

Clean Line Energy

Clean Energy. Delivered.

ACC Biennial Transmission Assessment
June 1, 2016

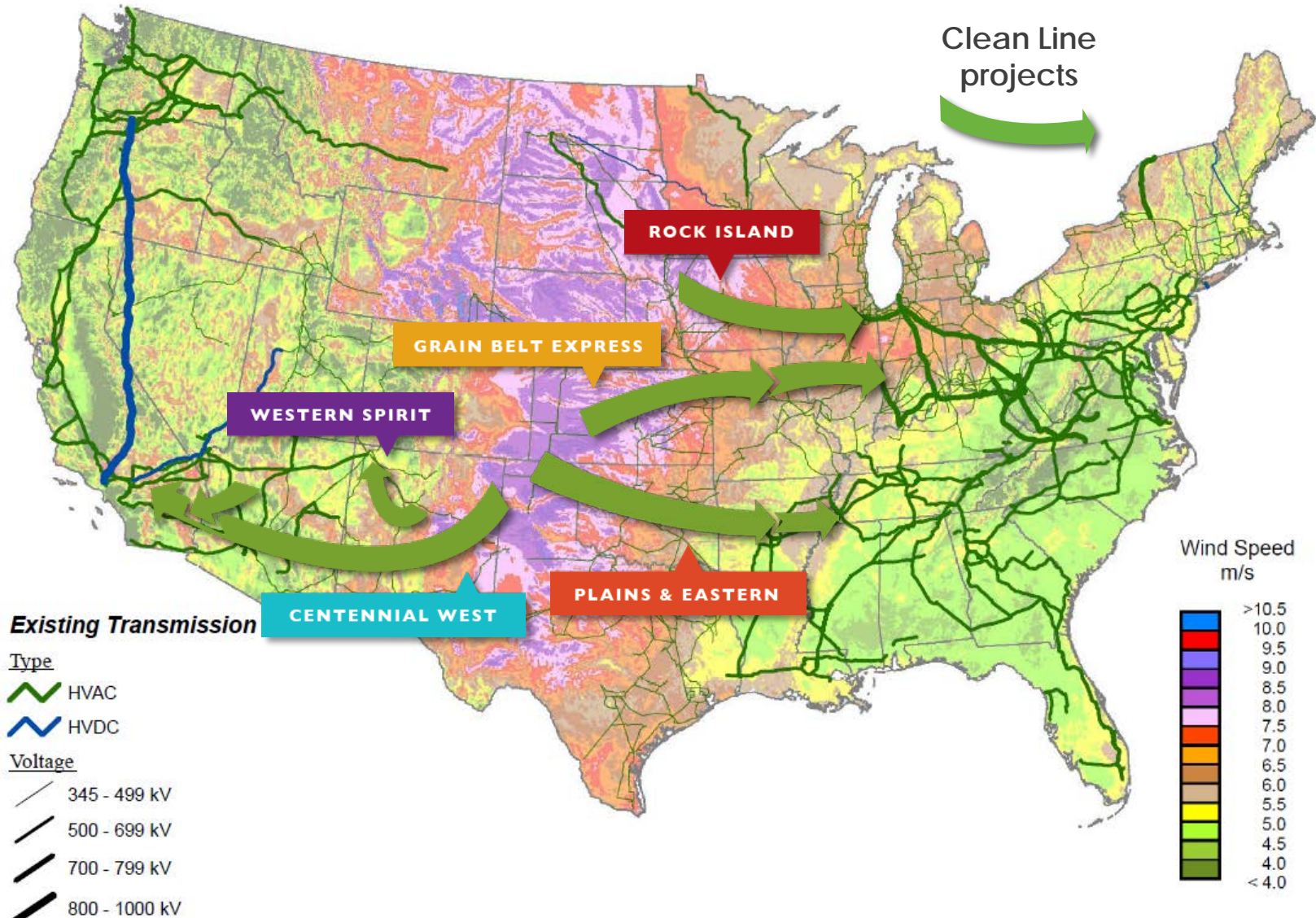
Jonathan Abebe

CLEAN LINE
ENERGY PARTNERS

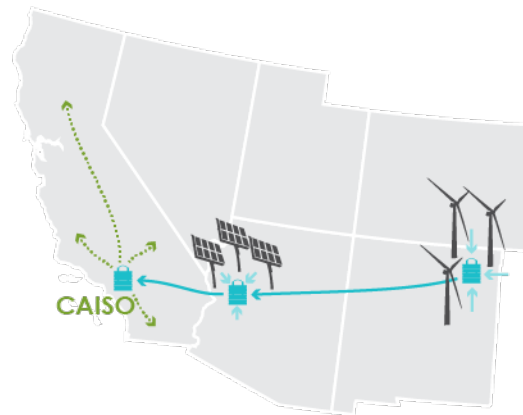
The logo for Clean Line Energy Partners features the text "CLEAN LINE" in a bold, sans-serif font above "ENERGY PARTNERS" in a smaller, all-caps sans-serif font. Below the text are two curved, parallel lines in a light green color, resembling a stylized power line or a swoosh.

June 2016





Clean Line's projects connect the lowest-cost wind resources to major demand centers



Centennial West will deliver renewable energy from New Mexico and Arizona to California



KEY

-  Collector system (AC)
-  Centennial West Clean Line (HVDC)
-  Existing utilities' system (AC)
-  AC/DC Converter

This map is intended for illustration purposes only and does not represent a proposed route.

KEY MILESTONES

INTERCONNECTION

- Completed WECC Project Coordination Review

ENVIRONMENT & ROUTING

- Filed SF – 299 right-of-way application with BLM in 2010
- BLM National Project Manager coordinating NEPA process with Western Area Power Administration, BLM and U.S. Forest Service

