

**RENEWABLES: SELF
INFLICTED WOUND**

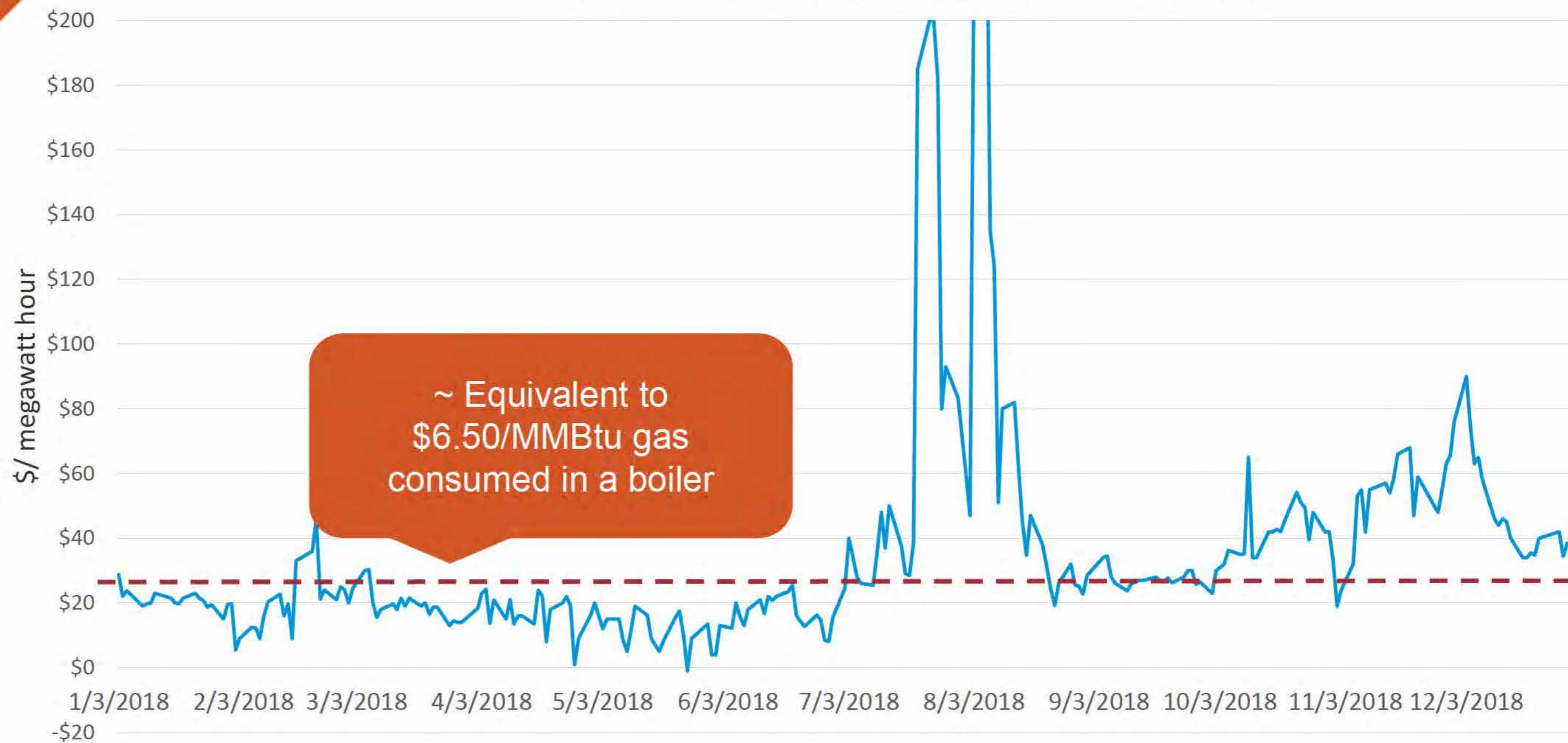
“High penetration of solar depresses electricity prices in the middle of the day, and amps up the peaks before and after the solar generation arrives...”

