

9th Annual Nebraska Wind and Solar Conference

Nebraska Wind & the Southwest Power Pool (SPP) Marketplace

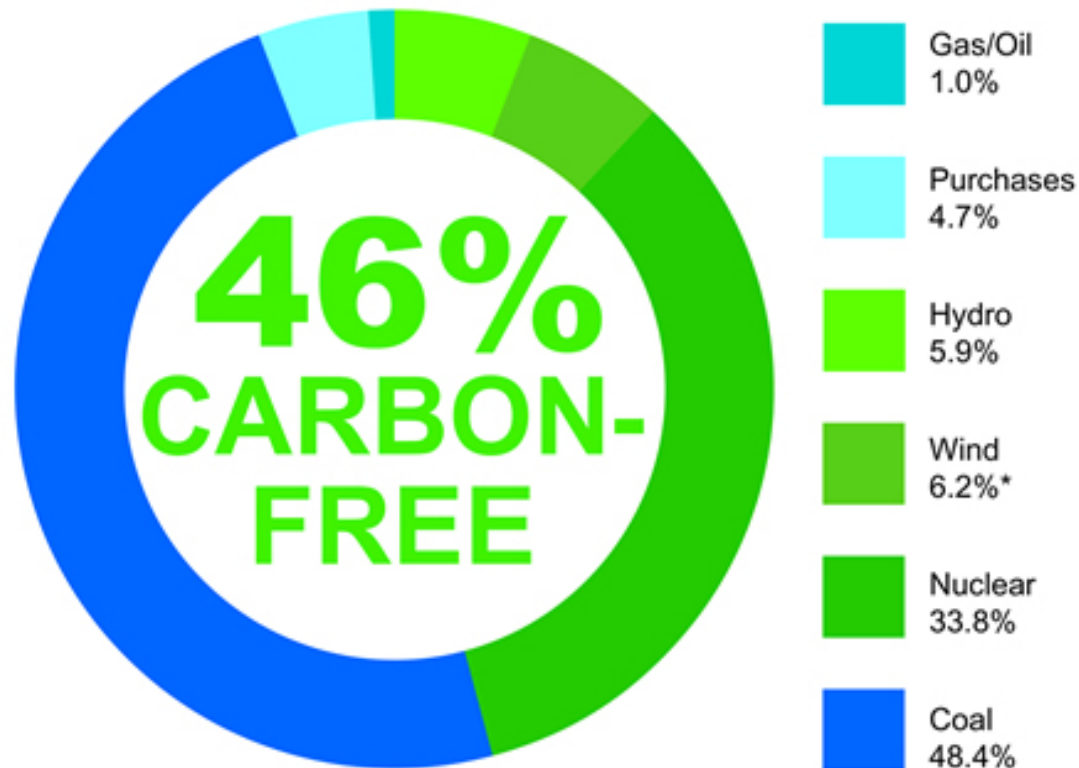
Ron Thompson
Energy Manager
Nebraska Public Power District (NPPD)