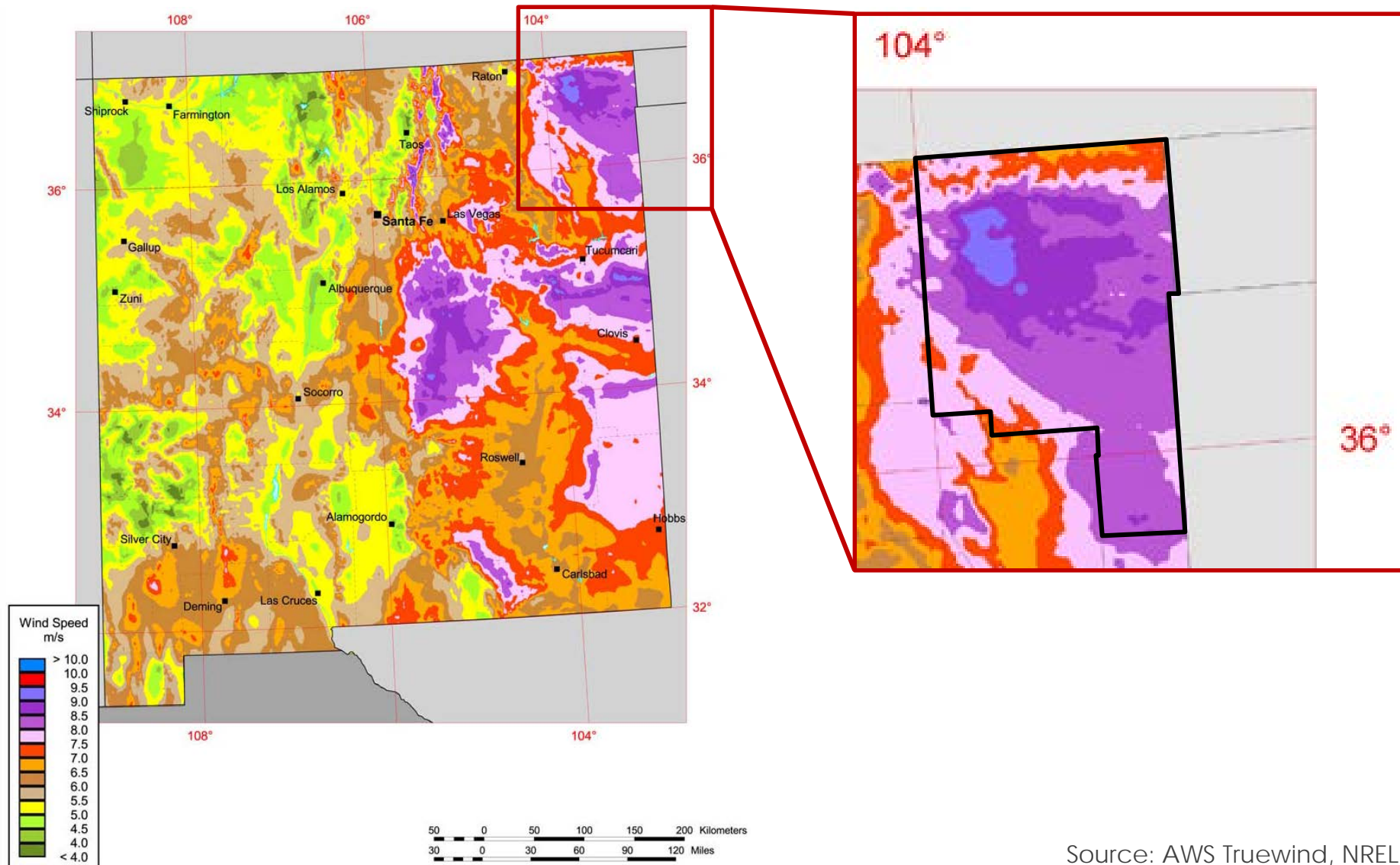
AGREEMENTS & ALLIANCES

- Executed MOU with New Mexico Renewable Energy Transmission Authority; RETA is authorized by statute to acquire land for the project and own transmission facilities
- Finalized development agreement with Western Area Power Administration

OUTREACH

- Held 18 community leader workshops in four states and two tribal nations to gather information about local routing opportunities and constraints

Centennial West will capture exceptional northeastern New Mexico wind resource



Source: AWS Truewind, NREL

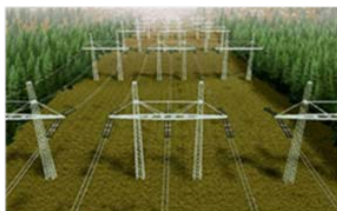
Direct current transmission is the right answer to tap distant wind resources

HVDC is...

ideal for hauling power over long distances

- Reliability – DC, unlike AC, allows **complete control of power flow** and prevents cascading outages
- Efficiency – Over long distances, **DC transfers more power** with lower line losses and with less infrastructure than comparable AC lines
- Smaller footprint – DC requires narrower right-of-way than equivalent AC configuration, resulting in **lower land use impact**

