Expanding the Footprint of the Global Biomass Industry: The Potential Role of Pinyon and Juniper Woodlands Located in the Western United States

Emerging Biomass Feedstocks Forum
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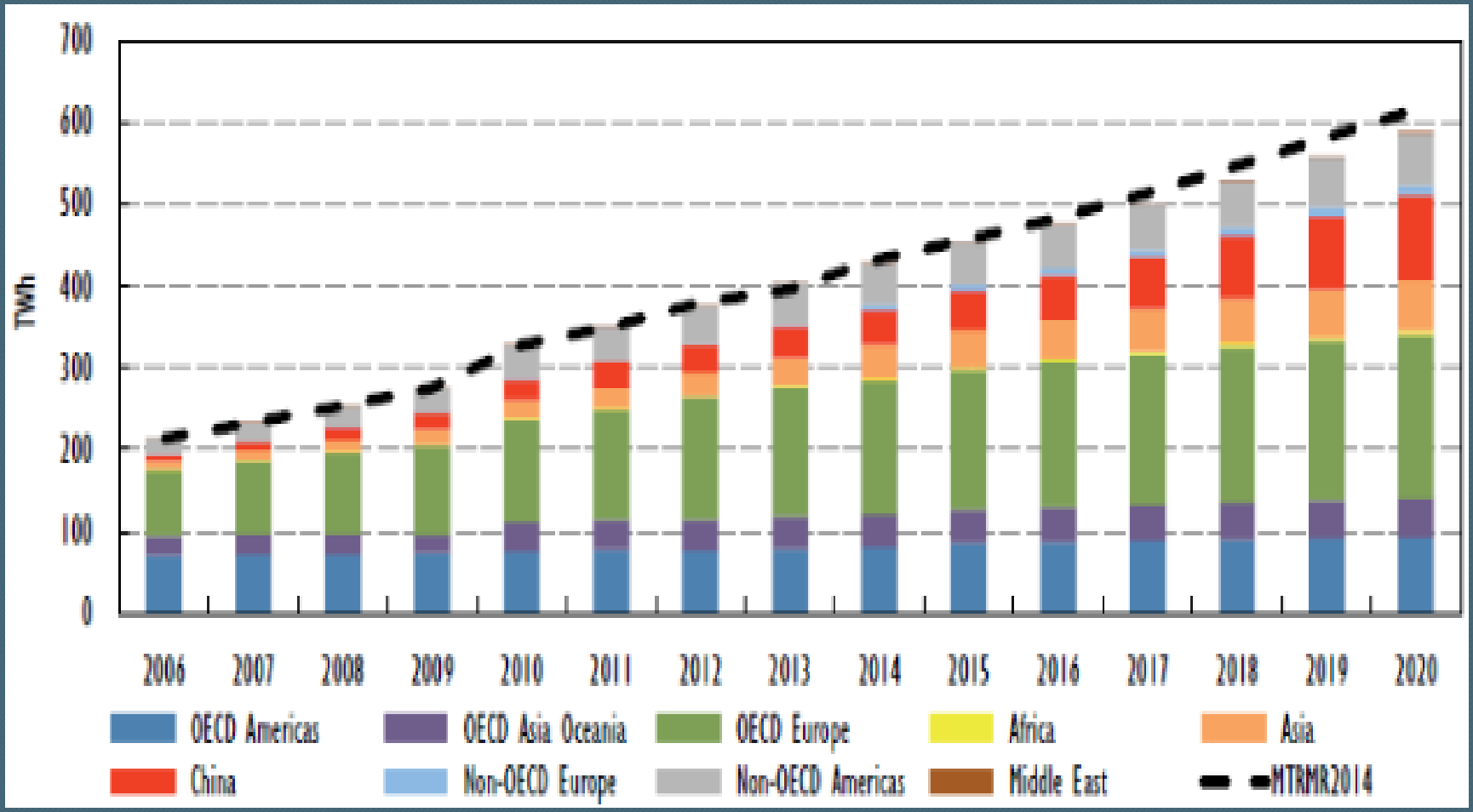
Global Conditions and Trends

