Facilitating a Deeper Discussion

(Levelized Cost of Electric Energy,
RFP Results for Xcel Energy in Colorado, Duty Cycle, Voltage
in the Context of Transmission, Cost per MW

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Note: the thoughts contained within are mine and do not represent the thoughts of the BPU or DPU

Motivation

- What is my role as a Board Member
  - To look out for the interests of our customers – cost, environment, reliability, safety, etc.
  - To be a critical eye
  - Always be respectful of a valuable service provided by the DPU – admittedly by presentation style, I come off harsh – I am a work in progress
- Provide context to decisions LAC will face in electricity generation

U.S. Utility-scale Electricity Energy Generation by Source – 2020 U.S. Energy Information Administration (EIA)

Energy Source	Share of Total
Natural Gas	40.3%
Coal	19.3%
Petroleum	0.4%
Nuclear	19.7%
Wind	8.4%
Hydropower	7.3%
Solar	2.3%
Biomass	1.4%
Geothermal	0.4%
Other	0.5%

Summary:

Energy Source	Share of Total
Fossil Fuels	60.0%
Carbon Free	39.5%

Pre-Covid-19 data:
2019: 62%/38% split

Nuclear, coal and renewables are all ~20%

LAC Electricity Energy Generation by Source – 2020 DPU/BPU

Energy Source	Share of Total
Natural Gas (assuming all free-market purchases are gas?)	28.5%
Coal	51.3%
Nuclear	0.0%
Wind	0.0%
Hydropower	20.0%
Solar*	0.1%

Summary for 2020:

Energy Source	Share of Total
Fossil Fuels	79.9%
Carbon Free	21.1%

Anticipated Summary for 2023:

- Assume Uniper Contract fully implemented (~19%)

Energy Source	Share of Total
Fossil Fuels	~60%
Carbon Free	~40%

In 2014 the BPU first set their net-carbon-zero goal, how are we doing after ~7 years? After Uniper, we will be right at the average for USA

Likely Transition in the Electric Industry – Much Greater Capacity Relative to Load

- Utilities of the last half of the 20th Century
  - ~50% cost for electric generation – carbon full
  - ~50% for transmission and distribution
- Utilities looking forward?
  - ~25% cost for electric generation – carbon free, cheaper and much more capacity
  - ~25% cost for managing intermittency
    - Storage, load shifting, generation curtailment, etc.
    - Paying a premium for nuclear
    - Transmission may fit in here as well as the next bullet
  - ~50% for transmission and distribution
- Main point?
  - Yes, managing intermittency costs money but this cost enables us to access the cheap, cheap energy, which is also carbon free and supports our local NM economy
  - Add capacity!!! Electrification is expected to double to triple electric consumption

Per Aug. 2021 BPU Mtg, in 2020:
- San Juan was most expensive power (1st)
- Short duration power purchases was 2nd

