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The background of the slide is a photograph of a large-scale construction project at night. Several massive, light-colored concrete piers are visible, supporting a bridge deck. Scaffolding and construction equipment are present on the piers. In the background, a steel truss bridge structure is illuminated with warm orange lights. The sky is a deep blue, suggesting twilight. The overall scene conveys a sense of industrial activity and infrastructure development.

Virginia Coal & Energy Alliance Southern States Energy Board Coal Ash Opportunities

May 22, 2017

Coal Ash Opportunities In A Dynamic Market

- Regulatory Climate
- Annual Production & Use – Market Status
- Trends & Market Drivers
- Impacts To Beneficial Use Market
- Impacts To State Budgets & Policies

RCRA 1976 – Energy Goal & Objective

- **RCRA -42 U.S. Code § 6902 - Objectives and national policy**
- **Objective** “The objectives of this chapter are to promote the **protection of health and the environment** and to **conserve valuable material and energy resources by**”... “**providing technical and financial assistance to State and local governments and interstate agencies** for the development of solid waste management plans (including resource recovery and resource conservation systems) which will promote improved solid waste management techniques (including more effective organizational arrangements), new and improved methods of collection, separation, and **recovery of solid waste**, and the environmentally safe disposal of non-recoverable residues;”
- “The Congress finds **with respect to materials**, that ...**millions of tons of recoverable material which could be used are needlessly buried each year**” and that “**the recovery and conservation of such materials can reduce the dependence of the United States on foreign resources and reduce the deficit in its balance of payments.**”

- EPA Issued RCRA Subtitle D Regulation – April 17, 2015
 - Primary Purpose – Regulate CCR Disposal – Landfills & Ponds
 - Self Implementation – States & Citizen Suit Enforcement – Unparalleled Public Information Reporting To Enhance Enforcement
 - Design Requirements – Composite Liner Systems - Bottom & Cap
 - Stepped Up Groundwater Monitoring & Reporting
- Water Infrastructure Improvements For The Nation Act
 - Places State Approved Programs As Primary CCR Enforcement
 - Gives EPA Subtitle D Enforcement If State Program Not Approved
- ELG- Stay Of Deadlines & Reconsideration – 4/12/17
- EOs – Regulatory Burden Reduction
 - 13777: Reform & Reduction Task Reviews
 - 13771: Regulatory Reduction – 2 For 1
 - 13783: Suspend, Revise or Rescind Domestic Energy Burden Regs
- Request For Input On Regulatory Burden Candidates – 5-15-17
 - Industry Requests For Delay Of CCR Deadlines & Modifications

Traditional Opportunities-2015 Data



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- Cement 2016 Usage 101MTon
- CCR Production-2015-117.3 M Tons
- Beneficial Use-2015, 61.1MT-52%- Up
- CCRs 3% Of Cost Of New Home
- 50% Of Wallboard Has CCR