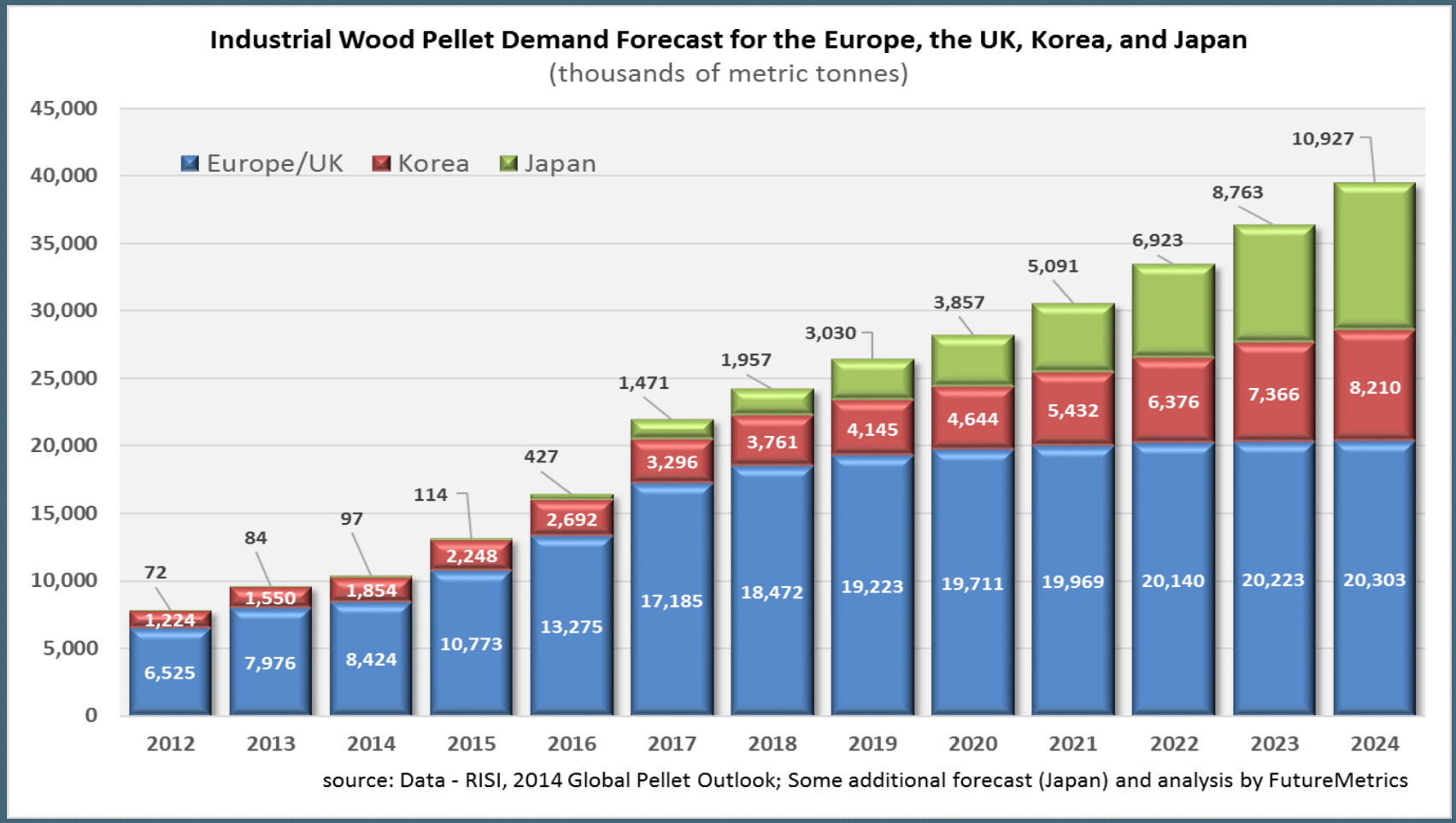
- 1.4 billion people globally lack access to electricity
- rapidly increasing population, rising concern of global warming, and the need to achieve national energy security is driving an unprecedented interest in exploring renewable power resources
- 120 countries, including China, have pledged to reduce fossil fuel use, increase energy efficiency and deploy renewable energy technologies
- It is estimated that bioenergy can contribute at least 150EJ (56EJ in 2013) to the energy supply sustainably in the near future
- China has yet to make its mark on the global bioenergy market, but it appears the government is now making bioenergy a priority