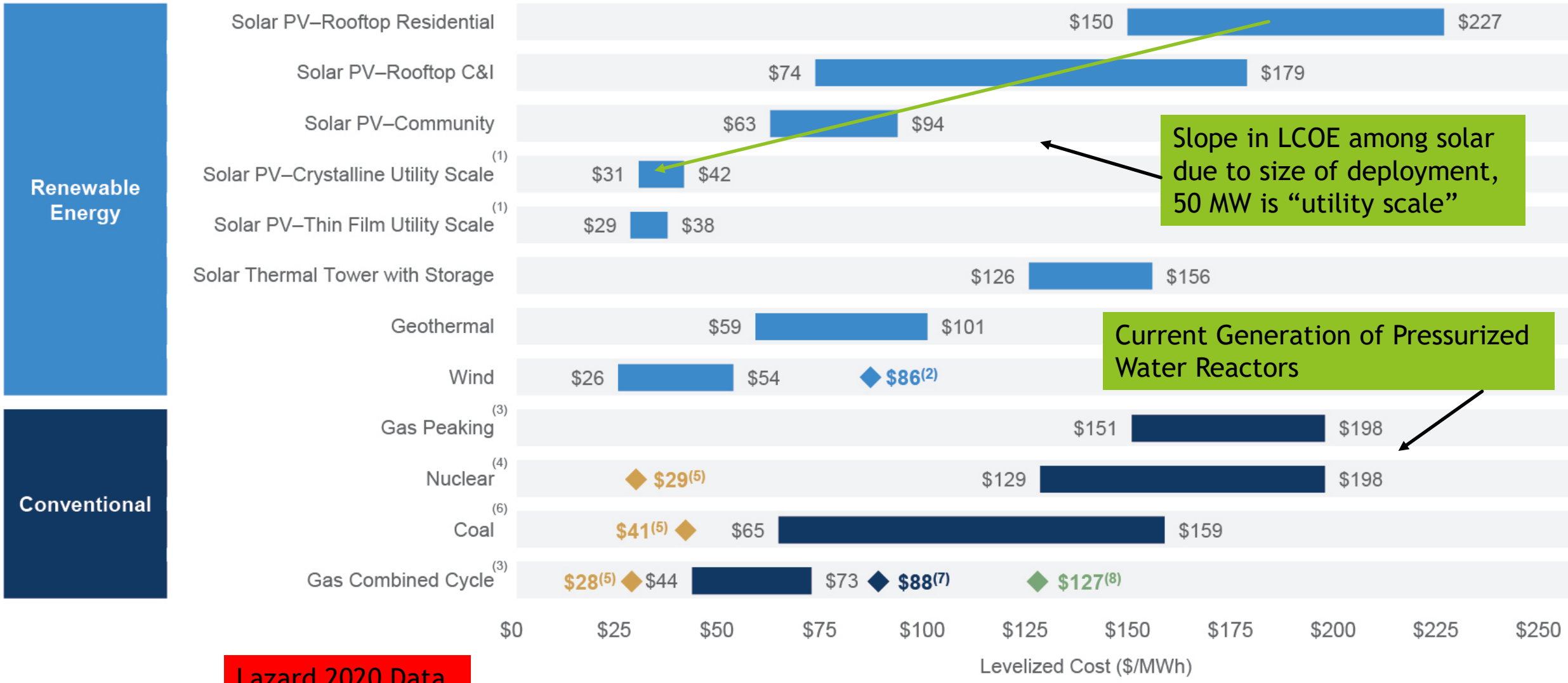
Starting Point: Levelized Cost Of Energy (LCOE)

- **LCOE = lifetime cost / energy produced**
- Major Caveats with LCOE as a metric of comparison
  - Firm vs. Intermittent
  - CO_2 emission
  - Marginal cost vs. new build
- Next two slides present analysis performed by ***Lazard*** which is a financial advisory and asset management firm that engages in investment banking. Each year they update their estimates, currently on Version 14

Levelized Cost of Energy Comparison—Unsubsidized Analysis

Emphasis: UNSUBSIDIZED Prices

Selected renewable energy generation technologies are cost-competitive with conventional generation technologies under certain circumstances