3000-4000 MW Capacity



Three 500 kV AC lines

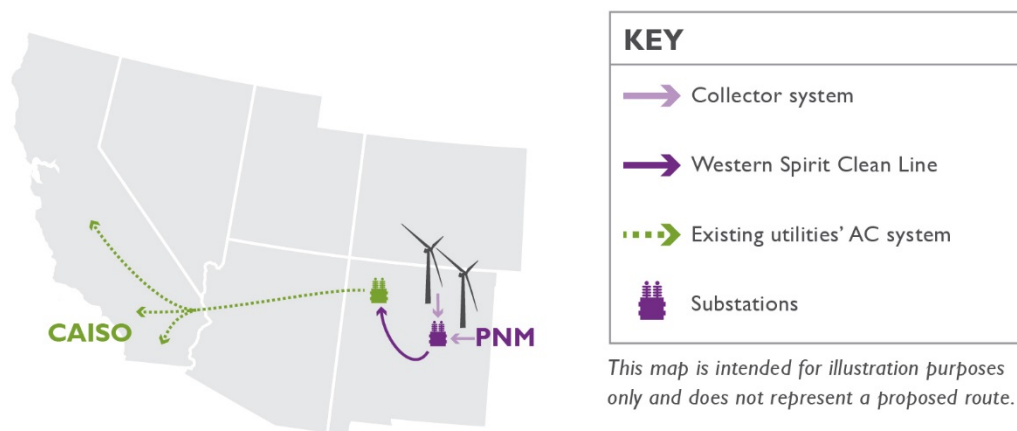


One \pm 500kV DC bipole

conducive to a merchant model

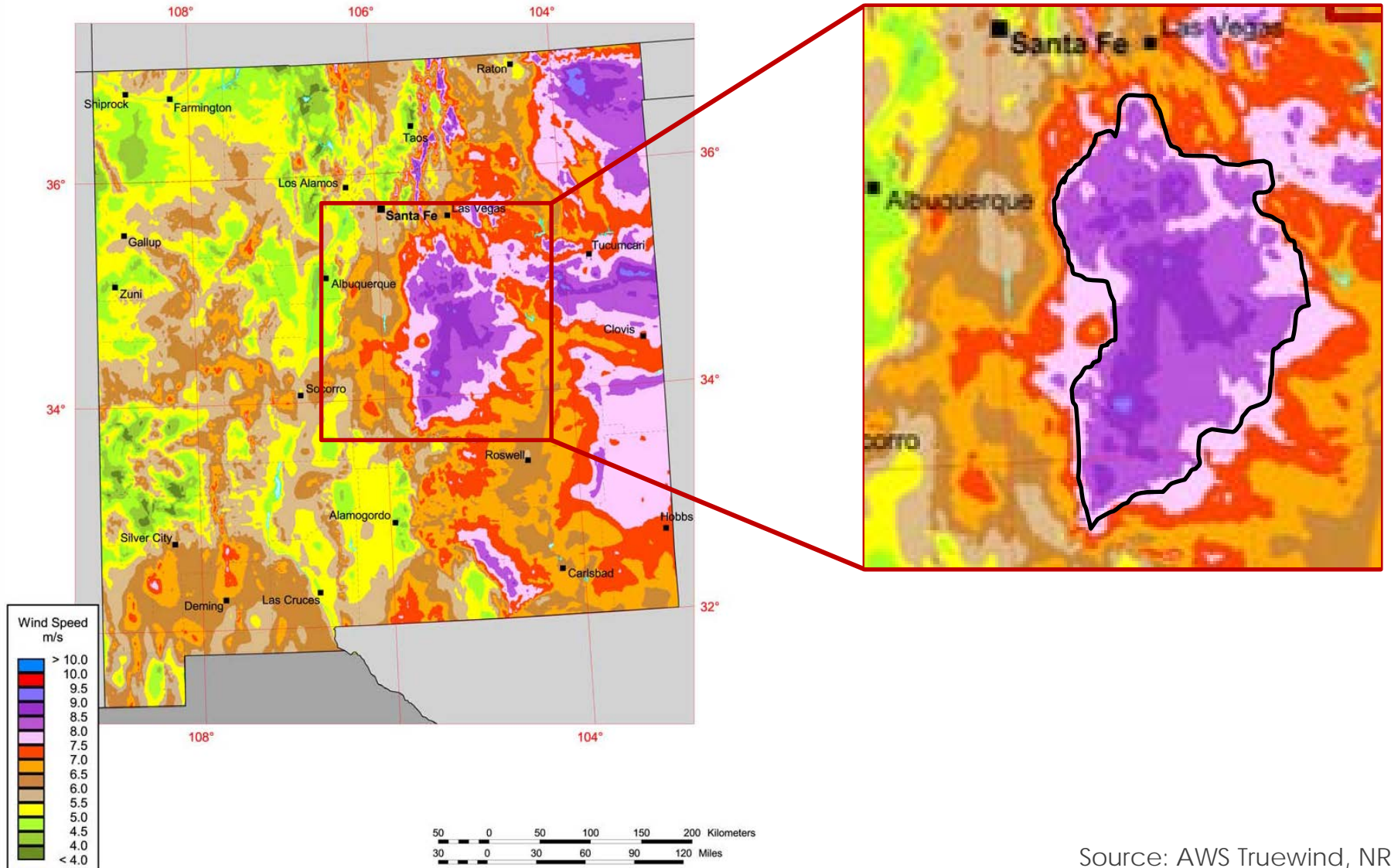
- Converter stations are like on- and off-ramps that make it easier to charge customers directly for service over the line
- Clean Line will sell transmission service to generators and load serving entities

Western Spirit will increase transfer capacity from New Mexico's best wind resources to Four Corners



- The Western Spirit Clean Line is a high-voltage alternating current (HVAC) transmission line that connects high capacity factor New Mexico wind resources with markets farther west
- Clean Line is in discussions with Public Service of New Mexico (PNM) for the Wires-to-Wires study process, is currently in the PNM's TSR queue for service to Four Corners, and is currently in Arizona Public Service's TSR queue for service from Four Corners to CAISO
- A preliminary route has been developed and a right-of-way agreement executed with Isleta Pueblo
- Western Spirit Clean Line has a lease agreement with New Mexico Renewable Energy Transmission Authority ("RETA")