Bioenergy power generation and forecast by region



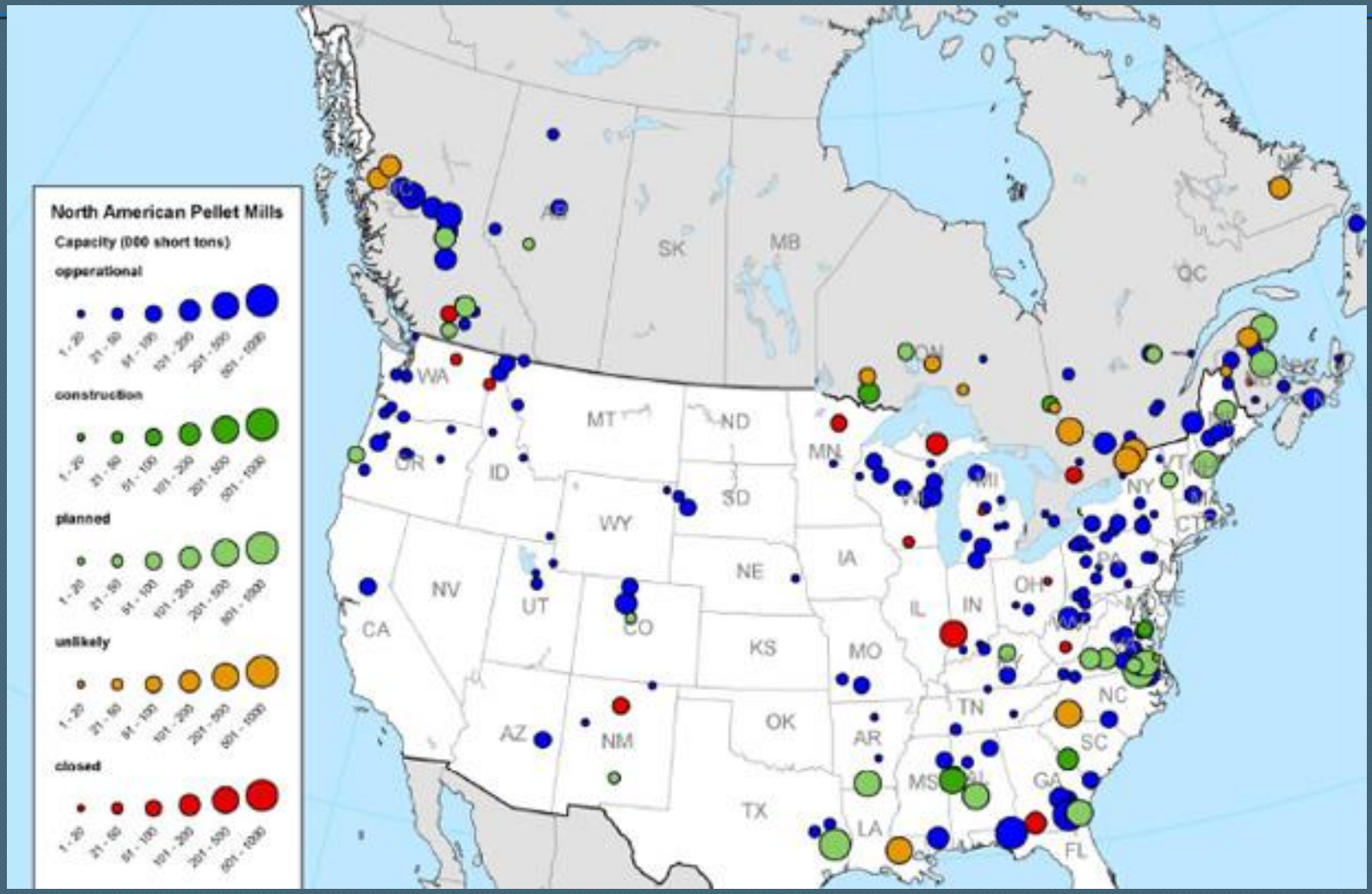
IEA, (2015), *Medium-Term Renewable Energy Market Report 2015*, OECD/IEA, Paris.

Asian Industrial Wood Pellet Demand to Grow



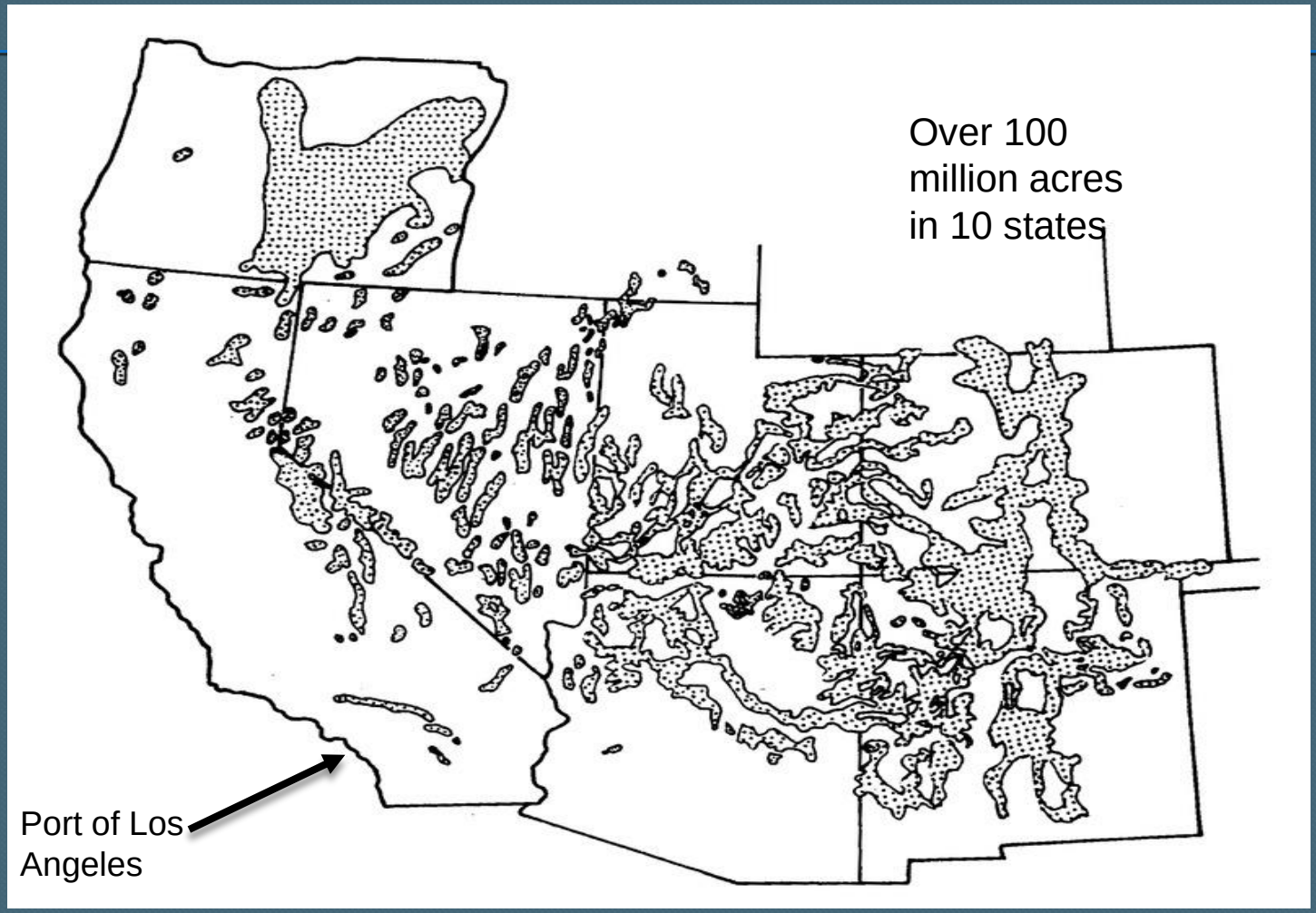
Source: Presentation by William Strauss of Future Metrics at WPAC AGM, Halifax, NS, November 4, 2015