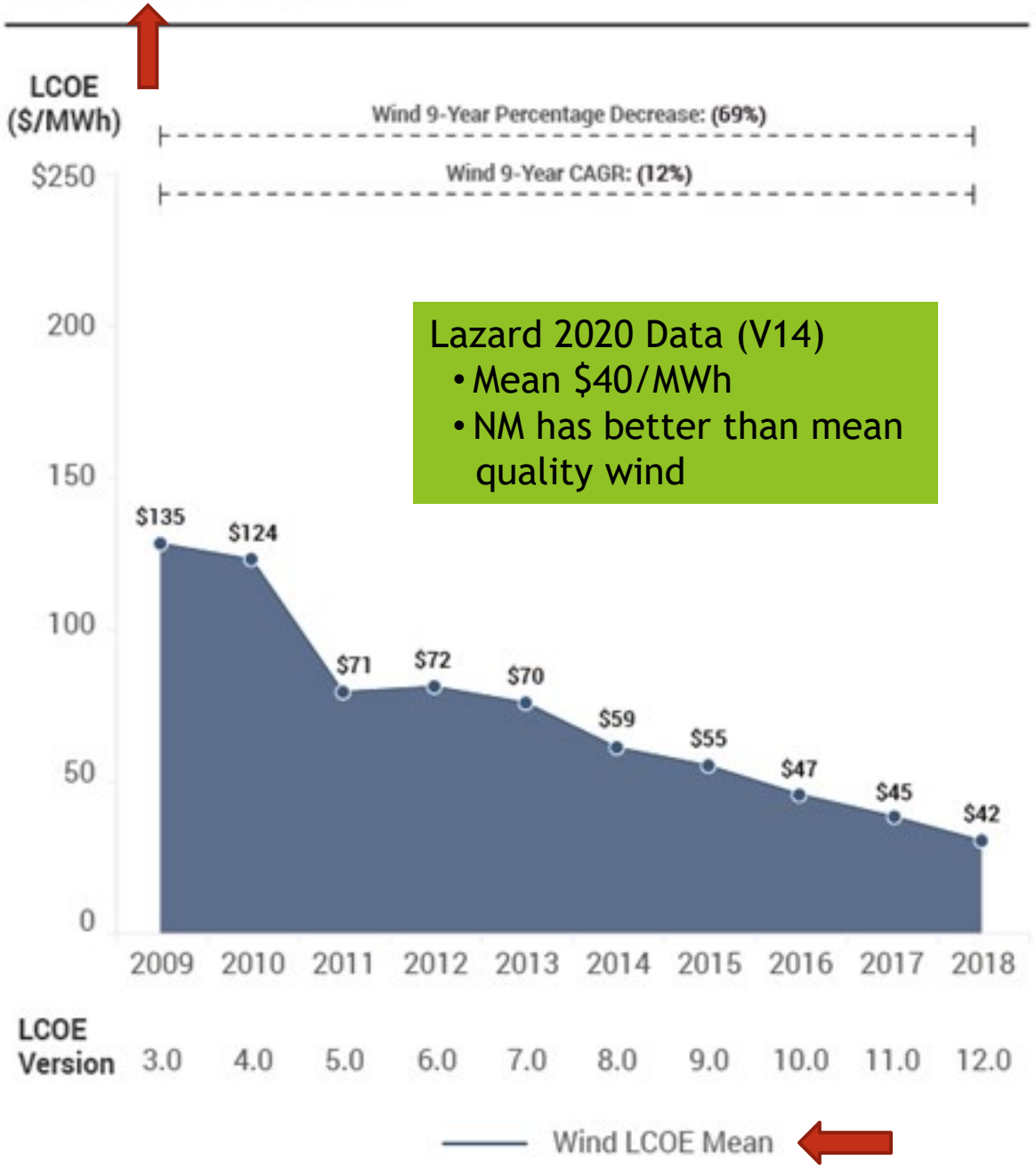


Slope in LCOE among solar due to size of deployment, 50 MW is "utility scale"

