



SonoAsh LLC

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COAL 2.0: A Path to Closed Loop Coal

Coal Smart 2018, Vancouver, Canada



CLEAN TECHNOLOGY INNOVATION MINING VALUE FROM COAL ASH



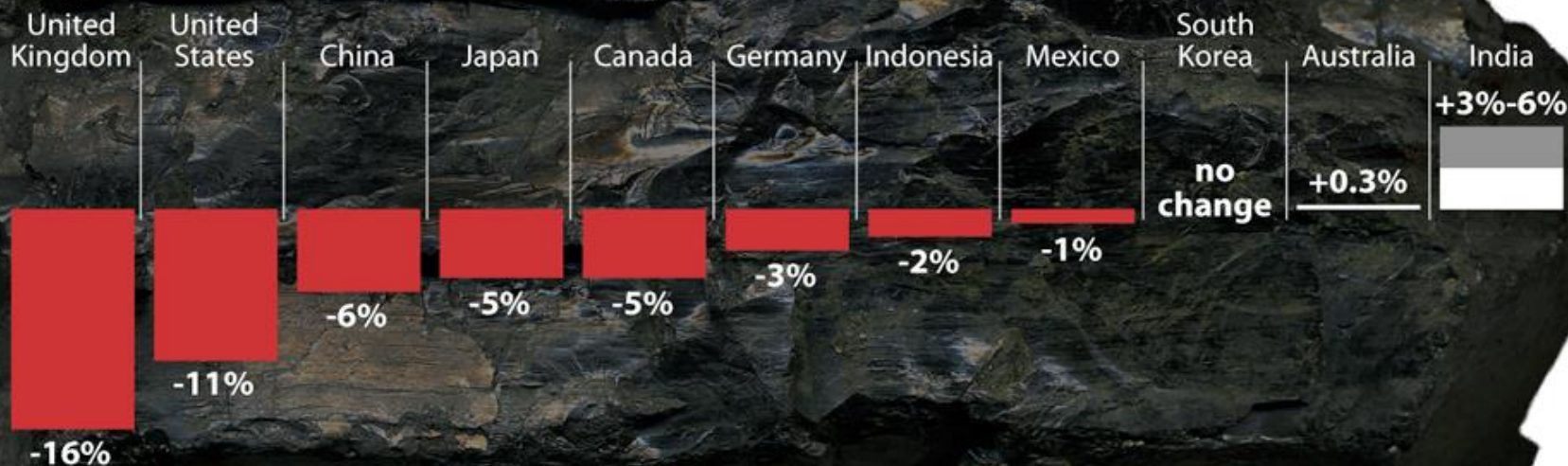
We are here to talk about a dying industry

World Coal Consumption Drops

It is "increasingly likely" that global coal consumption peaked in 2013, according to the Institute for Energy Economics and Financial Analysis. The chart shows coal use in the first nine months of 2015 compared to 2014 in the largest coal-consuming nations.