Limited Industrial Facilities to Process Biomass in the Southwestern United States



http://i.bnet.com/blogs/north-american-pellet-mills.jpg

Range of Pinyon-Juniper Woodlands in the Western United States



Evans, Raymond A. - *Management of Pinyon-Juniper Woodlands* United States Department of Agriculture, Forest Service -- Intermountain Research Station, General Technical Report INT-249, July 1, 1988.

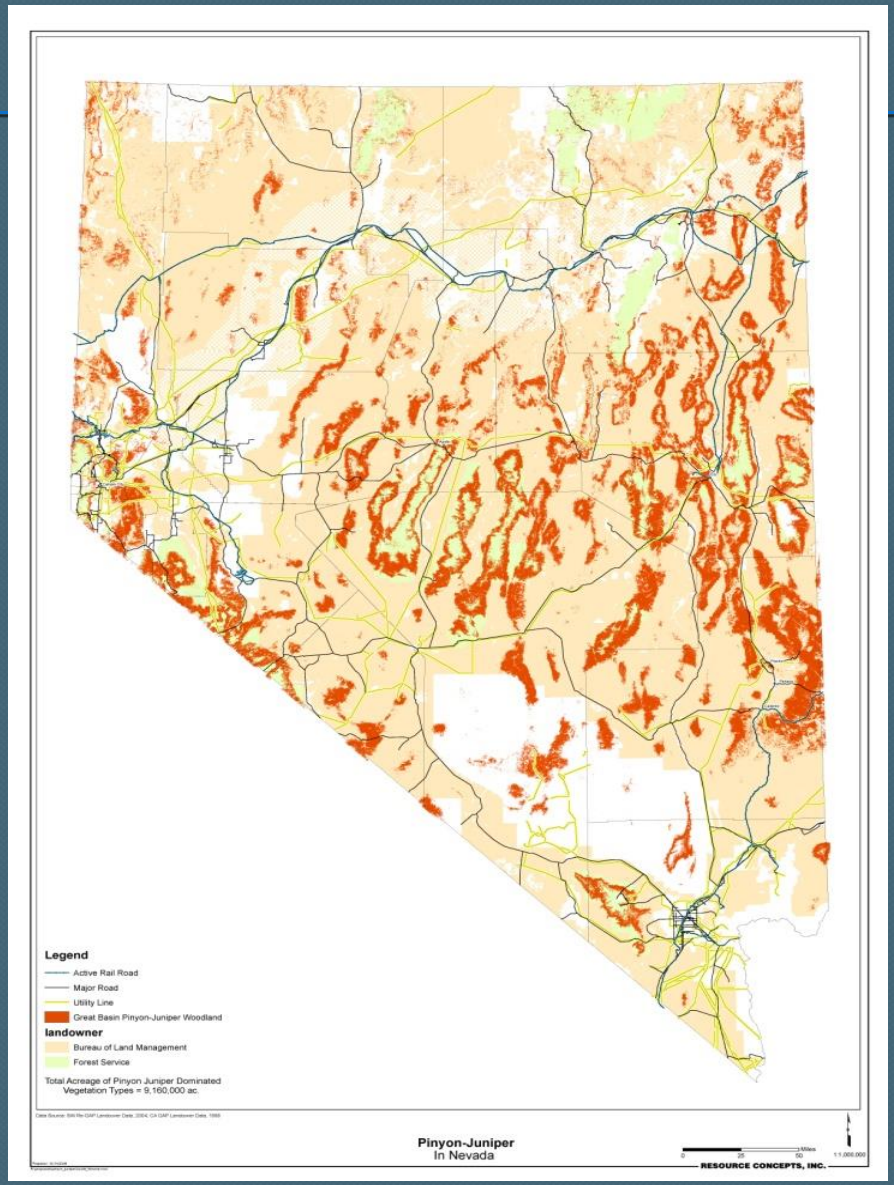
Nevada/Western States Rail Routes

Rail Distances to/from Caliente, NV (approx. miles)