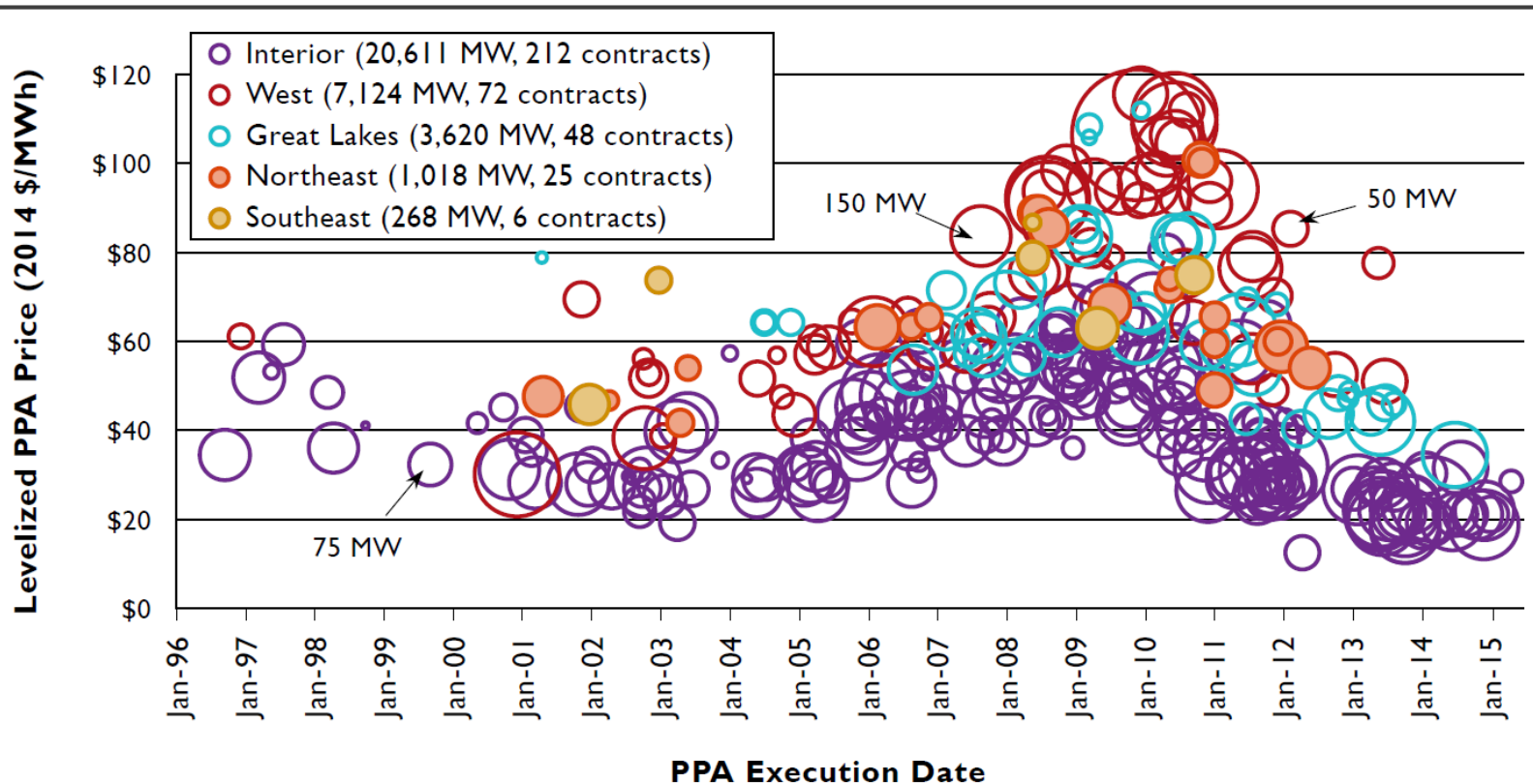
Western Spirit will capture exceptional central New Mexico wind resource



Source: AWS Truewind, NREL

Wind energy prices continue to decrease, particularly in the windiest part of the country