THIS POSES AN ENDURING THREAT TO SOLAR BUSINESS MODELS: If the value of solar generation continues to drop and curtailments rise, it will become harder to sustain new capacity”

- Greentech Media May 2018

**POWER PRICES
COMPETITIVE WITH
NATURAL GAS**

Mid Columbia Daily low Electric Price 2018

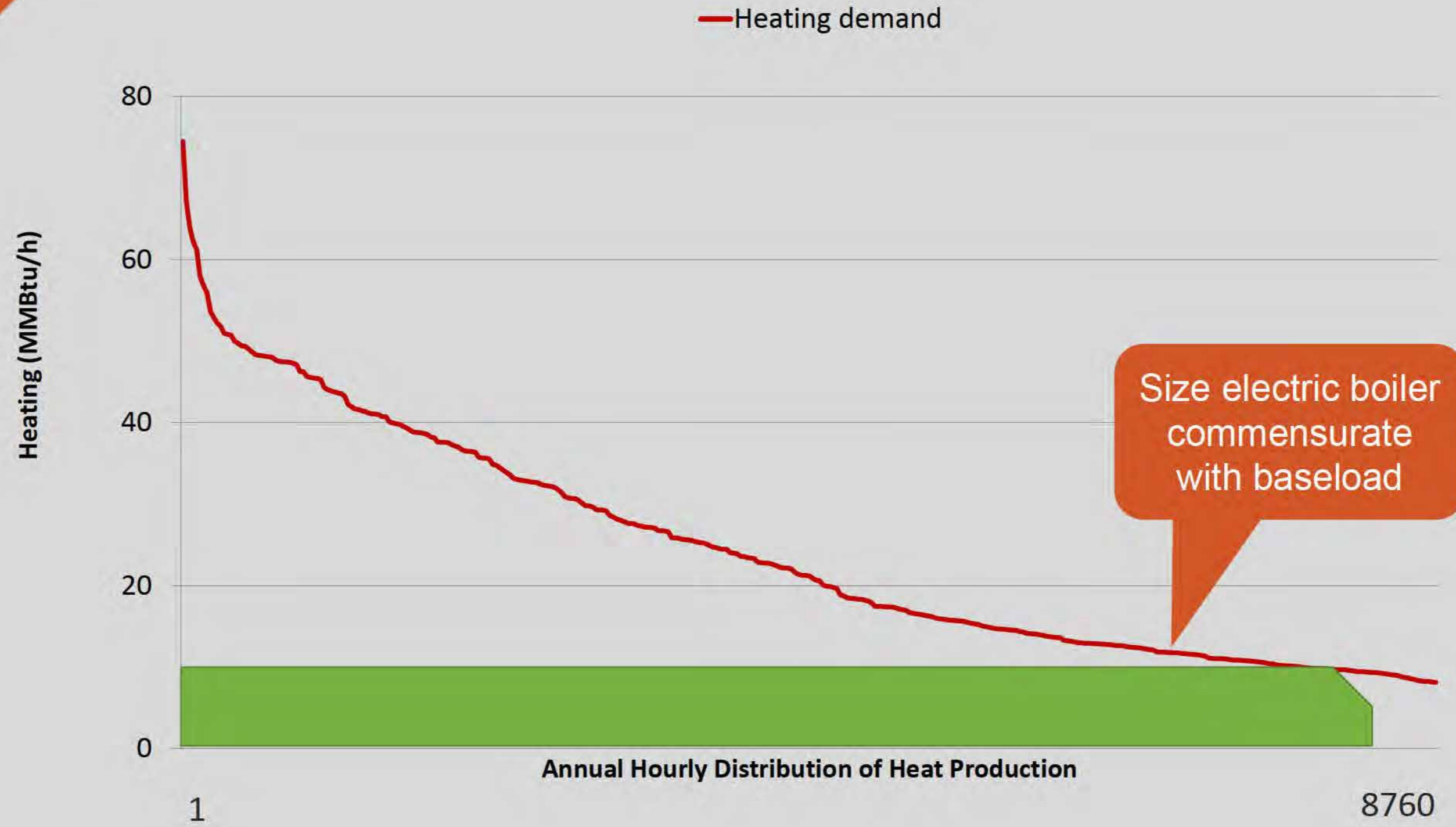


~ Equivalent to
\$6.50/MMBtu gas
consumed in a boiler

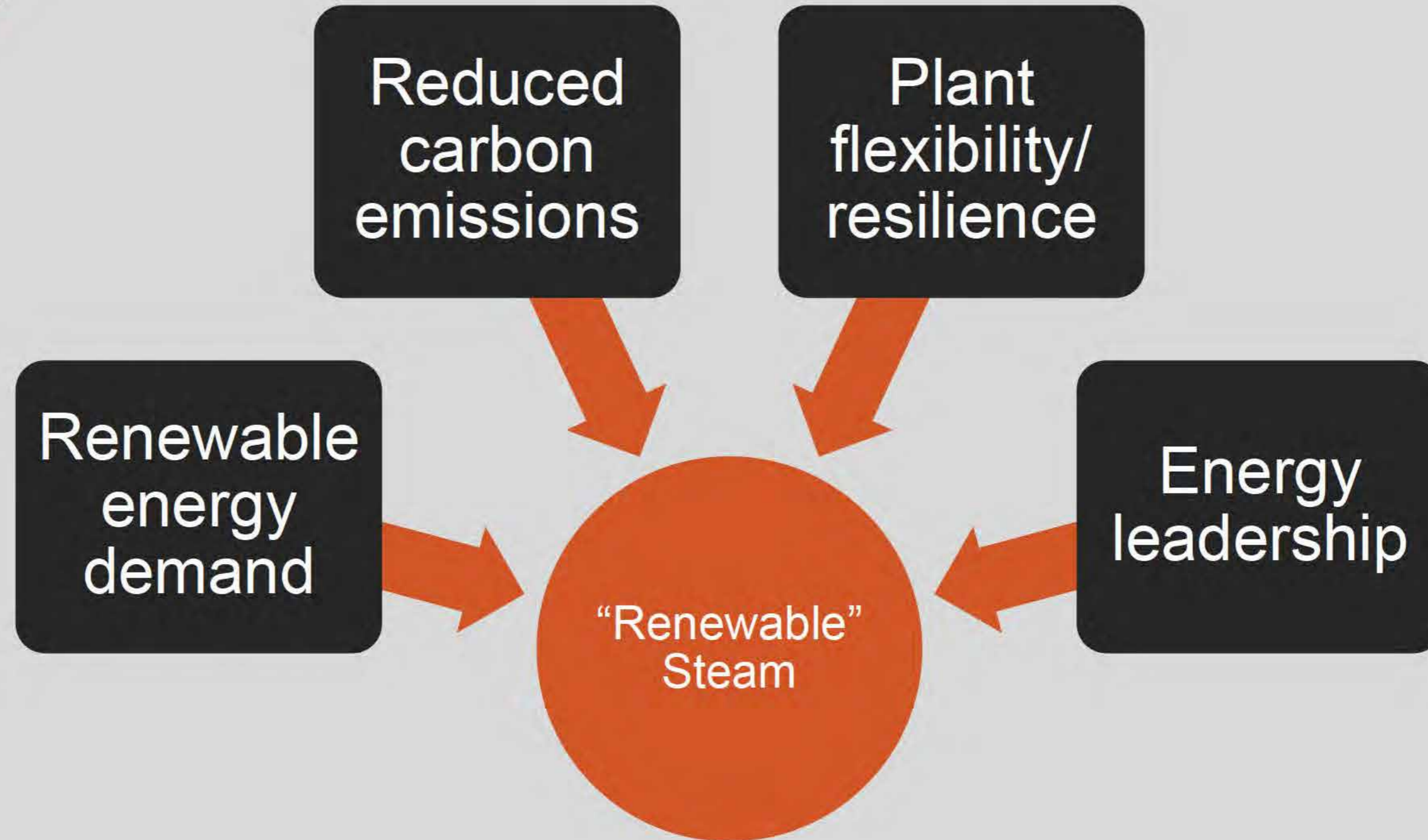
Source: US Energy Information Administration

RENEWABLE STEAM: YEAR ROUND OPPORTUNITY

Thermal Load Duration Curve (Campus)



RENEWABLE STEAM VALUE PROPOSITION



UMC is seeking interested parties to collaborate on a pilot project:



Host Facilities



Partner Electric Utilities



**Grant Support
(Commerce RD&D)**



Technology/Finance Partners

THANK YOU

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Wholesale Price Effects of 40-50% Wind & Solar