WORLD COAL CONSUMPTION

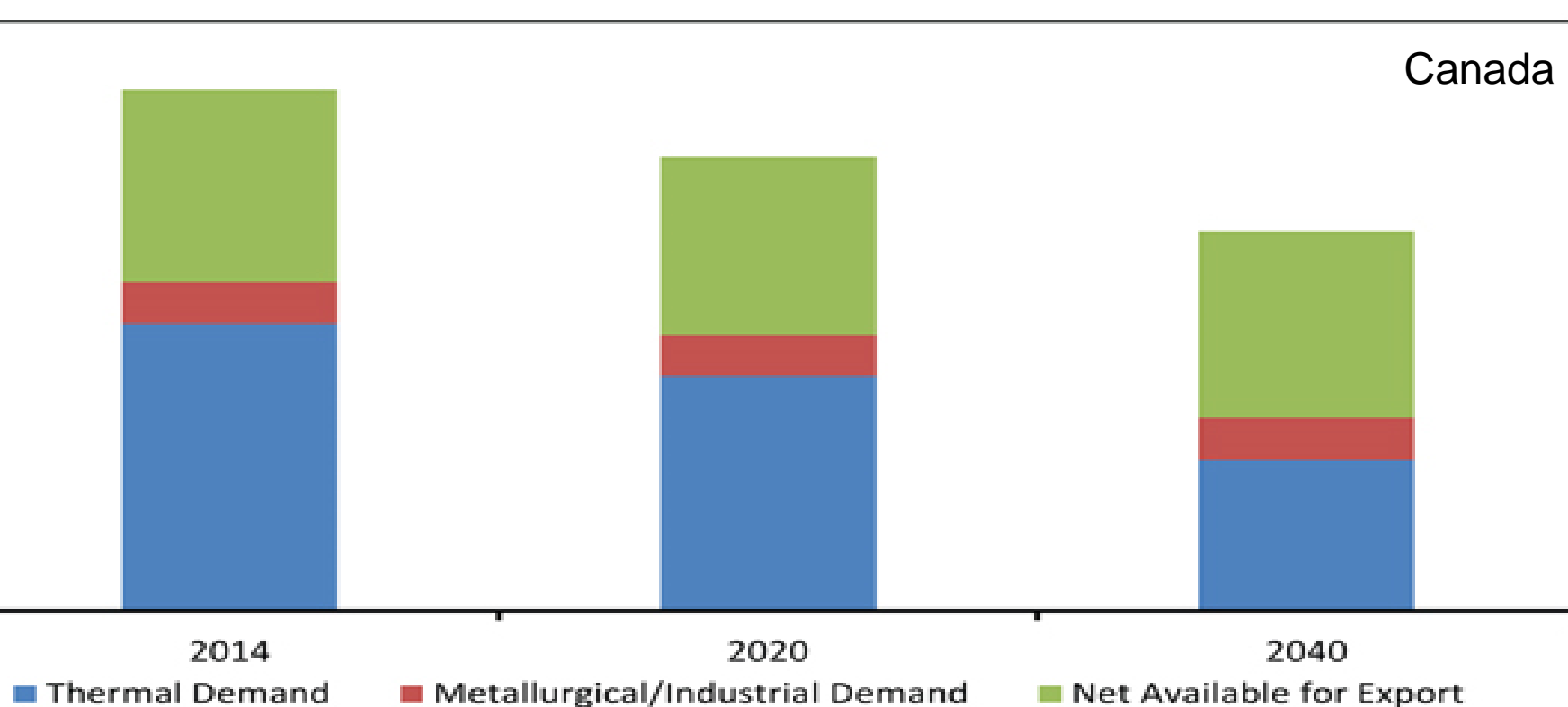
Year on year change, Jan.-Sept. 2015 vs Jan.-Sept. 2014



Note: Russia is among the 12 largest coal consumers, but the IEEFA was not able to locate precise data about its coal use.

Million Tonnes

Canada



CLEAN TECHNOLOGY INNOVATION MINING VALUE FROM COAL ASH

Source: <https://www.neb-one.gc.ca/nrg/ntgrtd/ftr/2016/index-eng.html>

Workers Required to Produce the Same Amount of Electric Power (2016)

COAL



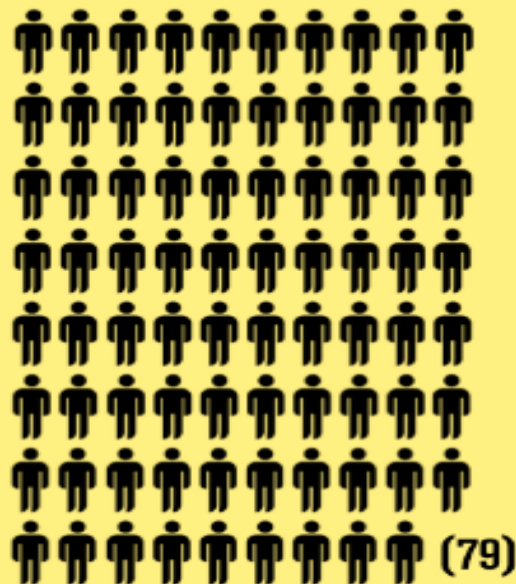
160,119 coal workers produced 1.24 billion megawatt hours (7,745 per worker)

NATURAL GAS



362,118 natural gas workers produced 1.38 billion megawatt hours (3,812 per worker)

SOLAR



373,807 solar workers produced 36.75 million megawatt hours (98 per worker)



Drivers

Rate payer

Environmental poverty

Strategic resource

Infrastructure

Cost & risk management

Barriers

Stakeholders (So What?)