NPPD's Resource Mix

2015 NPPD Energy Generation Resources

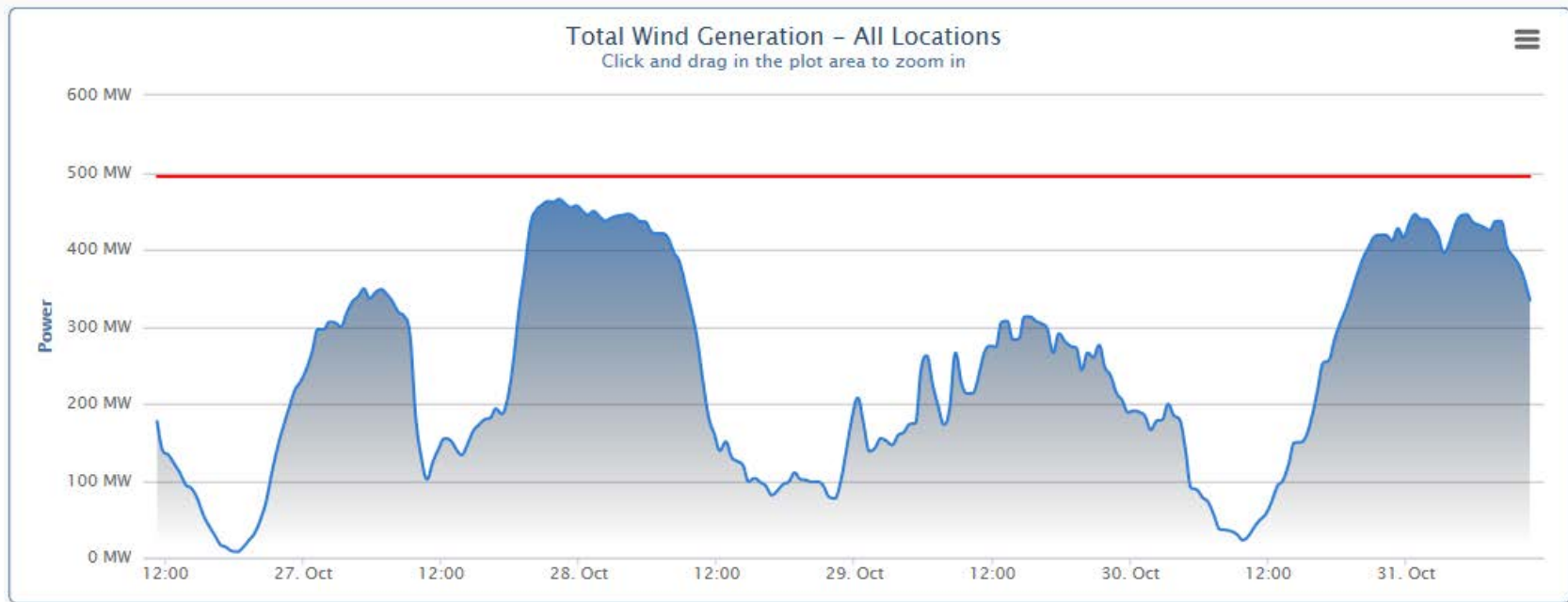
Nebraska Customers & Market Sales

April 2016



* Prior to sale of environmental attributes.

Wind Generation for NPPD



<u>NPPD Involved Wind Projects</u>	<u>Project size (Total MWs)</u>	<u>NPPD Share (MWs)</u>
(1) Ainsworth Wind Energy Facility	59.4	41.4
(2) Elkhorn Ridge	80	40
(3) Laredo Ridge	80	61
(4) Bluestem, LLC	3	3
(5) Crofton Bluffs	42	21
(6) Broken Bow	80	51
(7) Steele Flats	75	75
(8) Broken Bow II	73	29.2

