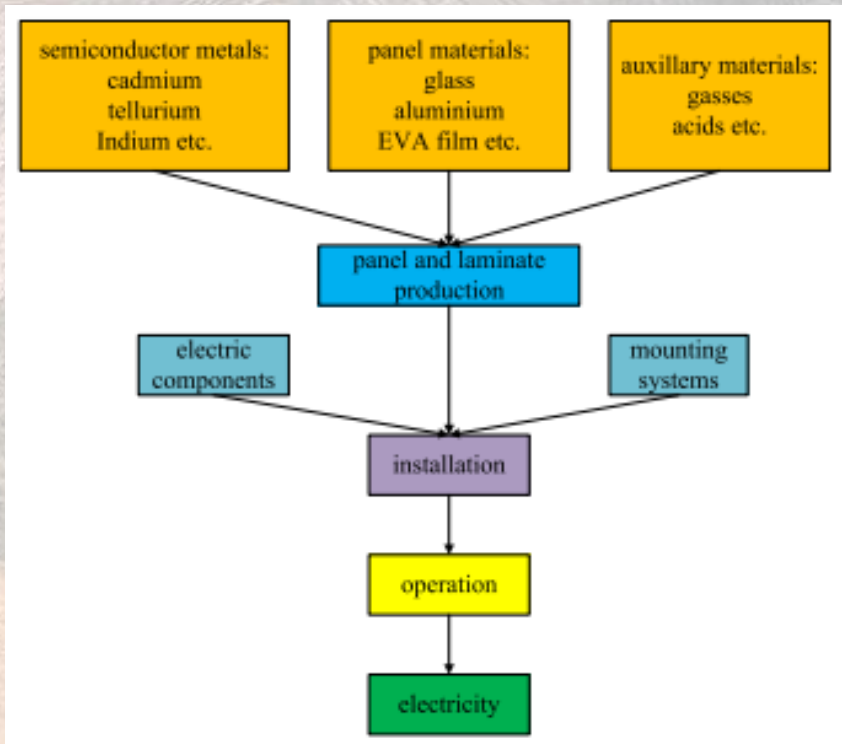


# Coal Unit Process Diagram

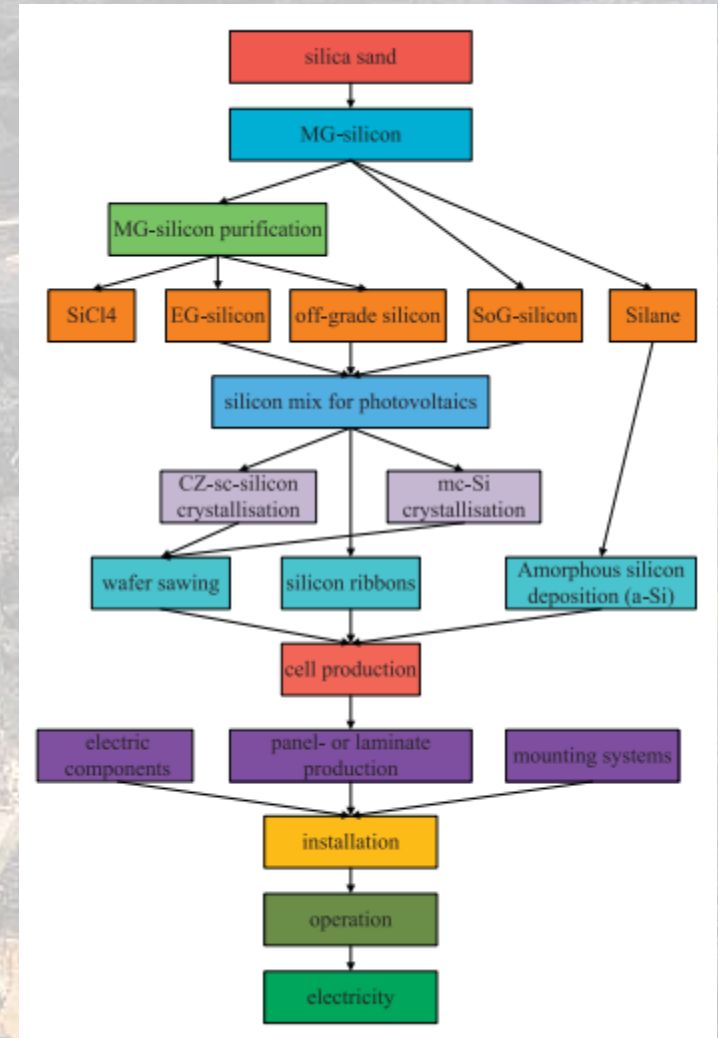


# PV System Diagram

## Solar PV Manufacturing Process

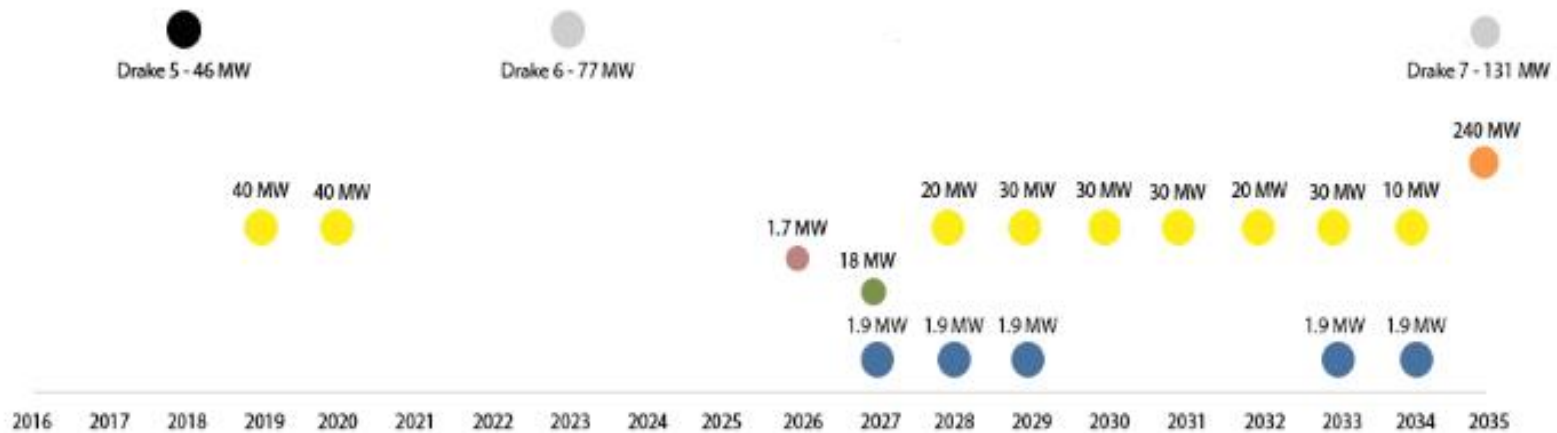


Flow chart of PV modules



# CSU Electric Integrated Resource Plan

## Electric Integrated Resource Planning Approved portfolio under proposed Clean Power Plan



- **Residential demand response:**  
program that cycles air-conditioning load during peak times
- **Conservation voltage reduction:**  
program that lowers voltage during peak times
- **Solar:** photovoltaic arrays

- **Combined-cycle power plant:**  
higher efficiency natural gas unit to be used for peaking, cycling or base-load
- **Biogas reciprocating engine:**  
convert gas from solid handling facility into energy
- **Decommissioned capacity:** no later than 2017
- **Tentative dates for decommissioned capacity:**  
no later than 2035

# CSU Solar Projects

## **Palmer Solar Project**

We signed a 20-year contract with Colorado-based renewable energy company juwi Inc. (juwi) to supply us with renewable energy from the Palmer Solar Project totaling 60 megawatts.

The approximately 500-acre site selected for this project is part of Woodmoor Water and Sanitation District's property, located in El Paso County. juwi will be responsible for developing, building and operating the facility planned to come online by December 2020.

## **Grazing Yak Project**

We signed a 25-year contract with NextEra Energy Resources (NextEra), the largest generator of solar and wind power in North America, to supply us with renewable energy from the Grazing Yak Project totaling 35 megawatts.

