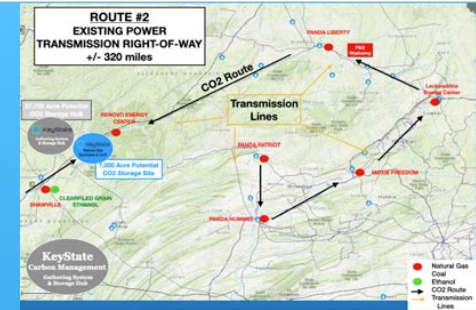


1 Page Summary



USEA/DOE Seminar
9.30.21

A Disciplined Approach for Decarbonization of Pennsylvania Industry & Power Generation

'Laboratory at Scale'

KeyState
Natural Gas
Synthesis &
Carbon Storage



KeyState
Carbon Management
Gathering System
& Storage Hub

RESULT:
The Decarbonization of 60% of Pennsylvania's Gas-Fired Power Generation

- ...assurance of longterm energy jobs at 12 plants
- ...assurance of dependable baseload electricity
- ...facilitate a decade long construction boom

SYNERGY & PROGRESSION:

PHASE #1 CCS INTEGRATED COMMERCIAL DEMONSTRATION - 200,000 tpy
 - 'Anchor Project' - KeyState Blue H2 & NH3 Production + CCS
 - Single Source Industrial Emissions Carbon Capture & Storage
 - Onsite gas extraction, Onsite Synthesis & Onsite CO2 Sequestration

PHASE #2 CCS CLUSTER - 1,500,000 tpy
 Keystone Carbon, Gathering System & Storage Cluster
 - Collaboration with nearby power generation & ethanol emitters for CO2 storage at KeyState 7,000 acre tract + adjacent State Forest.

PHASE #3. CCS HUB - 30,000,000+ tpy
 KeyState Carbon, Gathering System & Storage Hub -
 - Gathering CO2 from multiple major emitters within 150 miles
 Storage at adjacent 27,700 acre Punx/Driftwood Field

Note please that the CO2 emitter list of power plants and manufactures contained herein are not under any agreement. The following is presented as a concept with discussions initiated .