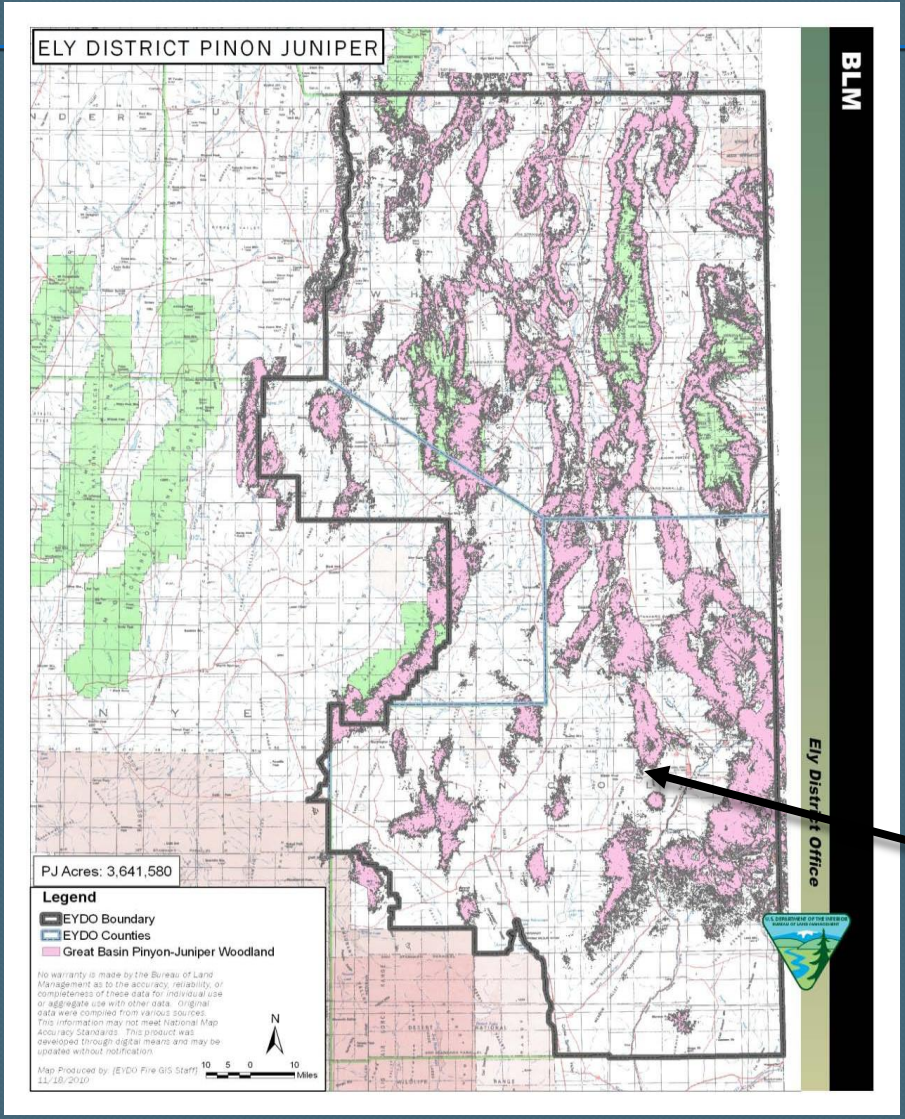
Las Vegas, NV	135
Los Angeles, CA	441
Denver, CO (Southern Route)	754
Denver, CO (Northern Route)	961

Distribution of Pinyon-Juniper in Nevada

9 million acres of Pinyon-Juniper woodland in Nevada



Extent of Pinyon-Juniper Woodlands in BLM's Ely District



Lincoln County, NV

Pinyon-Juniper Woodland Types

Phase I Foreground
Phase II Midground
Phase III Background

Bureau of Land Management, Ely District
Landscape Restoration Goals in Eastern Nevada