The approximately 270-acre site selected for this project located south of Calhan, Colo. NextEra will be responsible for developing, building and operating the facility planned to come online in late 2019.

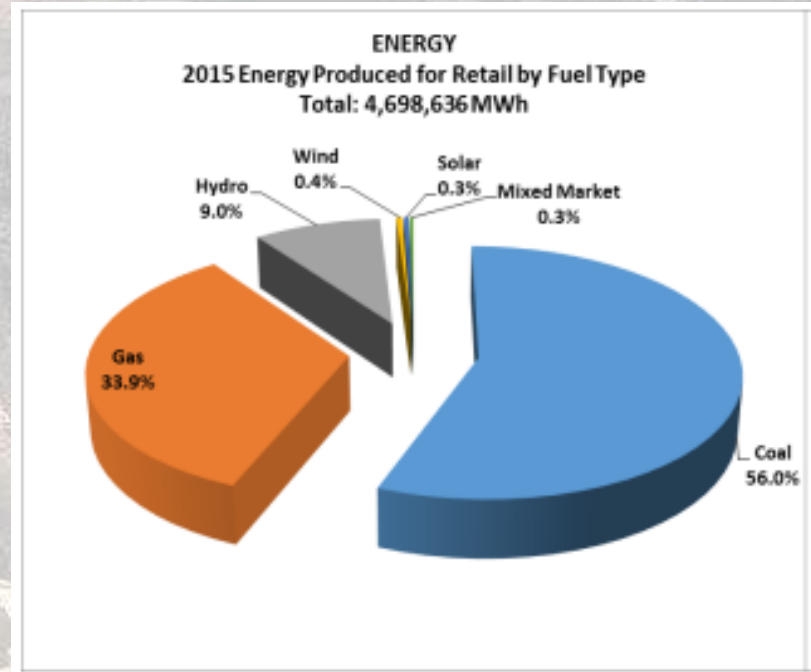
## **Clear Spring Ranch solar array**

Our 10-megawatt solar array built on approximately 156 acres at our Clear Spring Ranch facility is our first solar project that is truly for the benefit of all our customers. The new array powers approximately 3,000 homes annually.

The solar array, built in coordination with NextEra Energy, consists of 42,000 panels.