ACAA Annual Survey Data-2015



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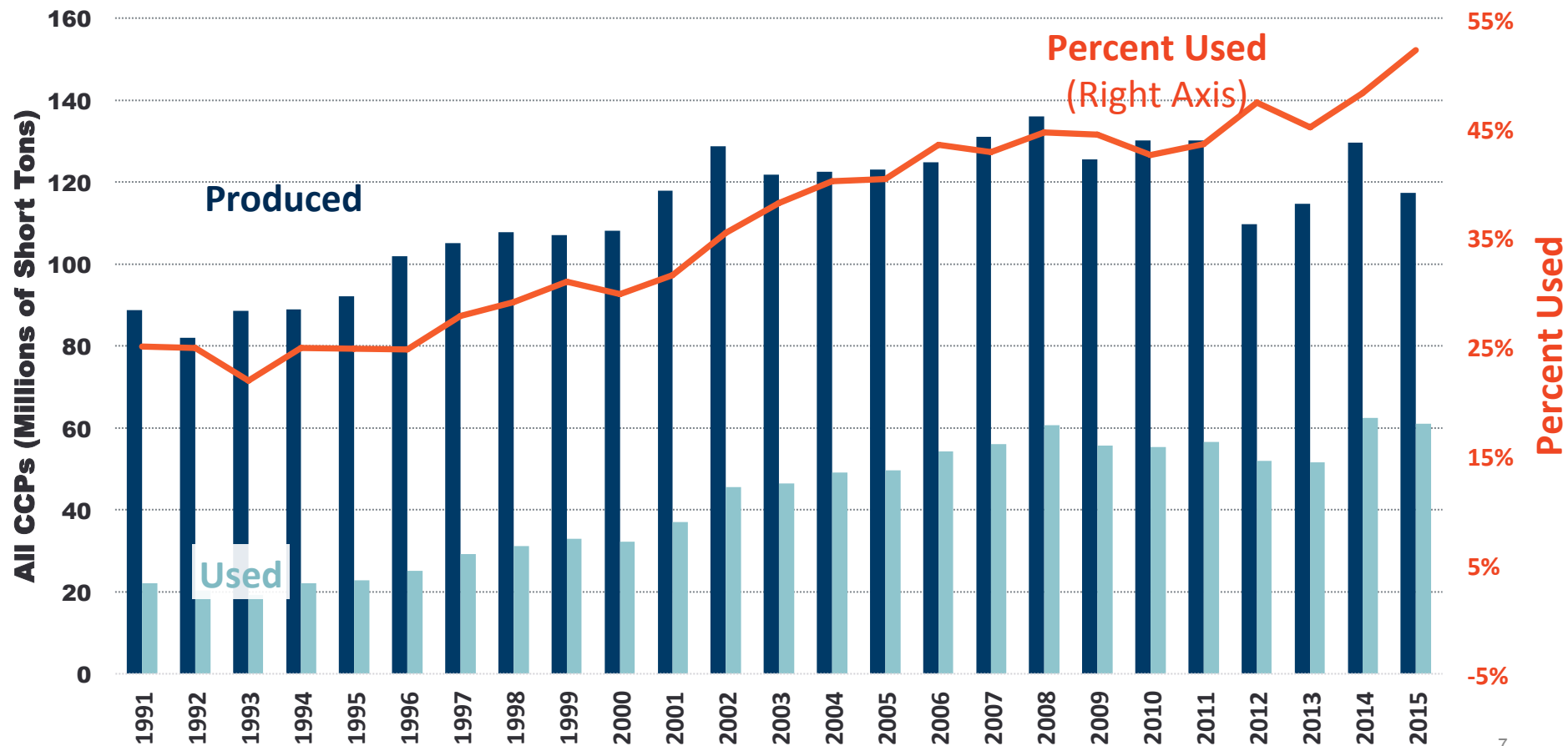
2015 Coal Combustion Product (CCP) Production & Use Survey Report

2015 CCP Categories	Fly Ash	Bottom Ash	Boiler Slag	FGD Gypsum	FGD Material Wet Scrub	FGD Material Dry Scrubbers	FGD Other	FBC Ash	CCP Production / Utilization Totals
Total CCPs Produced by Category	44,365,587	12,010,425	2,228,205	32,661,536	11,313,960	1,311,947	206,314	13,191,460	117,289,432
Total CCPs Used by Category	24,062,786	4,819,205	1,866,912	17,058,178	1,249,438	252,849	20,697	11,723,843	61,053,908
1. Concrete/Concrete	15,737,238	570,092	33,290	409,134	-	-	-	-	16,749,754
2. Blended Cement/Raw Feed for	3,629,151	1,130,802	-	1,649,934	-	-	-	-	6,409,887
3. Flowable Fill	107,263	9,106	-	-	-	-	-	-	116,369
4. Structural Fills/Embankments	1,277,356	1,561,531	305,770	1,221,865	100,940	-	-	-	4,467,462
5. Road Base/Sub-base	178,281	311,779	21	-	-	-	-	-	490,081
6. Soil Modification/Stabilization	216,483	66,253	-	8,053	-	-	-	-	290,789
7. Mineral Filler in Asphalt	52,784	-	14,176	-	-	-	11,479	-	78,440
8. Snow and Ice Control	-	527,695	77,935	-	-	-	-	-	605,630
9. Blasting Grit/Roofing Granules	-	184,712	1,400,455	173	-	-	-	-	1,585,340
10. Mining Applications	1,128,682	73,416	-	807,280	-	215,974	-	11,593,760	13,819,113
11. Gypsum Panel Products	-	28,378	-	11,322,016	973,785	-	-	-	12,324,178
12. Waste	1,138,078	242	-	-	-	-	9,218	130,083	1,277,621
13. Agriculture	2,409	1,788	-	1,392,693	174,713	-	-	-	1,571,602
14. Aggregate	-	173,472	-	-	-	-	-	-	173,472
15. Oil/Gas Field Services	181,907	-	-	-	-	36,875	-	-	218,782
16. Miscellaneous/Other	413,152	179,940	35,265	247,030	-	-	-	-	875,387
Summary Utilization to Production Rate									
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Category Use to Production Rate	54.24%	40.13%	83.79%	52.23%	11.04%	19.27%	10.03%	88.87%	52.05%