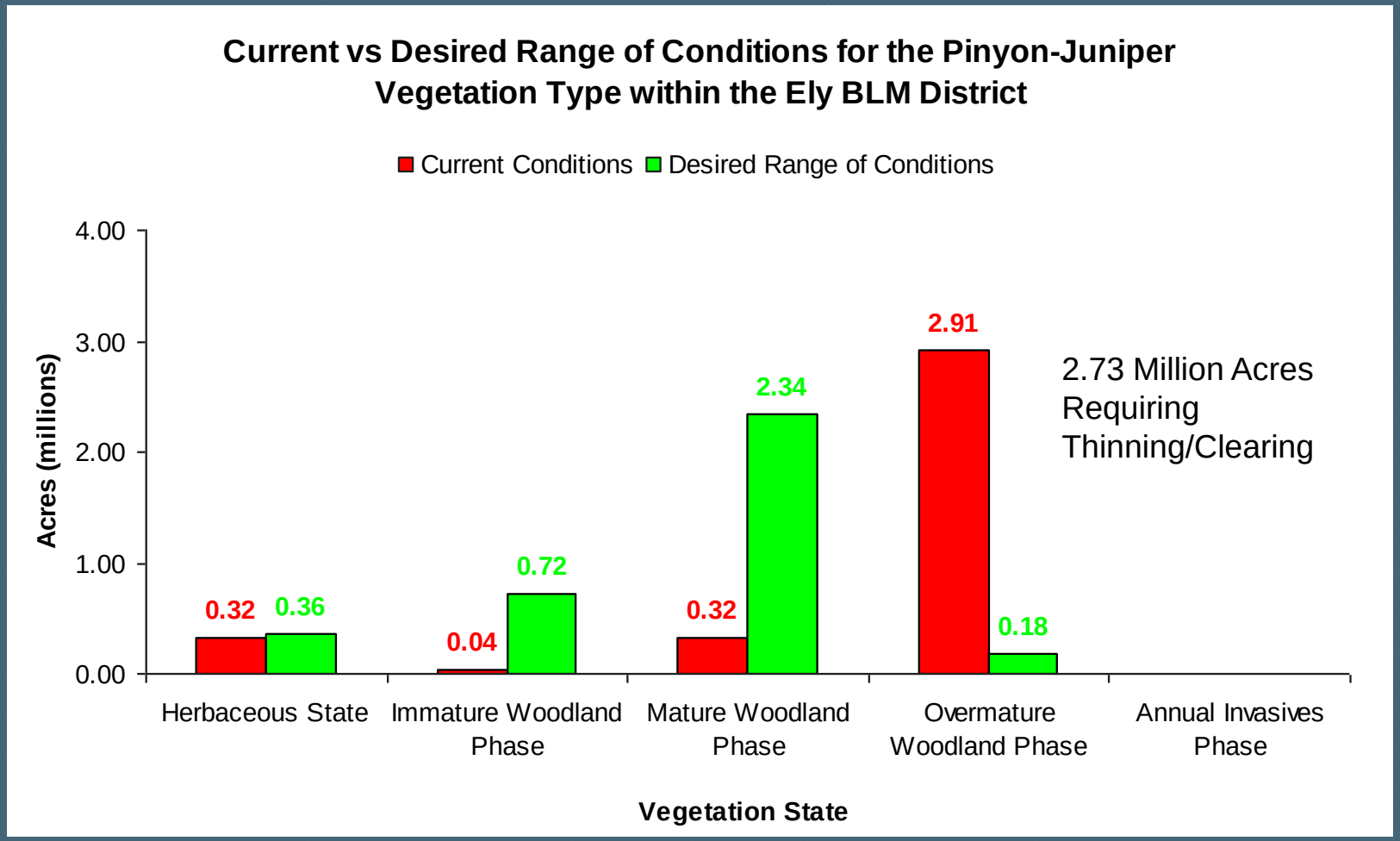


Chart developed based on information from Tables 3.5-2 and 3.5-3 from the Final Ely District EIS (Current State) and Table 2 from the Approved Resource Management Plan (Desired State).

Bureau of Land Management Landscape Restoration Objectives in Eastern Nevada and Western Utah

Phase I Landscape Restoration Projects

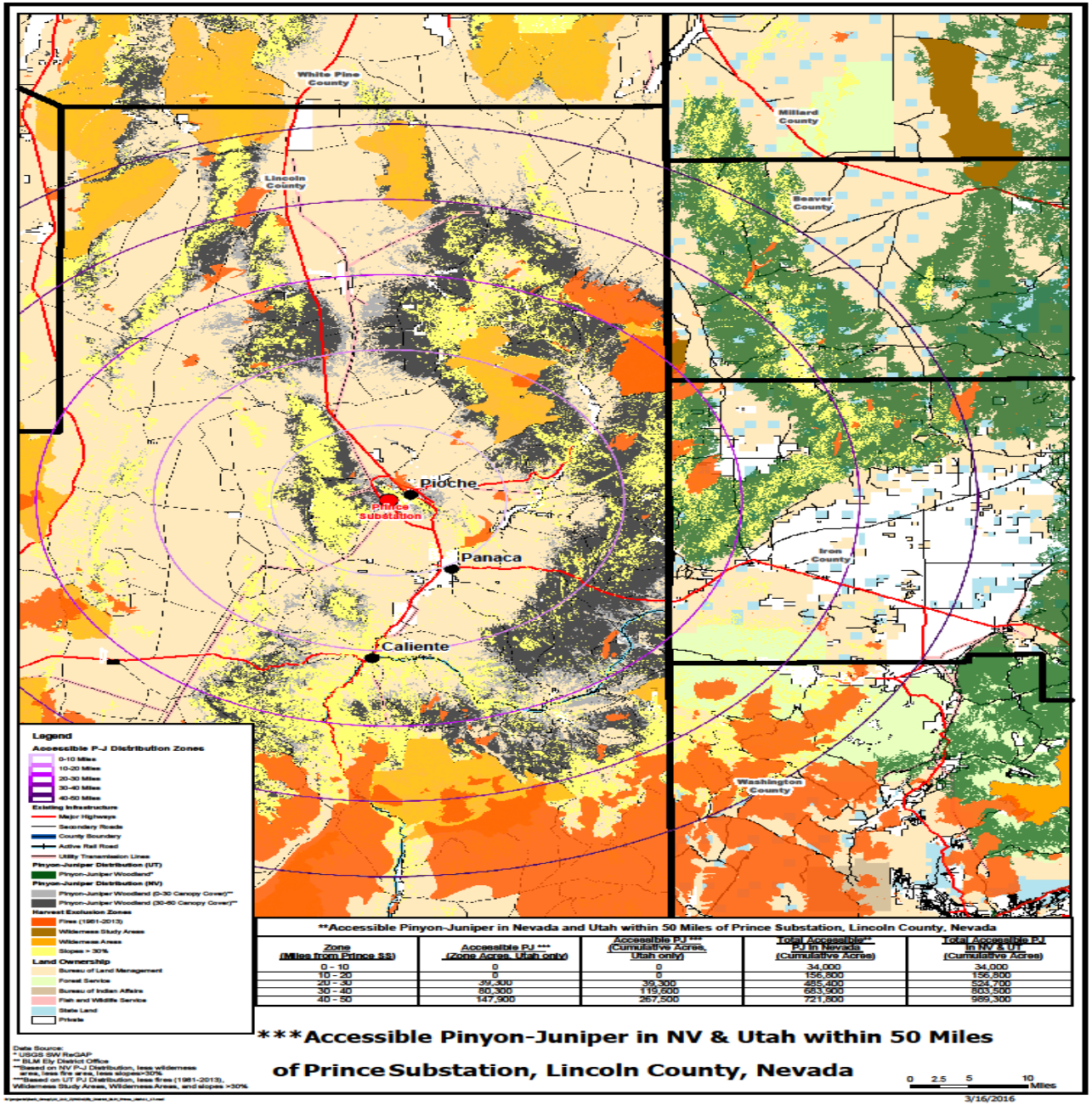
- Encroachment Control
- Sage Grouse Habitat Preservation