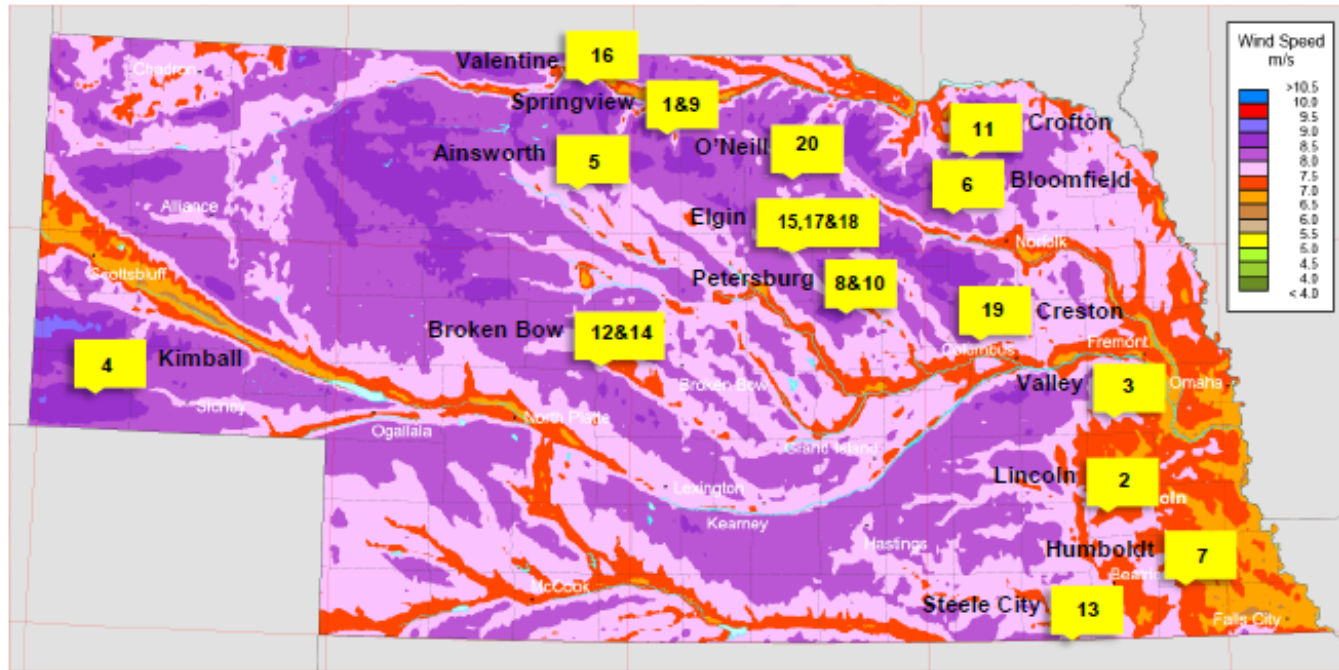
492.4MWs

321.6MWs

Click a Location

- Ainsworth
- Broken Bow 1
- Broken Bow 2
- Crofton
- Elkhorn Ridge
- Laredo Ridge
- Springview
- Steele Flats