Historical CCR Production & Use



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FGD Gypsum Utilized-Major Growth Categories



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FGD Gypsum

TOTAL CCPS USED BY CATEGORY

17,058,178

OTHER USES

1,471,670

STRUCTURAL FILLS/EMBANKMENTS

1,221,865

AGRICULTURE

1,392,693

CEMENT MANUFACTURE

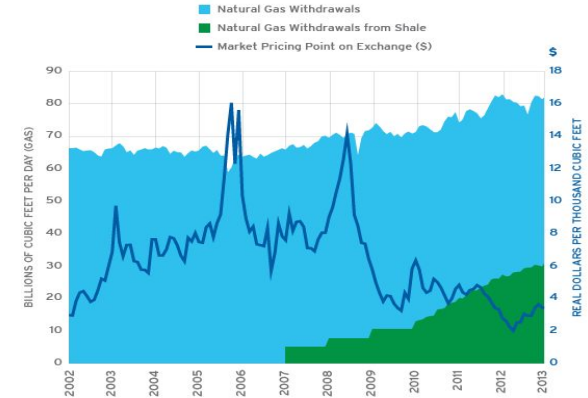
1,649,934

GYPSUM PANEL PRODUCTS

11,322,016

0 4,000,000 8,000,000 12,000,000 16,000,000

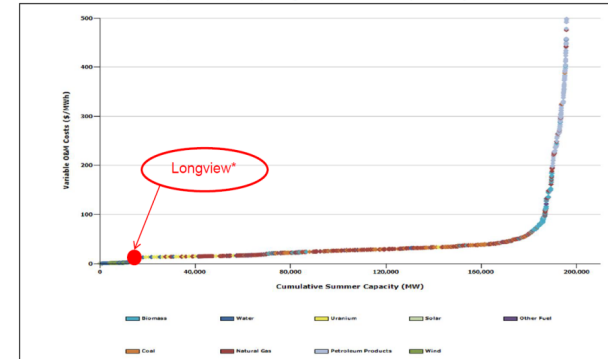
AS FRACKING GROWS, NATURAL GAS PRICES ARE DROPPING



Note: Gross withdrawals include not only marketed production, but also natural gas used to repressure wells, vented and flared gas, and non-hydrocarbon gases removed.
 Source: U.S. Energy Information Administration

BROOKINGS

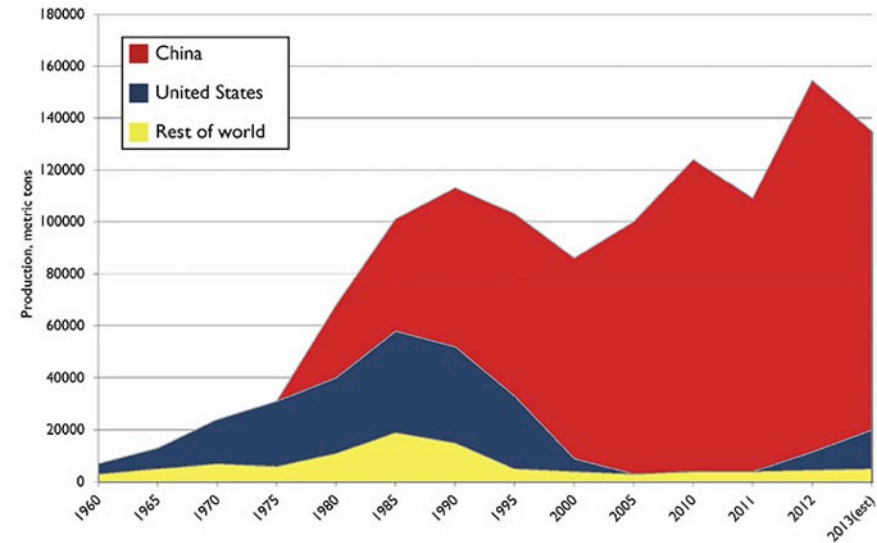
PJM Dispatch Curve (Marginal Cost of Dispatch by Unit)