Levelized PPA prices by PPA execution date
2014 \$/MWh



Note: Size of "bubble" is proportional to project nameplate capacity

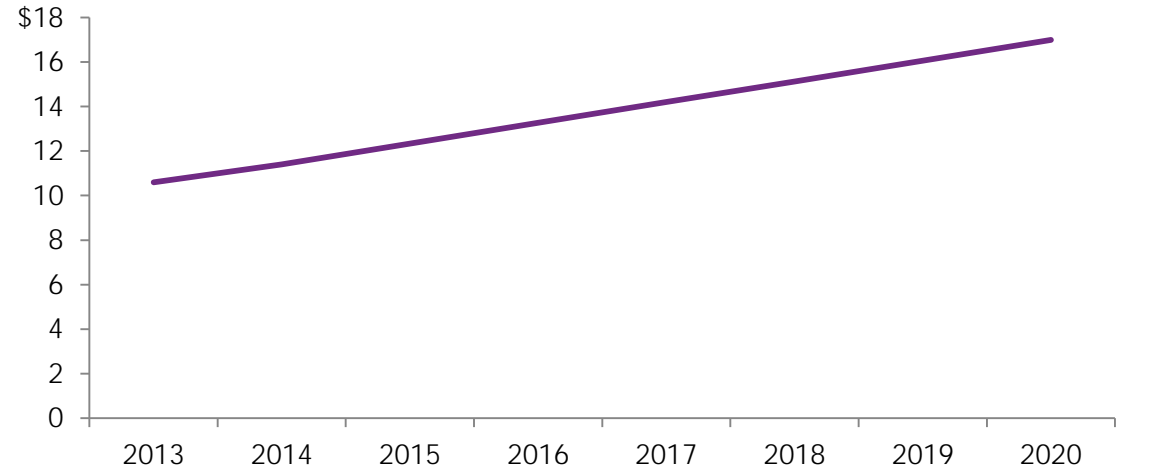
The "Interior" region consists of the 13 states where the wind resource is the strongest: OK, KS, IA, NM, SD, NE, TX, MN, WY, CO, ND, MT, and MO.

Source: DOE 2014 Wind Technologies Market Report published August 2015

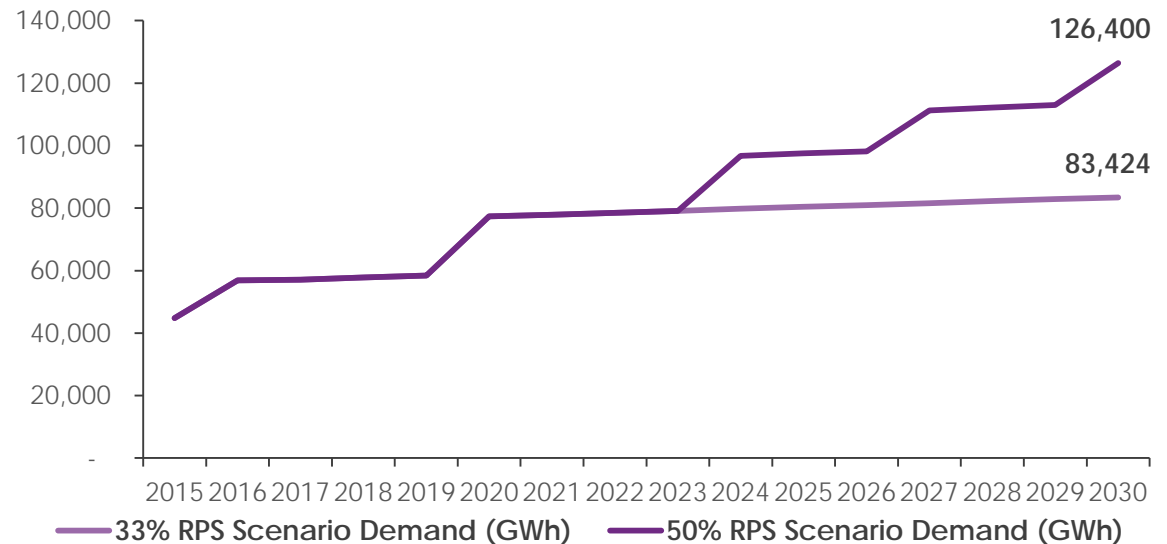
California's Renewable Portfolio Standard will create significant demand for renewable energy

- California has committed to reducing its greenhouse gas emissions to 1990 levels by 2020. The result is an effective carbon price that makes New Mexico wind more competitive with natural gas
 - Carbon allowance auctions are clearing at \$12/ton. This translates to an additional \$6 – \$9/MWh in wholesale power prices
- San Onofre Nuclear Generation Station shutdown has created need for additional low-carbon power supply in Southern California
- In September 2015, SB 350 increased California RPS from 33% by 2020 to 50% by 2030

Projected Allowance Auction Price (\$/ton)