# CSU Load Forecast & Current Mix

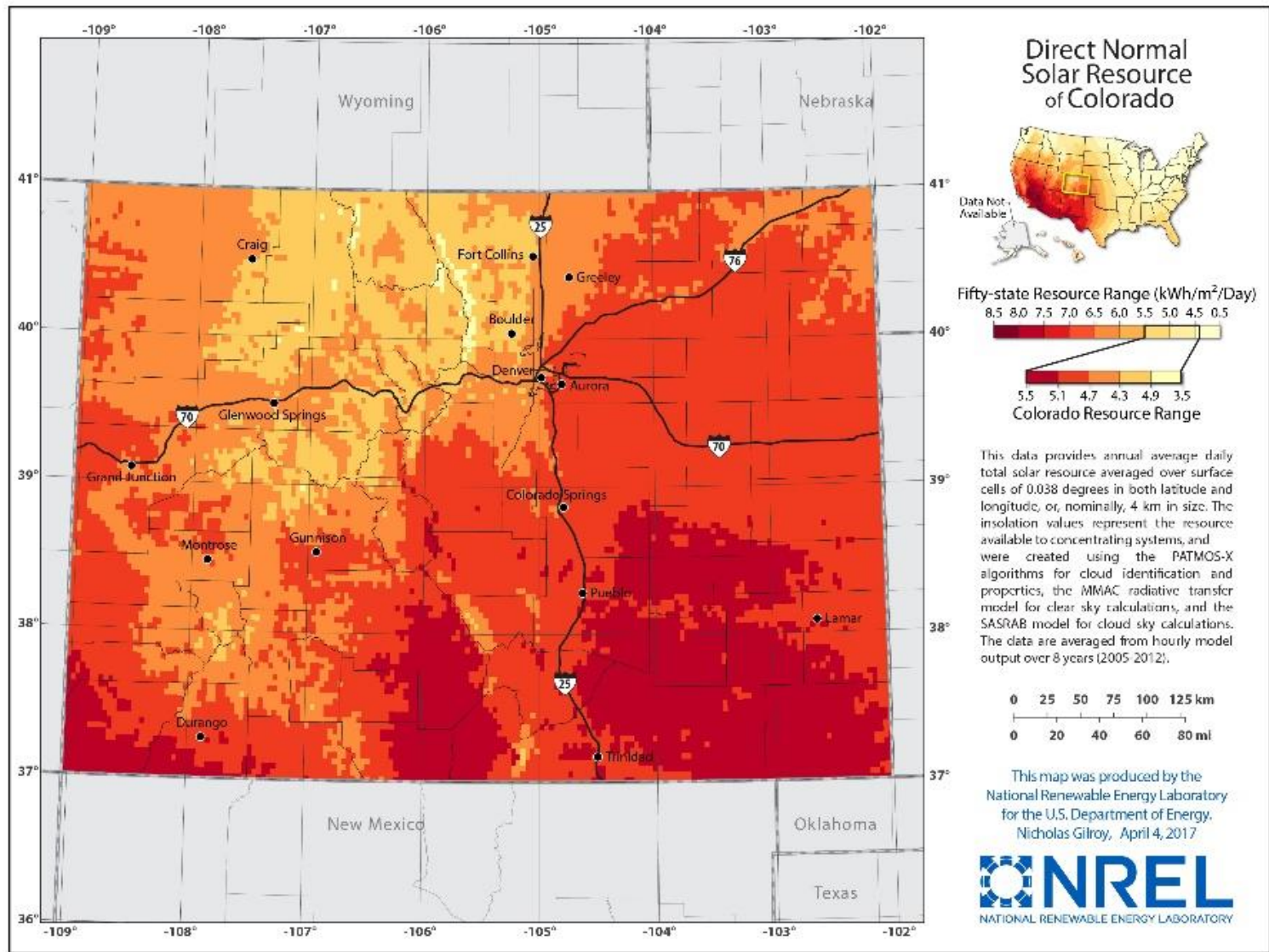
2015 Electric Load Forecast					
	System Energy		System Peak		System Load Factor
	Level (GWh)	Change (%)	Level (MW)	Change (%)	Annual (%)
2014	4,655		879		60%
2015	4,681	0.6%	905	3.0%	59%
2016	4,718	0.8%	917	1.3%	59%
2017	4,744	0.5%	926	1.0%	58%
2018	4,774	0.6%	934	0.8%	58%
2019	4,811	0.8%	941	0.8%	58%
2020	4,853	0.9%	948	0.8%	58%
2021	4,887	0.7%	956	0.8%	58%
2022	4,933	0.9%	964	0.9%	58%
2023	4,980	1.0%	973	0.9%	58%
2024	5,033	1.1%	982	0.9%	58%
2025	5,075	0.8%	989	0.7%	59%
2026	5,113	0.8%	998	0.9%	59%
2027	5,152	0.8%	1,007	0.9%	58%
2028	5,192	0.8%	1,016	0.9%	58%
2029	5,231	0.8%	1,025	0.9%	58%
2030	5,271	0.8%	1,034	0.9%	58%
2031	5,311	0.8%	1,044	0.9%	58%
2032	5,352	0.8%	1,053	0.9%	58%
2033	5,393	0.8%	1,063	0.9%	58%
2034	5,434	0.8%	1,072	0.9%	58%
2035	5,476	0.8%	1,082	0.9%	58%