Longview data based on consolidated marginal cost of production of Longview and Mepco (Utility Plant data from SNL).
 Longview marginal cost close to the cost of non-dispatchable, subsidized renewables

- Plant Closure & Lower Capacity Factors
 - Announced Closings – 18 Units – 1.5MTPY Ash – 1.2M FA
 - Specification Grade Fly Ash Shortage In Regional Markets- Boston Case
 - Travel Distance Increase – Rail & Barge Movements Increase
 - Wallboard Plants Seek Back-up Sources
- Ash Processing & Beneficiation Advance
 - Reclamation of Ash Must Fill Voids In Certain Markets
 - Future Access To Resources – Closed Units
 - Closure Permit Planning
 - Post Closure Planning For Access – Liability Issues & Timeline
 - Next Generation HELE Plant Reagent Improvements- MACT
 - Concrete Friendly Additives – Trona vs Lime etc.
 - CO2 Reduction While Producing Usable Byproducts
 - Rare Earth Elements – New Opportunities

- REE Are Crucial For Advanced Materials And Key Industries-Electronics, Automotive Energy Etc. – Impacts \$2.3 Trillion Of US Imports Finish Goods
- China Is The Saudi Arabia Of REE – 90+% Of Current Supply
- Strategic Interests Dictate That We Develop A Domestic Supply - Congress Mandate To Assess -In Strategic And Critical Materials Stockpiling Act For FY 2017
- Global Demand – 165KTPY –US-11% Of Total
- Crustal Average Concentration – 184ppm
- Coal And Related Products - >300ppm
- DOE Funded Projects- 15 Total:
 - Assess Sources >300ppm
 - Develop Process- 300ppm to 2%
 - Assess Economic Viability
 - Assess Environmental Impacts
- Study Success – Met Goal 300ppm To 2%