Owners/Operators	Liabilities, regulatory pressures
Rate Payers	No rate increases
Infrastructure	Access to metallurgical coal
Shareholders	Incremental net revenue
Jobs, Environment, Community	Economic efficiency and sustainability drivers



THIS IS NOT A DYING INDUSTRY



CLEAN TECHNOLOGY INNOVATION MINING VALUE FROM COAL ASH

DYNAMIC PATH *FORWARD*



CLEAN TECHNOLOGY INNOVATION MINING VALUE FROM COAL ASH



BENEFITS OF THERMAL COAL COMBUSTION



CLEAN TECHNOLOGY INNOVATION MINING VALUE FROM COAL ASH

**PRODUCE
ELECTRICITY**

**LOW EMISSIONS
CEMENT**

**ABOVE
GROUND ORE
BODY**



SONOASH: MANUFACTURED COAL ASH



Source **variable** coal ash

Address **environmental** liability

Definable product

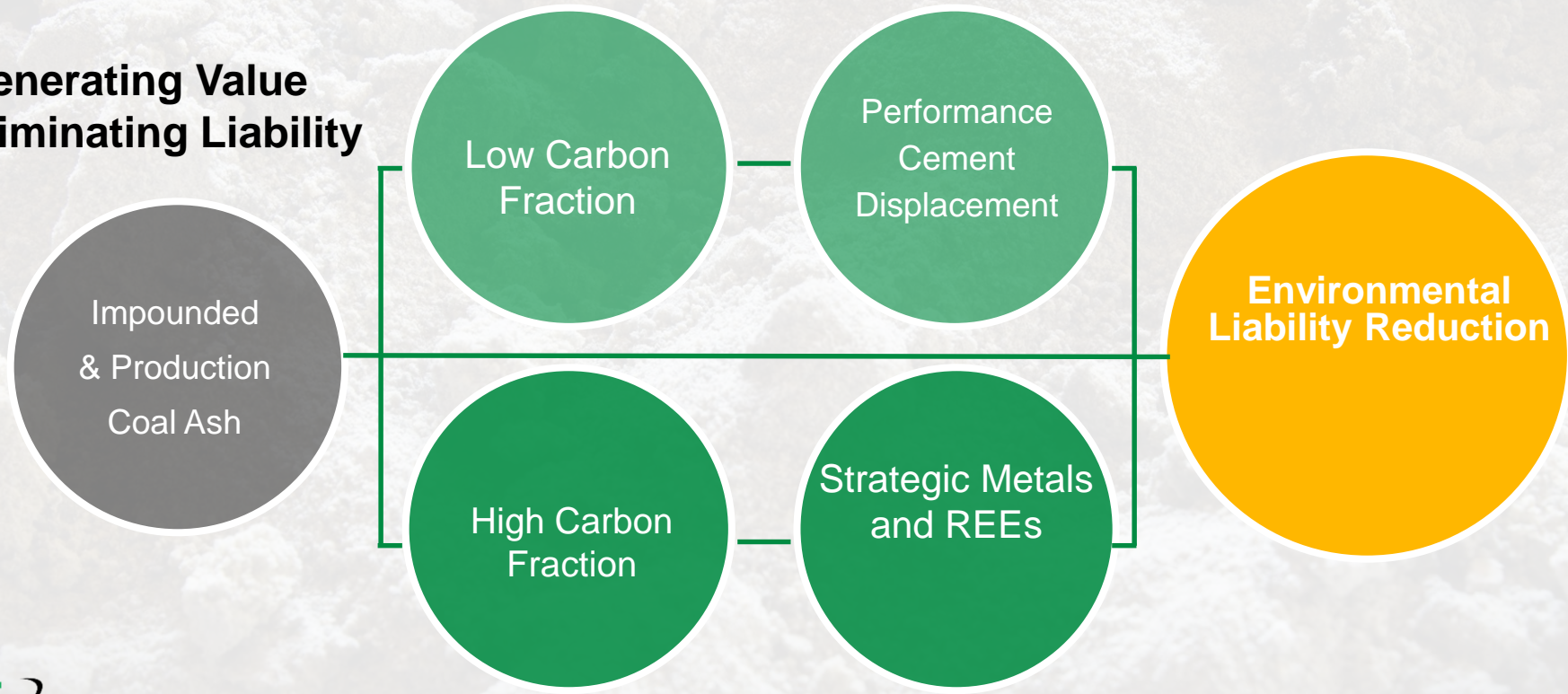
Uniform small particle size ($10 < d_{90} < 100 \text{ um}$)