WIND DEVELOPMENT IN NEBRASKA 80 Meter Wind Overlay

REVISION: September 2015

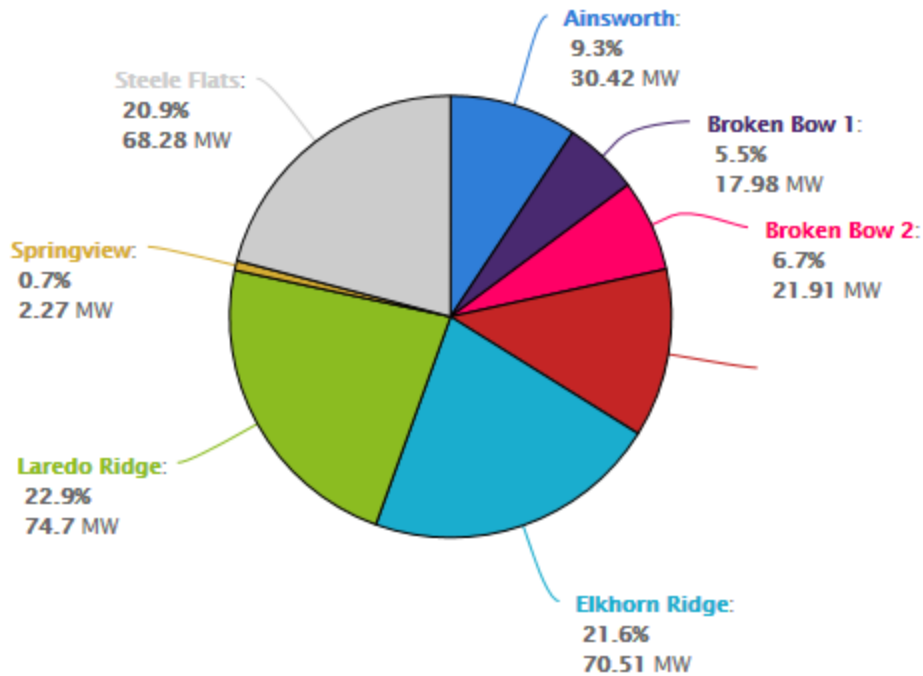


PROJECT	YEAR	MW	OWNER	PARTICIPANTS
1 Springview Wind Energy	1998	Retired	NPPD	NPPD, LES, MEAN, GI, KBR, Auburn
2 Salt Valley	1998-99	1.32	LES	LES
3 Valley	2001	.66	OPPD	OPPD, Valmont
4 Kimball	2002	10.3	MEAN	MEAN
5 Ainsworth Wind Energy	2003	59.4	NPPD	NPPD, OPPD, MEAN, GI, JEA* *Financial Participant for RECs
6 Elkhorn Ridge Wind, LLC	2009	80	NRG Energy	NPPD, OPPD, MEAN, LES, GI
7 Flat Water Wind Farm, LLC	2010	60	Gestamp Wind N.A.	OPPD
8 Laredo Ridge Wind Farm	2011	80	NRG Energy	NPPD, LES, MEAN, GI
9 Springview II/Bluestem, LLC	2011	3	Bluestem, LLC	NPPD, OPPD**, LES**, GI**, ** will receive RECs
10 TPW Petersburg, LLC	2011	40.3	Gestamp Wind N.A.	OPPD
11 Crofton Bluffs Wind Farm	2012	42	NRG Energy	NPPD, OPPD, LES, MEAN

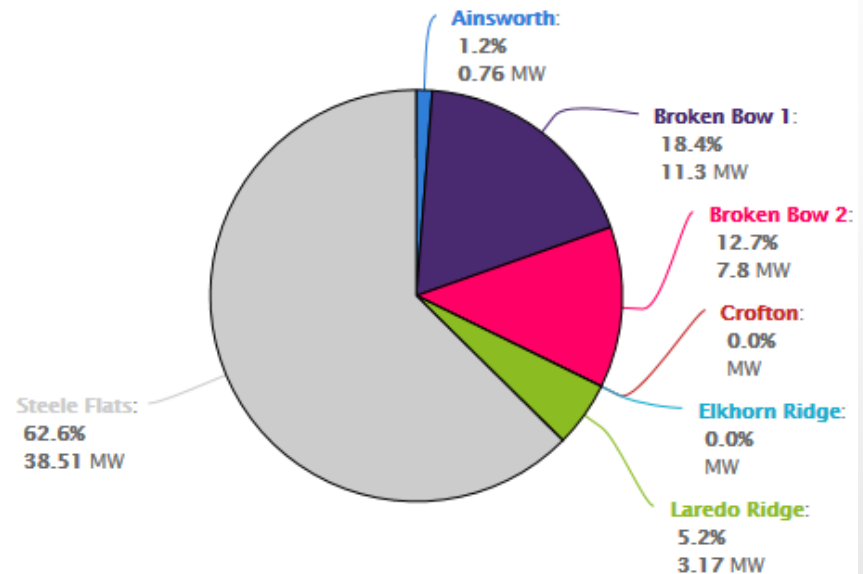
PROJECT	YEAR	MW	OWNER	PARTICIPANTS
12 Broken Bow Wind, LLC	2012	80	NRG Energy	NPPD, OPPD, LES, GI
13 Steele Flats Wind	2013	74.8	NextEra	NPPD
14 Broken Bow II	2014	75	Sempra	NPPD, OPPD
15 Prairie Breeze	2014	200	Invernergy	OPPD
16 Valentine Wind LLC	2014	1.83	Bluestem Sandhills	City of Valentine, NE
17 Prairie Breeze II	2015	73.4	Invernergy	LES
18 Prairie Breeze III	2015	33.8	Invernergy	City of Grand Island, Sharing with Nebraska City and Neigh
19 Creston Ridge LLC	2015	6.8	Bluestem Energy Solutions	Loup Public Power District
20 Grand Prairie	2016	400	Berkshire Hathaway Renewables	OPPD
		**1325.03	Total MW	