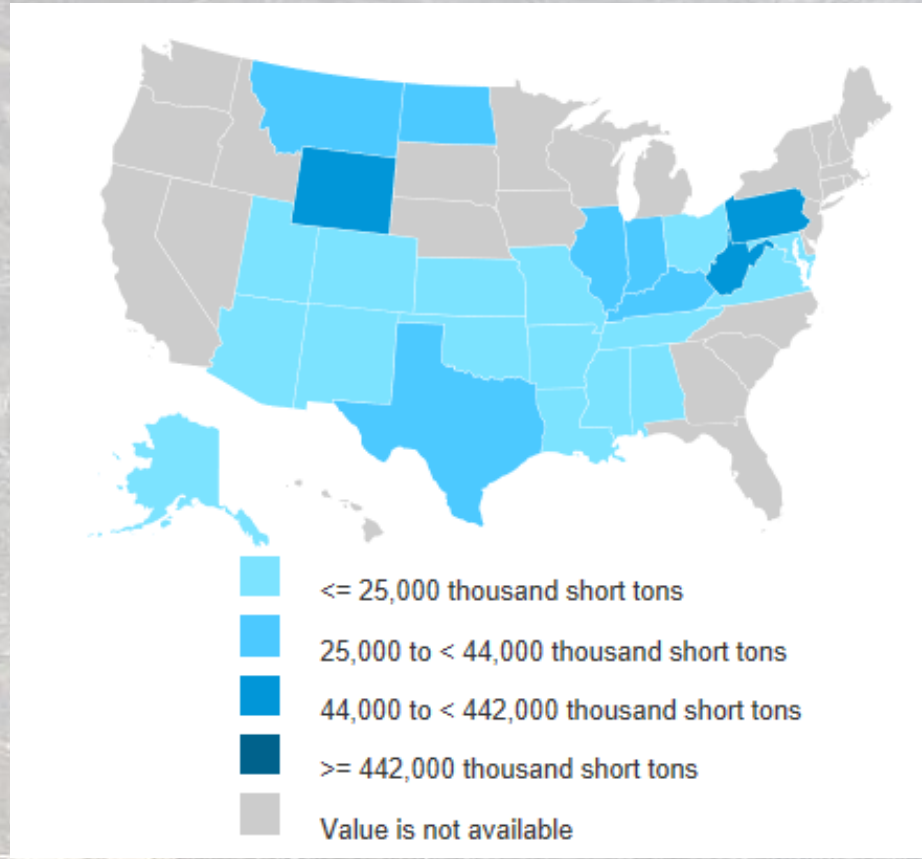


# Emissions Estimate from Solar Displacement


	4,853 GWh	2020 CSU Load Forecast		
	4,853,000 MWh			
	4,853,000,000 KWh	Coal Production	20% Displaced by Solar Production	
		2,717,680,000	543,536,000	900 g CO2 eq savings
		0.56	0.2	489,182,400,000 Grams
				489,182,400 Kilograms
DSM Estimate	4,270,640,000	2,391,558,400	478,311,680	900 g CO2 eq savings
		0.56	0.2	430,480,512,000 Grams
				430,480,512 Kilograms
				430,480.51 Metric tons