Current Generation of Pressurized Water Reactors

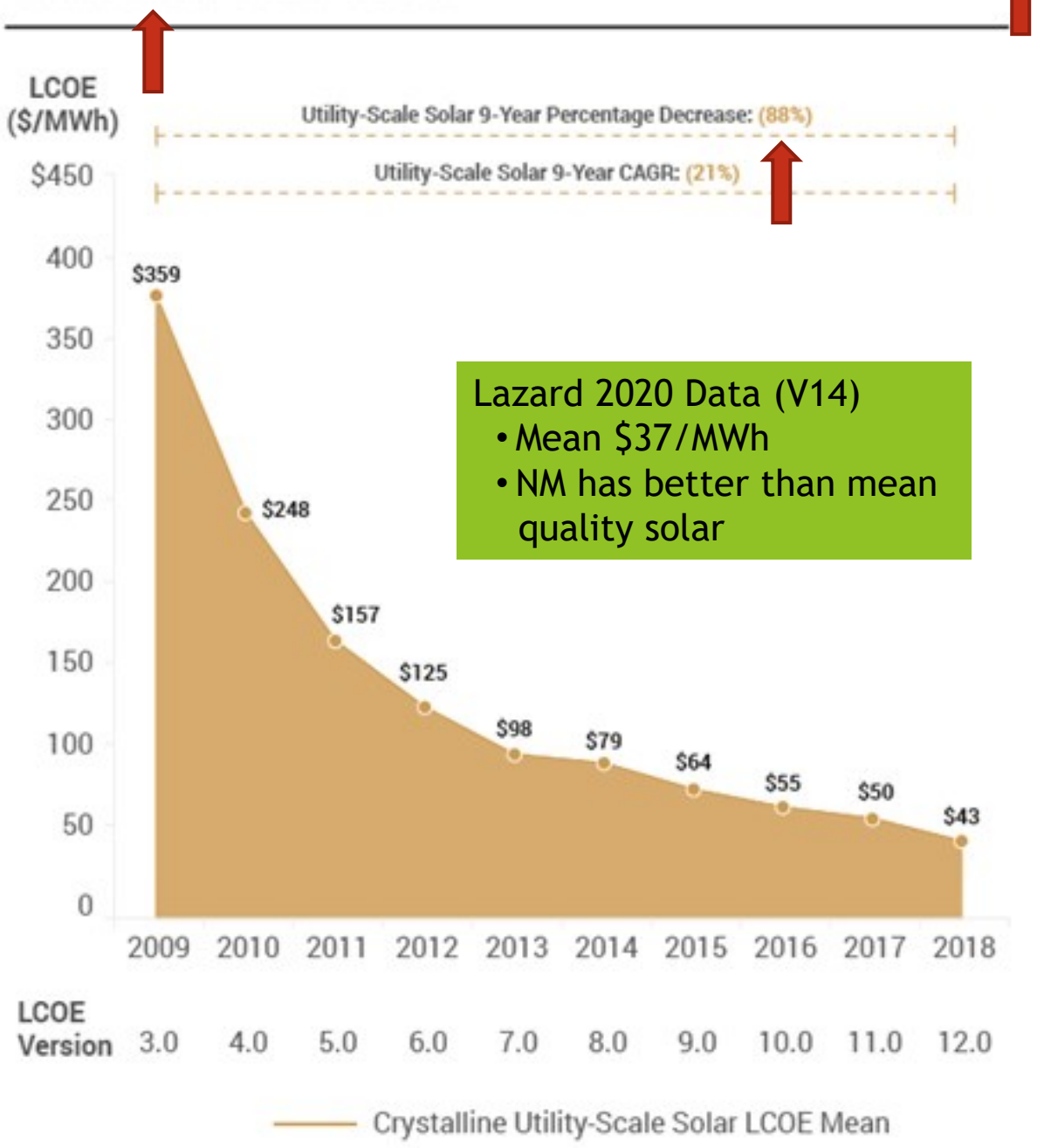
Lazard 2020 Data
LCOE Version 14.0

Unsubsidized Wind LCOE



Lazard 2020 Data (V14)
- Mean $40/MWh
- NM has better than mean quality wind

Unsubsidized Solar PV LCOE



Lazard 2020 Data (V14)
- Mean $37/MWh
- NM has better than mean quality solar

A Double check on Lazard's Analysis from Xcel Energy in Colorado

- In 2017 Xcel issues an "all-source solicitation" request for proposal to be provided by 2023
  - Xcel has 3.3 million customers in CO, NM and upper Midwest
  - Similar wind and solar resources to New Mexico
  - Where Lazard's results did not include subsidies, the Xcel Request for Proposals (RFPs) do

Xcel Energy data published by Vox, "In Colorado, a glimpse of renewable energy's insanely cheap future," Jan. 16, 2018. Online