Phase II and III Landscape Restoration Projects

- Catastrophic Wildfire Hazard Reduction
- Watershed Health
- Deer and Elk Habitat Enhancement
- Increased Biodiversity
- Pine Nut Production

USDA Funded Analysis of Accessible Pinyon and Juniper Biomass within 50-miles of Central Lincoln County, NV

Approximately 990,000 Acres of Accessible Pinyon and Juniper Biomass



Accessible Pinyon-Juniper Woodland within 50 Miles Central Lincoln County, Nevada by Phase Type – 989,900 acres

Nevada	Phase I Acres	Phase II Acres	Phase III Acres	In Zone Total Acres	Cumulative Total Acres
0 to 10 miles	8,500	17,100	8,500	34,100	34,100
11 to 20 miles	30,700	61,400	30,700	122,800	156,900
21 to 30 miles	82,200	164,400	82,200	328,800	485,700
31 to 40 miles	49,600	99,300	49,600	198,500	684,200
41 to 50 miles	9,500	19,000	9,500	38,000	722,200
Total	**180,500**	**361,200**	**180,500**	**722,200**	

Utah	Phase I Acres	Phase II Acres	Phase III Acres	In Zone Total Acres	Cumulative Total Acres
0 to 10 miles	-	-	-	-	-
11 to 20 miles	-	-	-	-	-
21 to 30 miles	9,800	19,700	9,800	39,300	39,300
31 to 40 miles	20,100	40,200	20,100	80,400	119,700
41 to 50 miles	37,000	74,000	37,000	148,000	267,700
Total	**66,900**	**133,900**	**66,900**	**267,700**	

Nevada & Utah	Phase I Acres	Phase II Acres	Phase III Acres	In Zone Total Acres	Cumulative Total Acres
0 to 10 miles	8,500	17,100	8,500	34,100	34,100
11 to 20 miles	30,700	61,400	30,700	122,800	156,900
21 to 30 miles	92,000	184,100	92,000	368,100	525,000
31 to 40 miles	69,700	139,500	69,700	278,900	803,900
41 to 50 miles	46,500	93,000	46,500	186,000	989,900
Total	**247,400**	**495,100**	**247,400**	**989,900**	

Estimated Bone Dry Tons of Accessible Pinyon-Juniper Biomass within 50 Miles of Central Lincoln County, Nevada by Phase Type

Distance from Central Lincoln County (miles)	Nevada & Utah acres in zone	Phase I BDT's	Phase II BDT's	Phase III BDT's	In Zone Total BDT's	Cumulative Total BDT's
0 – 10	34,100	22,100	87,200	147,100	256,400	256,400
11 – 20	122,800	79,800	313,100	531,100	924,000	1,180,400
21 – 30	368,000	239,200	938,900	1,591,600	2,769,700	3,950,100
31 – 40	278,800	181,300	711,400	1,205,800	2,098,500	6,048,600
41 – 50	185,900	120,900	474,300	804,500	1,399,700	7,448,300
	Total	**643,300**	**2,524,900**	**4,280,100**	**7,448,300**	

7.5 million bone dry tons

Source: The Beck Group, *Lincoln County, Nevada Biomass Supply Update*, prepared for the Lincoln County Regional Development Authority, Portland, Oregon, March 2016.