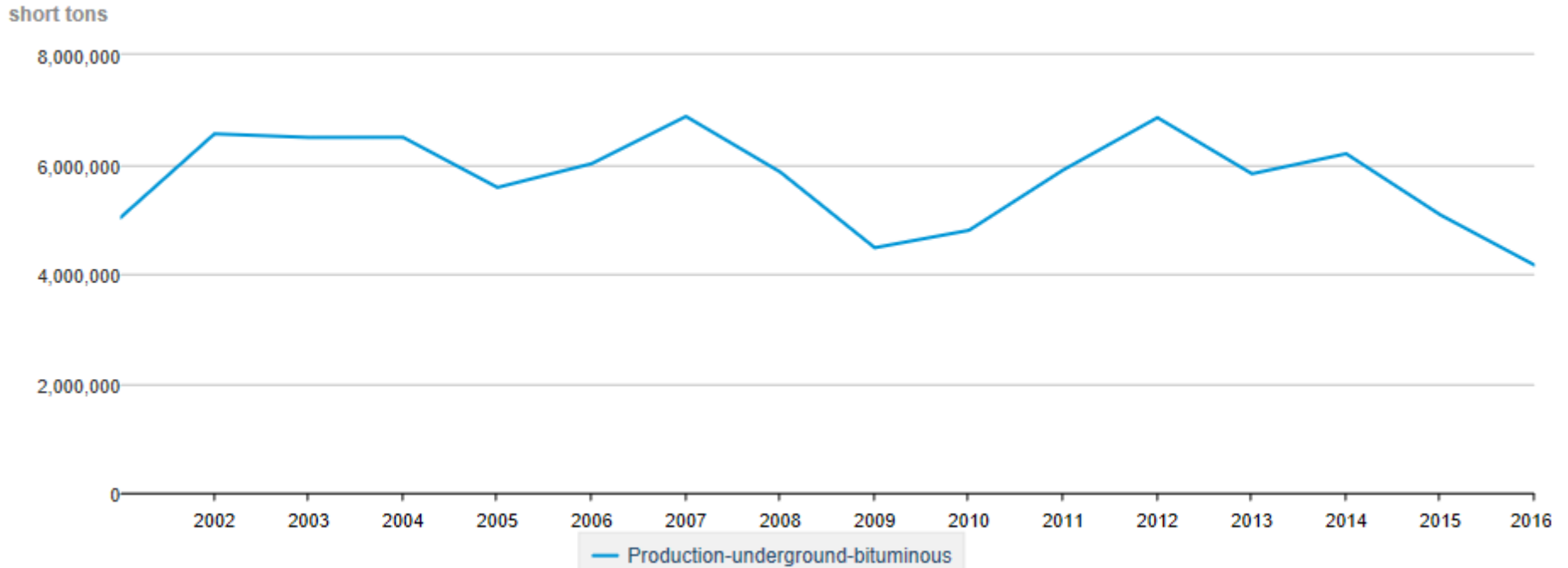


Rank	State	Coal Production (thousand short tons)	
1	Wyoming	297,218	<div style="width: 100%; height: 10px; background-color: #003366;"></div>
2	West Virginia	79,757	<div style="width: 26.9%; height: 10px; background-color: #003366;"></div>
3	Pennsylvania	45,720	<div style="width: 15.4%; height: 10px; background-color: #003366;"></div>
4	Illinois	43,422	<div style="width: 14.6%; height: 10px; background-color: #003366;"></div>
5	Kentucky	42,868	<div style="width: 14.4%; height: 10px; background-color: #003366;"></div>
6	Texas	39,001	<div style="width: 13.1%; height: 10px; background-color: #003366;"></div>
7	Montana	32,336	<div style="width: 10.9%; height: 10px; background-color: #003366;"></div>
8	Indiana	28,767	<div style="width: 9.7%; height: 10px; background-color: #003366;"></div>
9	North Dakota	28,121	<div style="width: 9.4%; height: 10px; background-color: #003366;"></div>
10	Utah	13,966	<div style="width: 4.7%; height: 10px; background-color: #003366;"></div>
11	New Mexico	13,341	<div style="width: 4.5%; height: 10px; background-color: #003366;"></div>
13	Colorado	12,634	<div style="width: 4.2%; height: 10px; background-color: #003366;"></div>
14	Ohio	12,564	<div style="width: 4.2%; height: 10px; background-color: #003366;"></div>
15	Alabama	9,643	<div style="width: 3.2%; height: 10px; background-color: #003366;"></div>
16	Arizona	5,423	<div style="width: 1.8%; height: 10px; background-color: #003366;"></div>
17	Mississippi	2,870	<div style="width: 0.9%; height: 10px; background-color: #003366;"></div>
18	Louisiana	2,798	<div style="width: 0.9%; height: 10px; background-color: #003366;"></div>
19	Maryland	1,616	<div style="width: 0.5%; height: 10px; background-color: #003366;"></div>
20	Alaska	932	<div style="width: 0.3%; height: 10px; background-color: #003366;"></div>
21	Oklahoma	654	<div style="width: 0.2%; height: 10px; background-color: #003366;"></div>
22	Tennessee	644	<div style="width: 0.2%; height: 10px; background-color: #003366;"></div>
23	Missouri	234	<div style="width: 0.08%; height: 10px; background-color: #003366;"></div>
24	Arkansas	49	<div style="width: 0.02%; height: 10px; background-color: #003366;"></div>
25	Kansas	27	<div style="width: 0.01%; height: 10px; background-color: #003366;"></div>