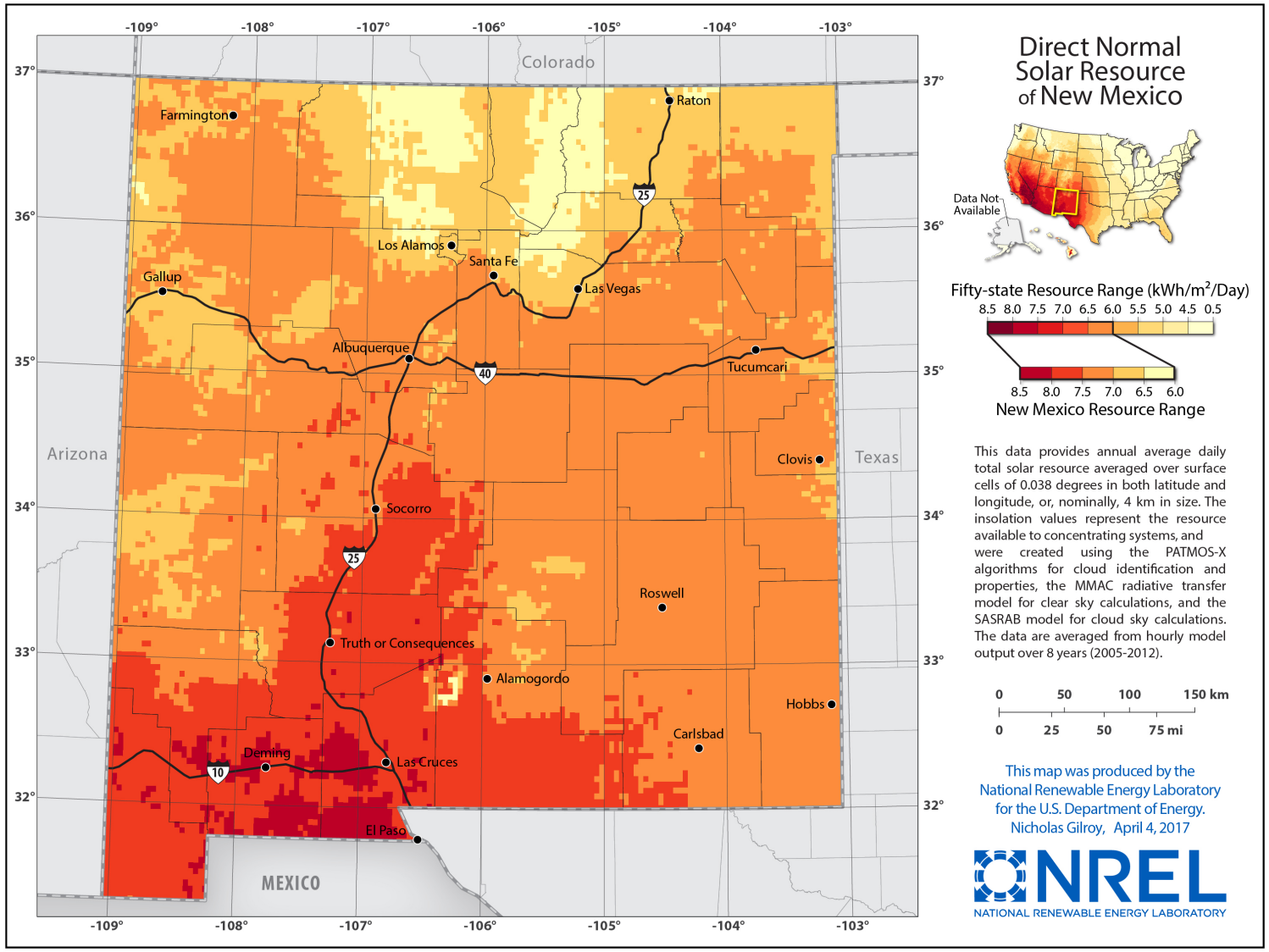
RFP Responses by Technology

Generation Technology	# of Bids	Bid MW	# of Projects	Project MW	Median Bid Price or Equivalent	Pricing Units
Combustion Turbine/IC Engines	30	7,141	13	2,466	$ 4.80	$/kW-mo
Combustion Turbine with Battery Storage	7	804	3	476	6.20	$/kW-mo
Gas-Fired Combined Cycles	2	451	2	451		$/kW-mo
Stand-alone Battery Storage	28	2,143	21	1,614	11.30	$/kW-mo
Compressed Air Energy Storage	1	317	1	317		$/kW-mo
Wind	96	42,278	42	17,380	$ 18.10	$/MWh
Wind and Solar	5	2,612	4	2,162	19.90	$/MWh
Wind with Battery Storage	11	5,700	8	5,097	21.00	$/MWh
Solar (PV)	152	29,710	75	13,435	29.50	$/MWh
Wind and Solar and Battery Storage	7	4,048	7	4,048	30.60	$/MWh
Solar (PV) with Battery Storage	87	16,725	59	10,813	36.00	$/MWh