LOI $< 1\%$

Stabilizing ash supply markets

SONOASH

**Generating Value
Eliminating Liability**

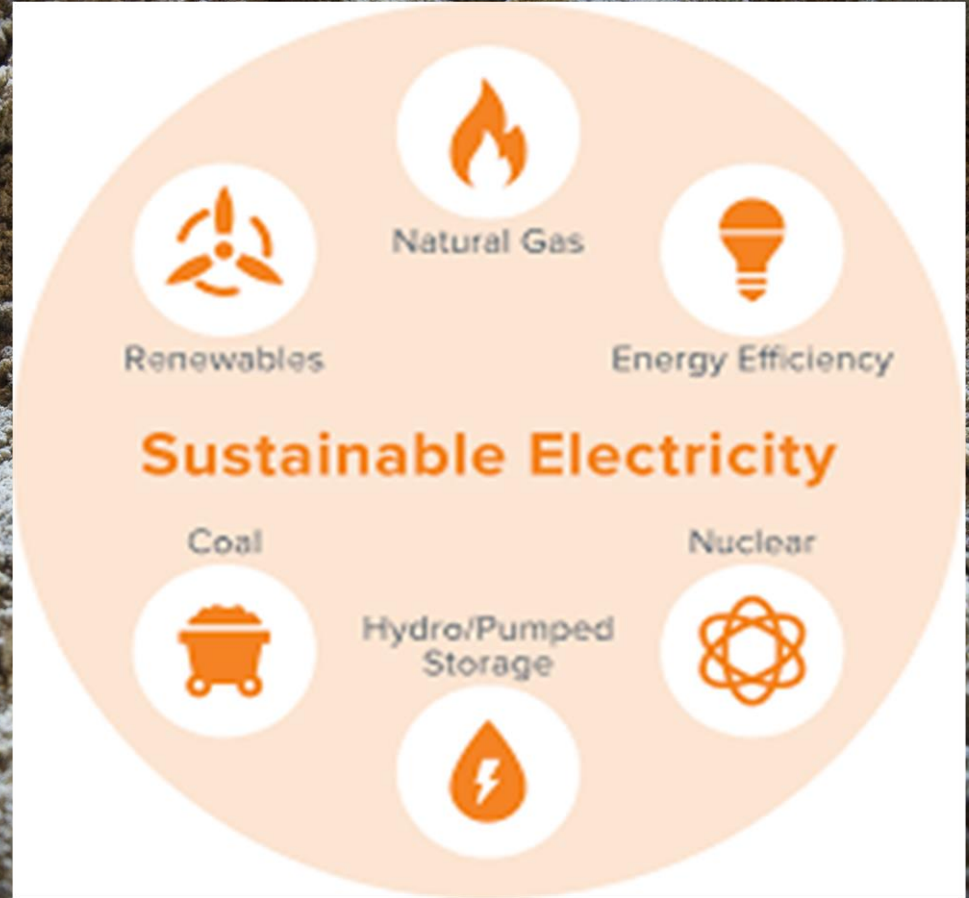


Sustainability

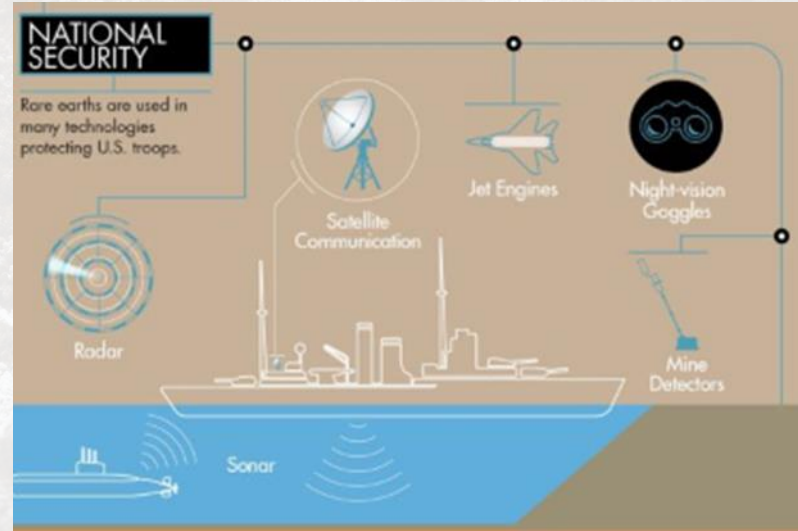
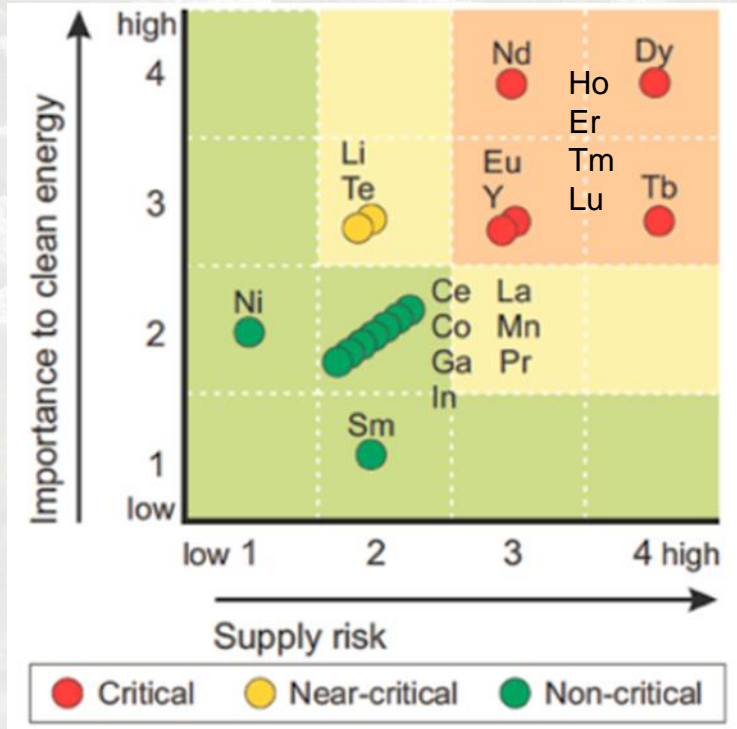
Power
generation

Renewables &
REEs

Efficiency



REE Impacts



Military & Energy: Magnets, motors, sensors, turbines

(A) Cumulative Energy Demand (MJ-eq / kg)

H																	He 67.5
Li 125	Be 1,720	<div> <div>Lowest</div> <div></div> <div>Highest</div> </div>										B 27.3	C	N	O	F	Ne
Na	Mg 18.8											Al 131	Si	P	S	Cl	Ar