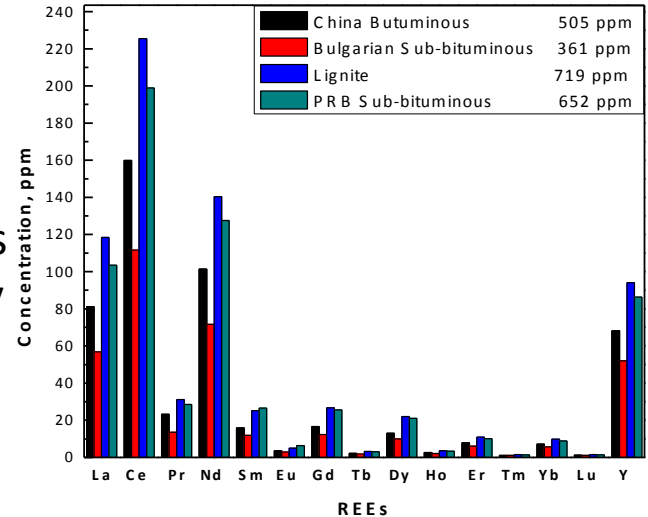
DOE Funded REE Projects - 2017



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Type of Project	Research Host	Location	Materials	Process	DOE (\$000s)	Private (\$000s)	Total (\$000s)	Schedule
Bench Scale	University of Wyoming	Larimie, WY	PRB Coal Ash	CO ₂ , FeChloride under Supercritical Conditions	660	221	881	3/1/16 to 8/31/17
Bench Scale	Duke Unviversity	Durham NC	Various CCB	Solvent Extract & Membrane Filtration	720	183	903	3/1/16 to 8/31/17
Bench Scale	West VA University	Morgantown WV	NApp Coal Mine Drainage	Extraction from AMD & AMD Sludges	750	201	951	3/1/16 to 8/31/17
Bench Scale	Batelle	Columbus OH	OH Coal & Ash	Closed Loop Digestion	710	190	900	3/1/16 to 8/31/17
Bench Scale	University of North Dakota	Grand Forks, ND	ND Lignites & Refuse	Separate, Extr & Concentrate	749	188	937	3/1/16 to 8/31/17
Pilot Scale	University of KY	Lexington KY	Central App Prep Refuse	Qtr TPY Physical & Chemical Seaparation	1,000	320	1320	3/1/16 to 8/31/17
Pilot Scale	Physical Sciences, Inc	Andover MA	Ash E KY Fire Clay & Antracite Refuse	1-5 TPD Physical-Chemical Separation	999	251	1250	3/1/16 to 8/31/17
Pilot Scale	Southern Res Institute	Birmingham AL	Cent App & E Bitum Coal	Plasma Based Testing on Ash	1,000	290	1290	3/1/16 to 8/31/17
Pilot Scale	Tusaar Inc	Lafayette, CO	KY & OH Coal Ash	Extraction & Metal Sorption	984	246	1230	3/1/16 to 8/31/17
Sample & Characterize	UK Research Foundation	Lexington KY	Coal & Coal By-Products	Sample & Characterize	400		400	10/1/16 to 4/30/18
Sample & Characterize	Resources Research	Morgantown WV	Coal & Coal By-Products	Sample & Characterize	400		400	10/1/16 to 4/30/18
Sample & Characterize	XLight Corporation	Morristown NJ	Coal & Coal By-Products	Sample & Characterize	215		215	10/1/16 to 4/30/18
Sample & Characterize	Tetra Tech Inc.	Pittsburgh PA	Coal & Coal By-Products	Sample & Characterize	373		373	10/1/16 to 4/30/18
Sample & Characterize	Tetra Tech Inc.	Pasadena CA	Coal & Coal By-Products	Sample & Characterize	376		376	10/1/16 to 4/30/18
Program	NETL	Various	Coal & Coal By-Products	Various Phase Support	34,769		34,769	2016 to 2020

- REE From Ash Offers Co-Benefits For Markets
 - Process Steps Can Improve Fly Ash Quality
 - Reclamation Of Ash From Closed Ponds & Landfills Can Offer Economic Co-Beneficiation
- Next Generation Power Plants Incorporate Processes
 - Capture REE Before Encapsulation Into Glass Fly Ash Matrix
 - Dual Income Streams – Energy & Materials
 - Dual Co-Product Income – Ash & REE Materials



- **Reduction Of Quality Fly Ash Volumes Will Impact DOTs**
 - Approximately 1/3 Of Fly Ash Used In Infrastructure Projects
 - Availability Will Be Dependent On Long Distance Supply Chains
- **State Legislation & Regulations Must Accept Delegation For Administration & Enforcement**
 - EPA Administrator Has Placed High Priority On Review & Approval Of State Program Submittals
 - Align State Regulations To Primary Criteria In RCRA CCR
 - Address Unique Character Of State Natural Resources To Address CCR
 - Ensure Future Reclamation Of Ash Resources Is Facilitated And Supported
 - View Ash As A Resource – Implement The Goals Of Congress In RCRA
 - Forward Think Future Needs: Access, Post Closure Care Responsibility
 - Next Generation Coal Plant Byproducts – HELE & IGCC – Multi-Phase Revenue
- **Promote Federal & State Tax Policies Which Recognize & Support Next Generation Lower Emissions HELE Plants – Incentives Should No Longer Dis-incentivize Coal**
- **Promote R&D Funding For Lower Emission Coal Plants**
 - Efficiency Improvements
 - CCS&U Demonstration

- Coal Use Will Be Impacted By Cheap Natural Gas (Capacity Factor) & Regulatory Impacts (Closures)
 - Current Administration Reviews May Reduce Regulatory Timed Impacts
- CCP Use As A Valued Resource Continues
 - Demand Increasing As Economy Grows – Infrastructure Impacts State \$\$
 - Volumes Impacted In Certain Markets – Closings & Capacity Factor
 - Quality Impacted By Regulation-Reclamation & Beneficiation Investment
 - Supply/Demand Economics Will Raise Prices
 - Future Opportunities May Include REE Extraction & Processing
- State Energy & CCR Programs – Address Current & Future Needs
 - Ensure State Control –
 - Enhance Resource Recovery & New Opportunities For Coal & Byproducts
 - Promote Federal & State Tax Policies & Funding For Logical Energy Decisions & Environmental Protection

QUESTIONS

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