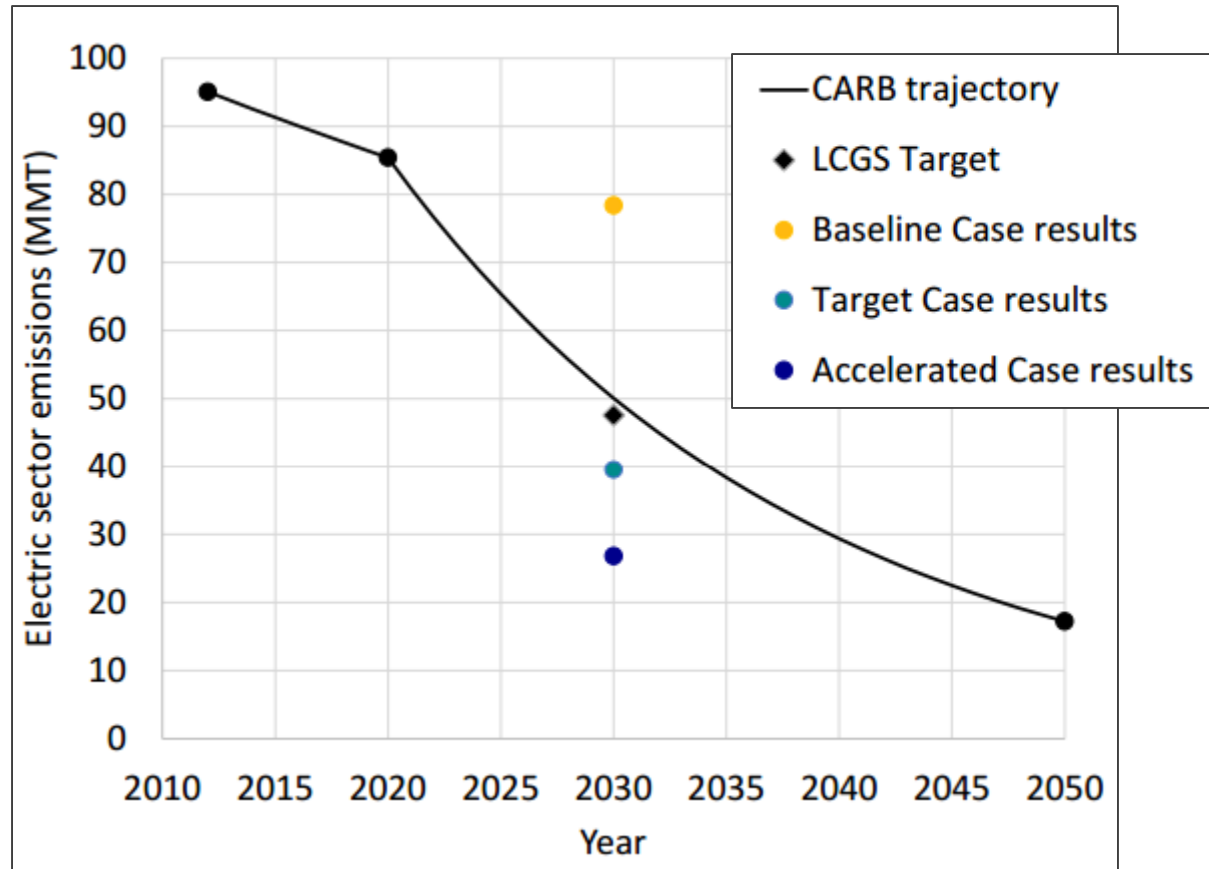


California RPS Demand



The Low Carbon Grid Study found that CA can reduce GHG emissions by 50% reliably and economically