Wind Generation Levels Change

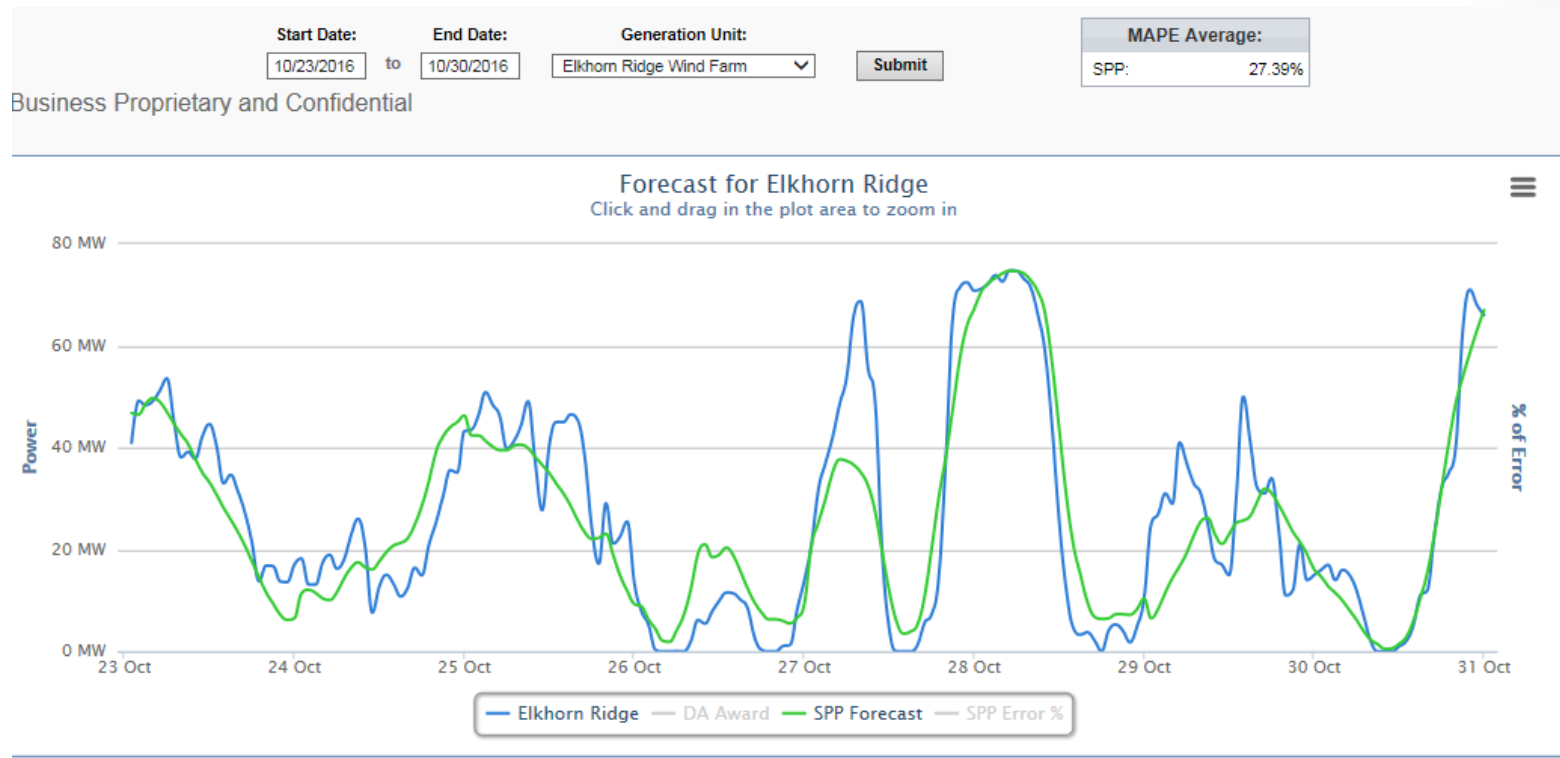
Wind Generation 10/31/16 11:18 AM



Wind Generation 11/01/16 2:41 PM



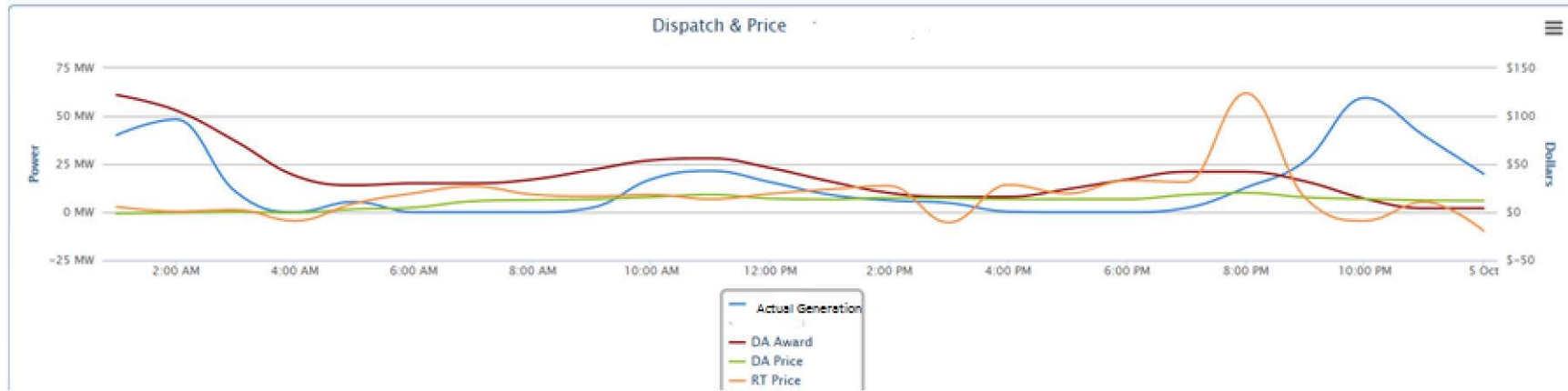
Impacts of Wind Forecast Errors



Market submittals are due by 0930 the day before (Market Closes)

- At midnight, the Wind Forecasts are already over 14 hours old
- By 11 p.m. on Operating day the wind forecasts are 37 hours old

Wind Generation – Market prices Day Ahead vs. Real-time – Double Edged



If Wind Forecasts come in higher than projected:

- Real-Time Price tend to come in lower than Day-Ahead
- Increase change of Transmission Flowgate Congestion and negative prices
- Selling in Real-Time at lower or negative prices

If Wind Forecasts come in lower than projected:

- Real-Time price comes in higher than Day-Ahead
- Increased chance of “Scarcity” Events and price spikes
- Buying back in Real-Time at higher prices

Southwest Power Pool (SPP) Operators use “Wind Forecasts” to manage the SPP System. Forecasted vs. Actual differences have an impact.

Wind Generation Impacts to NPPD

- **Additional Ancillary Service costs**
 - Additional Resources that can move may be needed to manage intermediate resources
- **Wind Generation impacts NPPD from different locations**
 - Nebraska
 - SPP South
 - SPP North (Western Area Power Administration (WAPA) joined SPP on 10/1/2015)
 - Midwest Independent System Operator (MISO)
- **Transmission Flowgate Congestion Risk is highest when wind output is high during low load periods**
 - High Volatile Prices
 - One five-minute pricing period impacts
 - Spring and Fall Maintenance periods have an impact as well

Questions