IC Engine with Solar	1	5	1	5		$/MWh
Waste Heat	2	21	1	11		$/MWh
Biomass	1	9	1	9		$/MWh
Total	430	111,963	238	58,283		

The price of electricity in LAC (power, transmission, distribution, etc.) is $115/MWh.

Solar Data in NM

- 2017 LAC Integrated Resource Plan emphasized **local** solar
- What is optimal for LAC?
  - Southern NM is part of LAC's "balancing area"
  - Solar panel from LAC will generate ~20% more power near Las Cruces – and we pay the same transmission fee if we connect directly to PNM
  - The bigger economic issue is that solar farm need to be large for optimal economics
    - 50 MW is ~1.4 miles by ~1.4 miles
    - Note: less than 1% of state surface area needed to meet entire states electric power needs



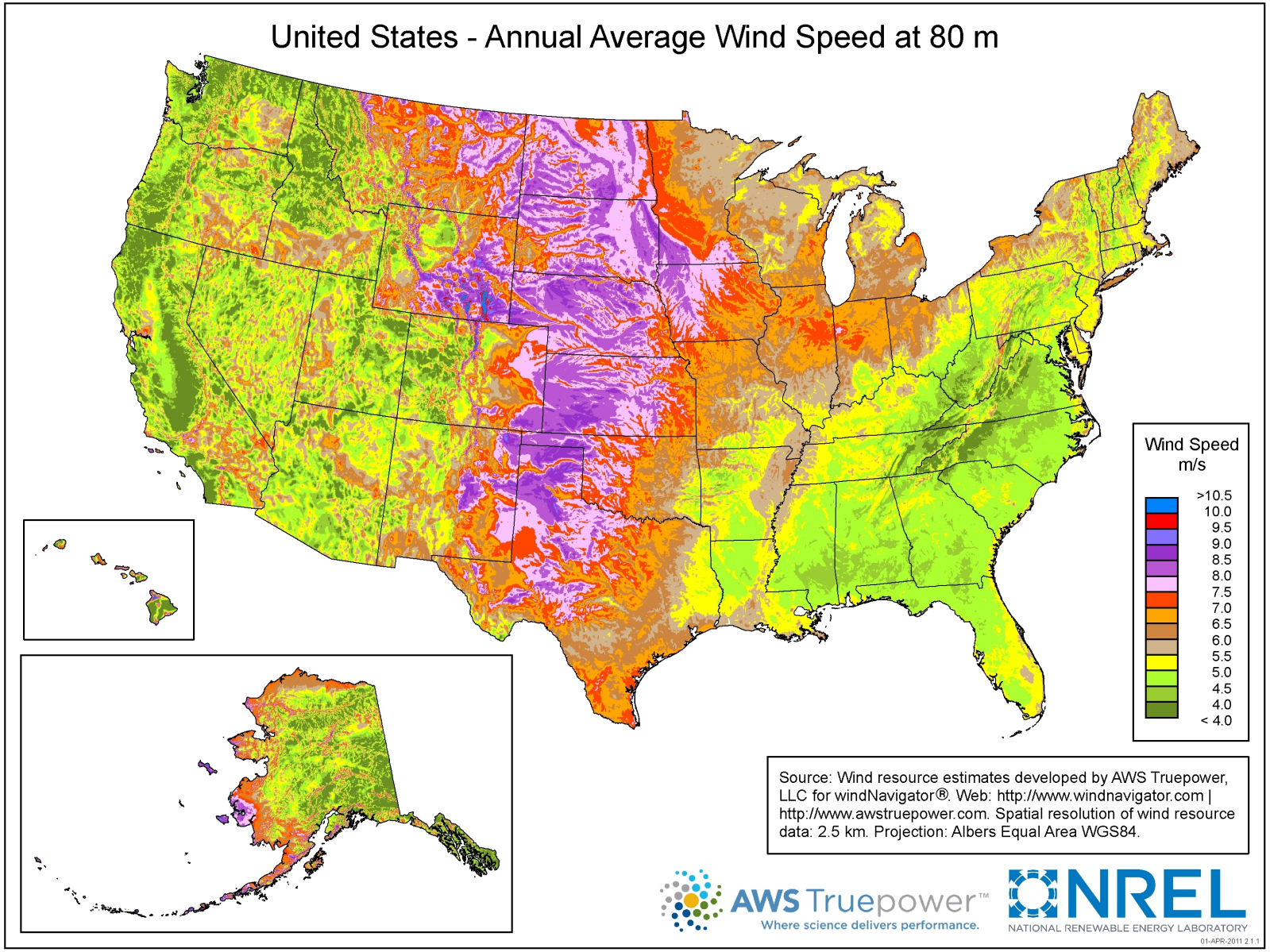
What are Local Communities Doing?