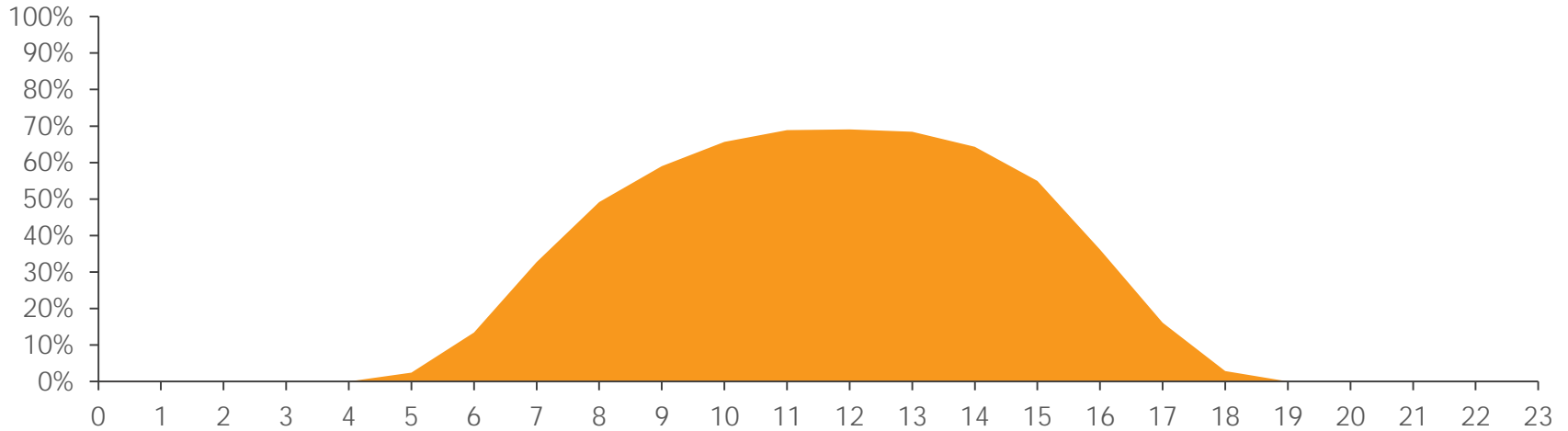
- Phase 1 of the Low Carbon Grid Study (“LCGS”) found that California can reduce carbon emissions by more than 50% with minimal rate impact, without compromising reliability, with a stable gas fleet, and with minimal curtailment of renewable energy
- The target case calls for an additional 9,480 MW of wind energy
- Of the 9 GW of additional wind capacity identified in the LCGS, over 1.5 GW is imported New Mexico wind



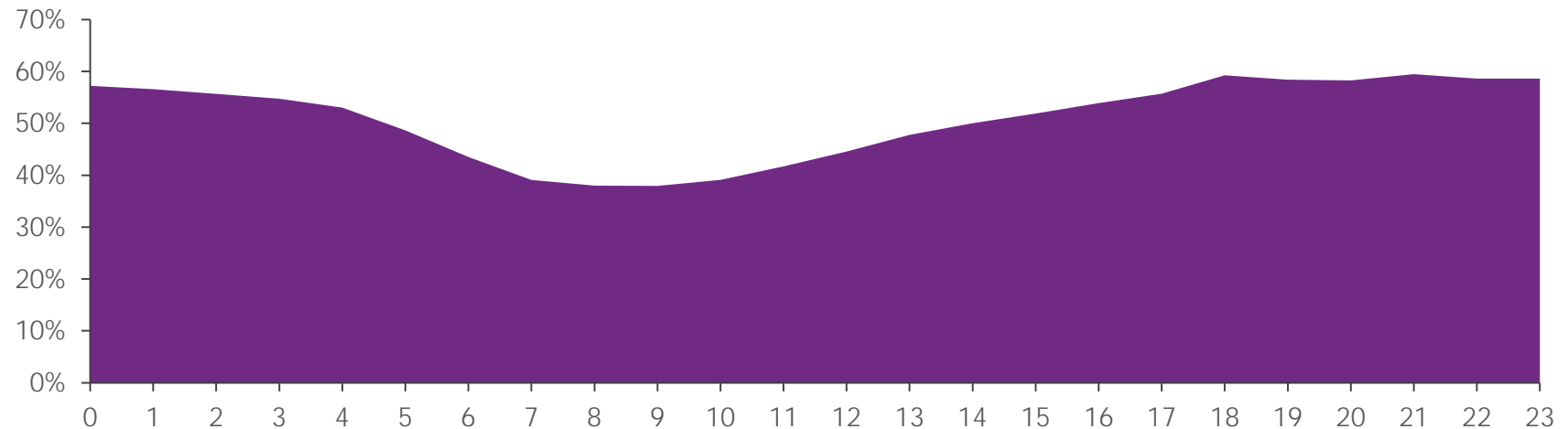
Source: The California 2020 Low-Carbon Grid Study (LCGS), Phase 1 Results Summary

Solar and wind technologies have complementary hourly generation profiles

Average Hourly Power Output of California Solar¹ (% of Nameplate Output)



Average Hourly Power Output of New Mexico Wind² (% of Nameplate Output)



1. Solar production profiles simulated in NREL's System Advisor Model using Mono-c-Si (SunPower panel) on a one-axis tracking system near Los Angeles, Fresno, San Diego and Oakland, CA

2. Wind generation profile is derived from NREL WIND Toolkit wind speed data for a site in Torrance County, New Mexico applied to a Vestas V136-3.45 turbine power curve

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