(**Wind:** 30% wind & 10+% solar | **Balanced:** 20% wind & 20% solar | **Solar:** 30% solar & 10+% wind)

Impacts in 2030 relative to baseline with 2016 wind & solar shares	Southwest Power Pool 2016: 18% wind & 0% solar			NYISO (New York) 2016: 3% wind & 1% solar			CAISO (California) 2016: 7% wind & 14% solar			ERCOT (Texas) 2016: 16% wind & 1% solar		
	Wind	Balanced	Solar	Wind	Balanced	Solar	Wind	Balanced	Solar	Wind	Balanced	Solar
Lower Average Prices [\$/MWh]												
More Hours <\$5/MWh In baseline: 0% of all hours	6%	8%	13%	2%	7%	11%	6%	7%	11%	6%	11%	19%
Changes in Diurnal Price Profile red baseline shows 2016 wind & solar shares												
More Price Variability	1.8x	2.1x	2.5x	2.1x	2.3x	2.5x	3.0x	2.9x	3.4x	1x	4.7x	6.6x
Higher AS Prices Regulation Down	5x	6x	9x	2x	2x	3x	3x	3x	3x	2x	3x	4x
Change in Timing of Top Net-Load Hours	Shift from 4pm to 7pm	Shift from 3pm to 5-7pm	No further shift 7pm	Shift from 3pm to 6-8pm								