K	Ca 5.8	Sc 97,200	Ti 115	V 516	Cr 40.2	Mn 23.7	Fe 23.1	Co 128	Ni 111	Cu 53.7	Zn 52.9	Ga 3,030	Ge 2,890	As 5.0	Se 65.5	Br	Kr
Rb	Sr 48.8	Y 295	Zr 19.9	Nb 172	Mo 117	Tc	Ru 41,100	Rh 683,000	Pd 72,700	Ag 3,280	Cd 53.0	In 1,720	Sn 321	Sb 141	Te 435	I	Xe
Cs	Ba 4.0	La-Lu*	Hf 3,510	Ta 4,360	W 133	Re 9,040	Os 85,000	Ir 169,000	Pt 243,000	Au 208,000	Hg 179	Tl 5,160	Pb 18.9	Bi 697	Po	At	Rn
Fr	Ra	Ac-Lr**	Rf	Db	Sg	Bh	Hs	Mt									
*Group of Lanthanide			La 215	Ce 252	Pr 376	Nd 344	Pm	Sm 1,160	Eu 7,750	Gd 914	Tb 5,820	Dy 1,170	Ho 4,400	Er 954	Tm 12,700	Yb 2,450	Lu 17,600
**Group of Actinide			Ac	Th ^a 1,260	Pa	U ^a 1,270	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr



Demonstration Plant Location

**Plant Size = 60,000 ft²
50,000 tpy**



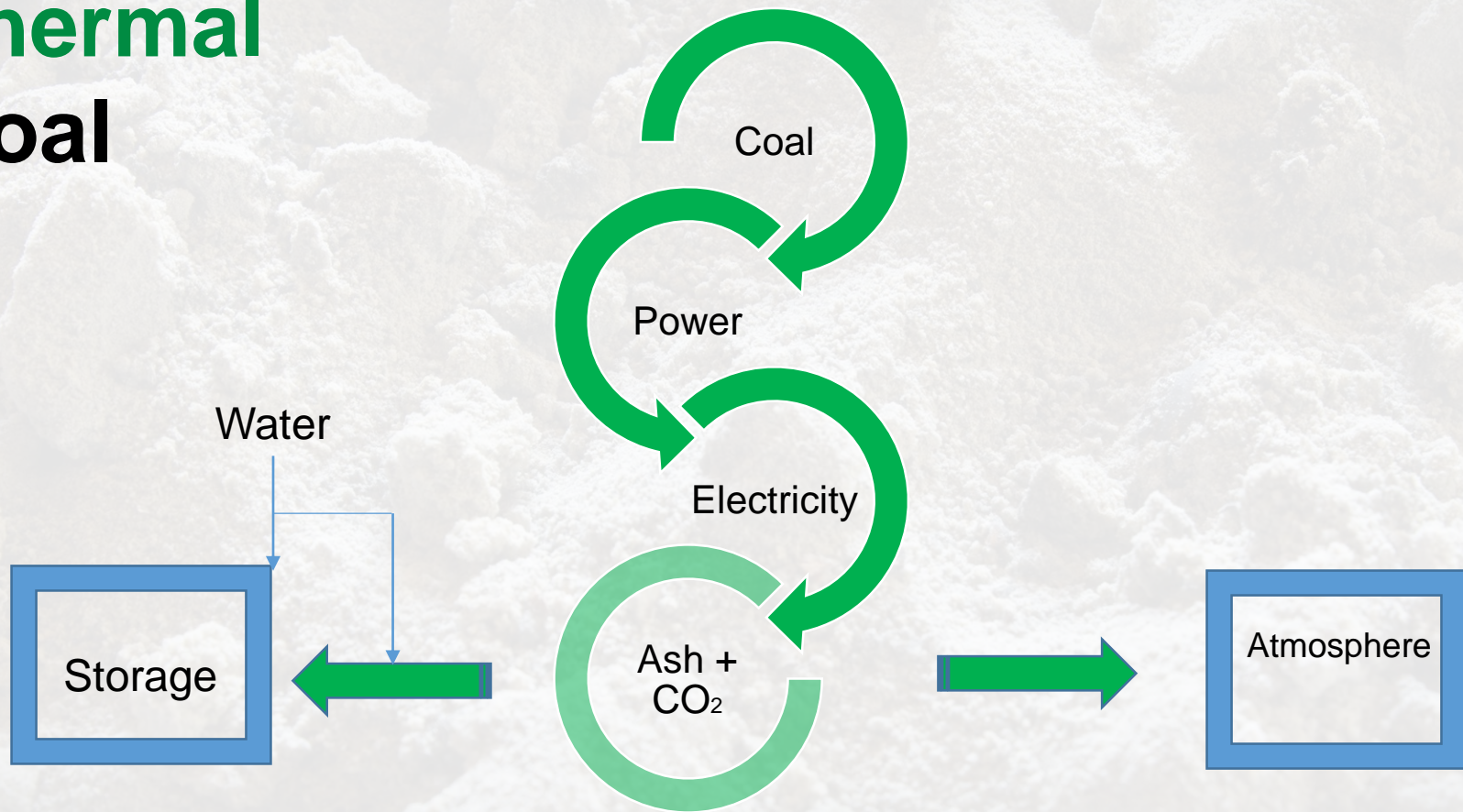
FEATURES:

Process wet production & mixed impounded ash

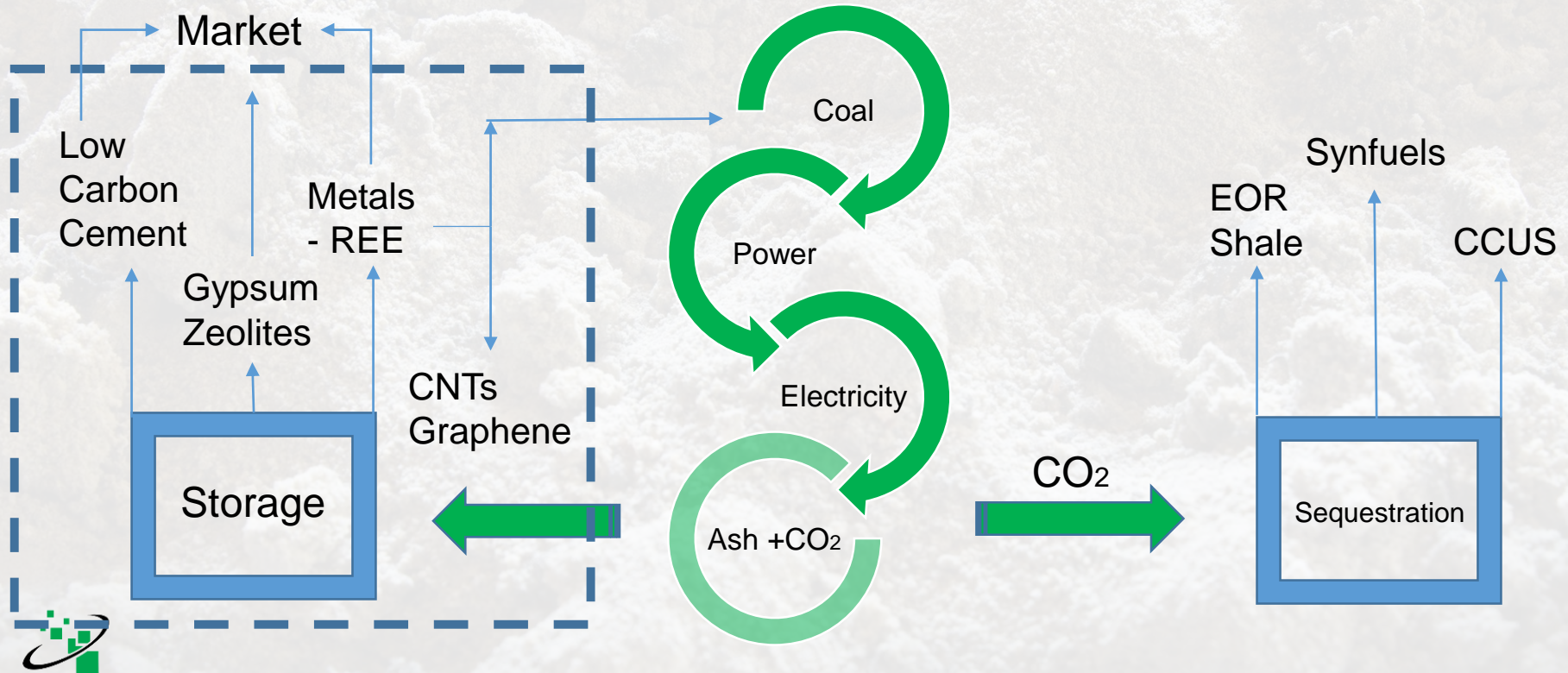
Create space in existing “pond” and “time” closure

Rural job creation

Thermal Coal



Closed Loop Coal: Orefinery



TOTAL **VALUE** FROM COAL COMBUSTION



A long, straight road stretches towards a sunset over a vast, flat landscape. The sky is filled with golden, dramatic clouds, and the road is flanked by dark, textured terrain. The overall mood is one of hope and forward-looking vision.

Goals:

Beneficiating 100% impounded ash.

Closed Loop Coal infrastructure.

**“Imagine a time when we burn
coal for the by-products.”**



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Move the Dial

Beneficiating 100% of impounded ash is possible.

The Path to Closed Loop Coal is plausible.

Creating the solution that pays for itself.