Why Consider Pinyon-Juniper Feedstock Derived from the Lincoln County, Nevada Area?

- **Nearly 1 Million Acres of Accessible Woodland Administered by One Land Owner**
  - United States Department of Interior, Bureau of Land Management
- **Approved Agency Plans and National Environmental Policy Act (NEPA) Compliance**
  - BLM's Ely Resource Management Plan – 2.7 million acres Requiring Thinning
  - Numerous Thinning Project Specific Plans and Environmental Assessments
    - Completed by BLM Ely District and BLM Cedar City District Staff and Ready for Implementation – in excess of 350,000 acres
    - Under Development by BLM Ely District and BLM Cedar City District Staff – 250,000 acres
- **BLM and USFS Paying $75 (Phase I) to $400 Per Acre (Phases II and III) for Contract Thinning**
- **BLM Authorized to Enter Into 10-Year Renewable Stewardship Contracts or Agreements Providing Feedstock Security**
- **Mainline Union Pacific Railroad Terminating at Port of Los Angeles Serves Region**

Analyses of Lincoln County, Nevada Derived Biomass (*reported on a dry basis)*

		Proximate (%)			Ultimate (%)		Calorimetry (btu/lb)	
	Analysis Source	Volatile	Ash	Fixed Carbon	Hydrogen	Carbon	HHV	LHV
Phase III Pinyon Pine	Idaho National Laboratory	79.64	1.85	18.52	6.27	52.70	9355	7901
	Biomass Energy Lab	82.2	1.19	16.60	6.20	51.90	9005	8456
Phase III Utah Juniper	Idaho National Laboratory	79.70	2.89	17.41	6.30	53.12	9517	8068
	Biomass Energy Lab	79.28	2.49	18.22	5.97	51.78	8941	8413

Idaho National Laboratory Analyses of Other Sources of Biomass (*reported on a dry basis)*

		Proximate (%)			Ultimate (%)		Calorimetry (btu/lb)	
Material		Volatile	Ash	Fixed Carbon	Hydrogen	Carbon	HHV	LHV
Hybrid Poplar		86.48	0.87	12.65	6.03	49.40	8746	7370
Lodge Pole Pine		84.50	1.08	14.41	6.06	50.14	8760	7371

Equipment Utilized in Pinyon-Juniper Thinning

Southern Utah Biomass Demonstration Days
June 2-4, 2011, Beaver, Utah

PONSSE COMBINATION
HARVESTER/FORWARDER

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Equipment Utilized in Pinyon-Juniper Thinning

Southern Utah Biomass Demonstration Days
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Loading Whole Tree Pinyon Juniper Chips

Fecon RTC 2500

Opportunities for Industrial Utilization of Pinyon-Juniper Biomass

- Synthesis Gas (Syngas)
- Compost
- Wood Composites
- Direct-Combustion Electrical Energy Generation
- Combined Heat and Electricity
- Biochar
- Charcoal
- Biochemical
- Cellulosic Biofuel
- Industrial Wood Pellets

Key Constraints to Industrial Utilization of Pinyon-Juniper Biomass

- BLM Funding Uncertain
  - Solution – HR 1815 of 78th Congress provides BLM access to public land sale proceeds to fund pinyon and juniper woodland projects, passed House 360-7, did not make it out of Senate. New bill to be introduced in House and Senate this month
- Ineligible Feedstock Under EPA Renewable Fuels Standard Program
  - Solution - Amend definition of renewable biomass in Title 40 CFR 80.1401 which disallows biomass sourced from federal forestland

For Additional Information:

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Credits

Slide 1 – Cover Photo, Doug Page
Slide 8 – map, Nevada Pinyon Juniper Partnership, http://www.nvpjpartnership.org/documents_pinyon/proactiveManagement.pdf
Slide 9 – map, Bureau of Land Management, Ely District Office
Slide 10 – photo, Scott Bell
Slide 11 – chart, Nevada Pinyon-Juniper Partnership, http://www.nvpjpartnership.org/documents_pinyon/proactiveManagement.pdf
Slide 12 – photo, Doug Page
Slides 13 and 14 – map and tables, **Source: The Beck Group, *Lincoln County, Nevada Biomass Supply Update*, prepared for the Lincoln County Regional Development Authority, Portland, Oregon, March 2016.**
Slide 17 – Idaho National Laboratory analyses of Lincoln County derived pinyon and juniper biomass performed using ASTM analytical methods for Lincoln County Regional Development Authority, April, 6, 2016; Biomass Energy Labs analysis of Lincoln County derived pinyon and juniper biomass performed using CEN/EN analytical methods for Lincoln County Regional Development Authority, July 1, 2016; Idaho National Laboratory analysis of other biomass sources accessed from INL website at https://bioenergylibrary.inl.gov/Sample/BiomassInfo.aspx
Slide 18 – both photos, Doug Page
Slide 19 – both photos, Doug Page
Slide 20- photo, http://www.nevadadaytrips.com/ward-charcoal-ovens.html
Slide 22 – photo, http://www.besustainablemagazine.com/cms2/wp-content/uploads/2013/11/Crescentino-Plant-view.jpg