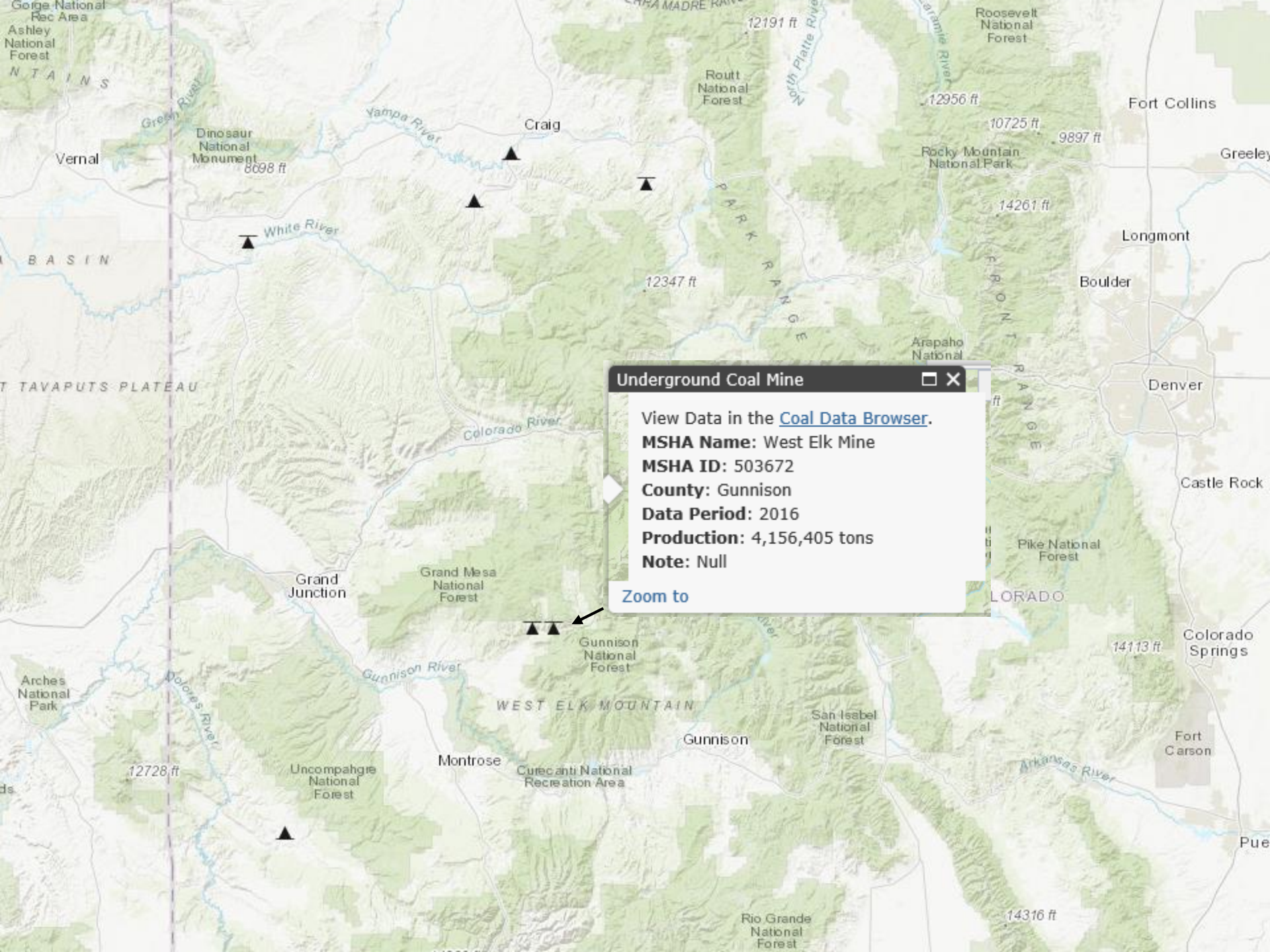


## West Elk Mine, Annual

 [DOWNLOAD](#)



 Source: U.S. Energy Information Administration



**Underground Coal Mine**

View Data in the [Coal Data Browser](#).

**MSHA Name:** West Elk Mine

**MSHA ID:** 503672

**County:** Gunnison

**Data Period:** 2016

**Production:** 4,156,405 tons

**Note:** Null

[Zoom to](#)





University of Colorado  
Colorado Springs



University of Colorado

Boulder | Colorado Springs | Denver | Anschutz Medical Campus