In 2018, Kit Carson Electric Cooperative (KCEC) and its energy supplier Guzman Energy are continuing to move the co-op toward its goal of being 100 percent daytime solar reliant by 2022

Might we cooperate with them? Should produce economies of scale…

Wind data for the USA

- NM is blessed with quality resources
- Wind and Solar average well … the combined duty cycle is more than either separately



Thoughts on Rooftop Solar vs. Utility Scale

- Per Lazard, the LCOE difference between rooftop and utility is ~500% (midpoint $33.5/MWH vs $189/MWH)
  - Rooftop solar customers fund 100% of their own hardware
  - Because some costs within our $0.115/KWH are based on “net usage,” non-rooftop customers subsidize rooftop
  - Though rooftop may provide services to non-rooftop users: frequency regulation, reduced need for transmission (possible), other? What is the value here?
  - Equity concern: are lower income individuals (less likely to have rooftop) subsidizing higher income (more likely to have rooftop)?

Past solar subsidies are a significant reason why solar is now so inexpensive. Have subsidies served their purpose? Now target storage?

Economics of SMR

- Per BPU handout:
  - DOE: ~25% of CFPP is $1.4 billion; therefore …
    - Total cost of CFPP is $5.6 billion
  - Total power produced is 462 MW
    - Assuming 50 -> 60 -> 77 MW per unit is accepted
  - Power per Cost can now be calculated:
    - 462 MW/ $1.4 billion = **82.5 MW/billion dollars**

Power per unit cost is a metric for comparing among reactors

- Comparing to the AP1000 Reactor
  - From Westinghouse's webpage: "The world's first proven Generation III+ pressurized water reactor"
    - One half of the EPR vs. AP1000 competition – the main products from the main Western vendors
    - Associated Press, May 18, 2021, "more than $26 billion" for 2 AP1000s which produce 1100 MW
  - Power per Cost can now be calculated:
    - 1100 MW/ $13 billion = **84.6 MW/billion dollars**

- Main Point: CFPP and AP1000 cost the same for each unit of power produced! Therefore we can take advantage of the economics studies already performed for the AP1000!
  - Lazard LCOE, 2020 put the cost of energy the AP1000 from $129 to $198 per MWh with a midpoint value of $163/MWh
  - This does not compare well with the **target** of $58/MWh
    - **163/58 = 2.8, so 280% cost difference**

Opportunity Cost? 163/33.5 = 487%, or 163/86 ~ 200%

Conclusion/Summary

- By 2023, LAC will reach the 2020 national average of ~40% carbon free power
- Yet, we are nearly the most blessed state in the nation when it comes to cheap, carbon free power – we should use much more:
  - Surplus supply kills price spikes
  - Carbon free during the day is an affordable goal
- The opportunity cost of the CFPP SMR concern me especially given the unrealistic ~$58/MWH "cost **target**"
  - CFPP ~ AP100 ~$163/MWH