GEOLOGIC CARBON SEQUESTRATION OPPORTUNITIES IN PENNSYLVANIA

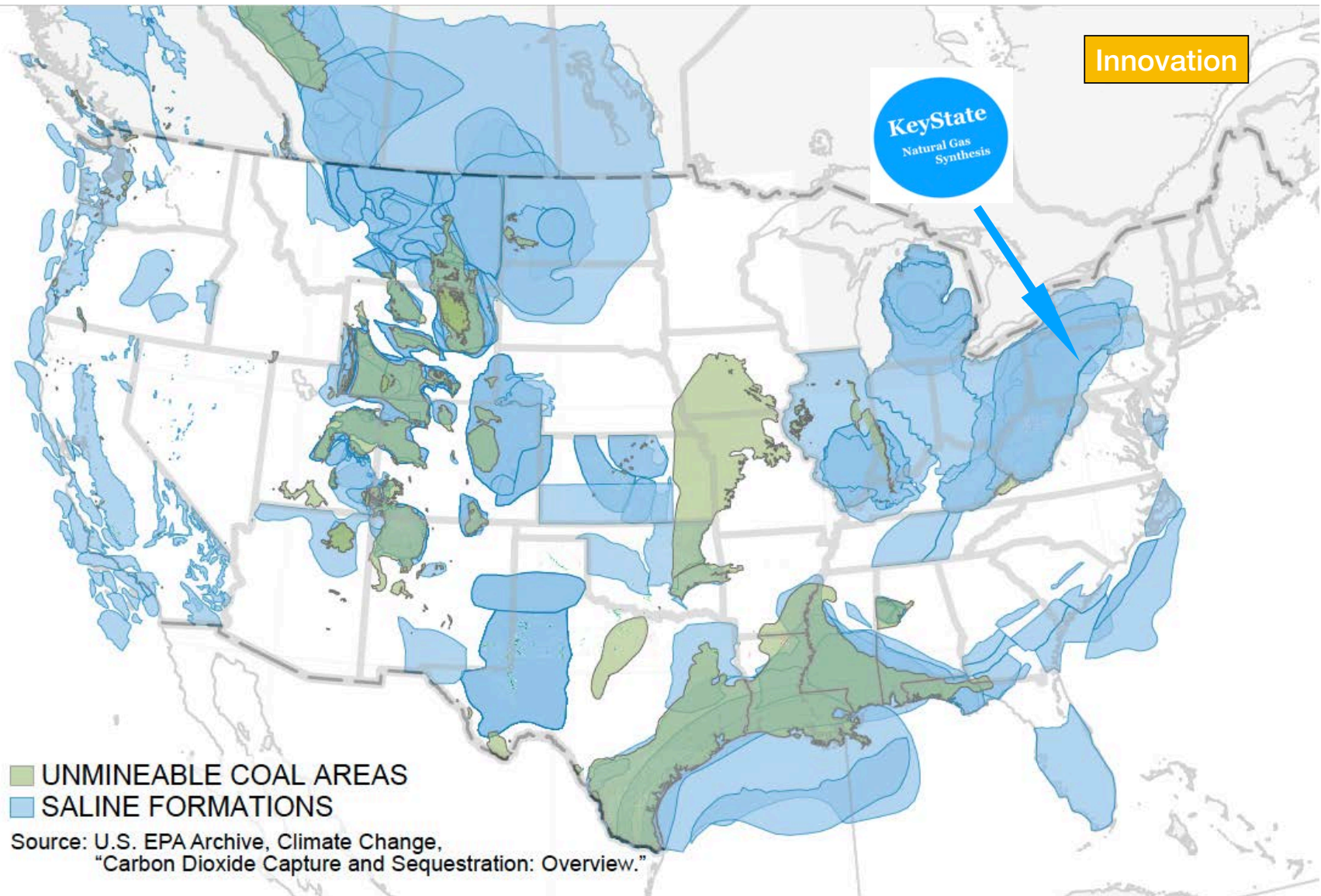


Figure ES-10. U.S. Assessment of Geologic CO₂ Storage Potential

KeyState Carbon

Gathering System & Storage Hub

CONCEPT

Major Sources of CO2 Emissions

Our story...Phase 1.. Anchor Project, Integrated Commercial Demonstration of novel onsite CCS from KeyState H₂/NH₃ plant ... Phase 2..CCS Cluster.....maximize CO₂ storage potential on KeyState's 7,000 acre site with nearby gas fire power and ethanol plants ...Phase 3... CCS Hub... gather CO₂ from major regional emitters for adjacent a world-scale CO₂ Storage hub,27,700 acre, Punx/Driftwood field.

To the East:
300 mile network
7 Gas-Fired Power Plants
14mm tpy CO₂

KeyState Carbon
Gathering System
& Storage Hub

3 Industrial Source
1 mm tpy CO₂

To the Southeast:
150 mile gathering system
5 Gas Fired Power Plants
8mm tpy

Note please that the CO₂ emitter list of power plants and manufactures contained herein are not under any agreement. The following is presented as a concept with discussions initiated .

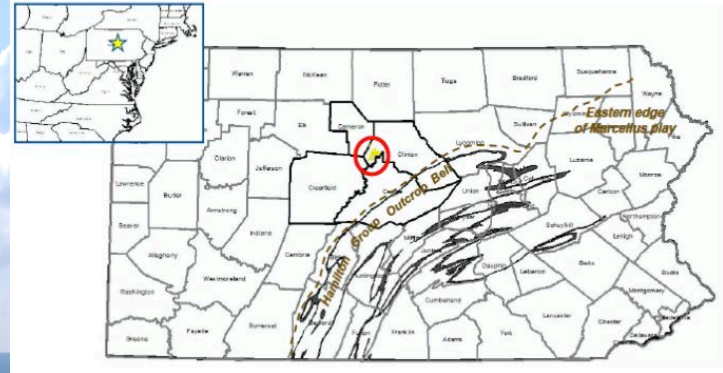
<https://www.energy.gov/sites/prod/files/2015/>



KeyState Geological Storage Asset

Phase 1 - Commerical Demonstration of CCS
ANCHOR PROJECT - KeyState single source, industrial emitter/H2 & NH3 Production & novel integration of gas extraction and CO2 storage.

Phase 2 - CCS Cluster
Gathering & storage services provided to nearby gas fired power & ethanol plants



**7,000 Acre Contiguous
1 Owner Tract
- Clinton County, Pa.**

Natural Gas & CCS Partner



Vertically Integrated Business Case

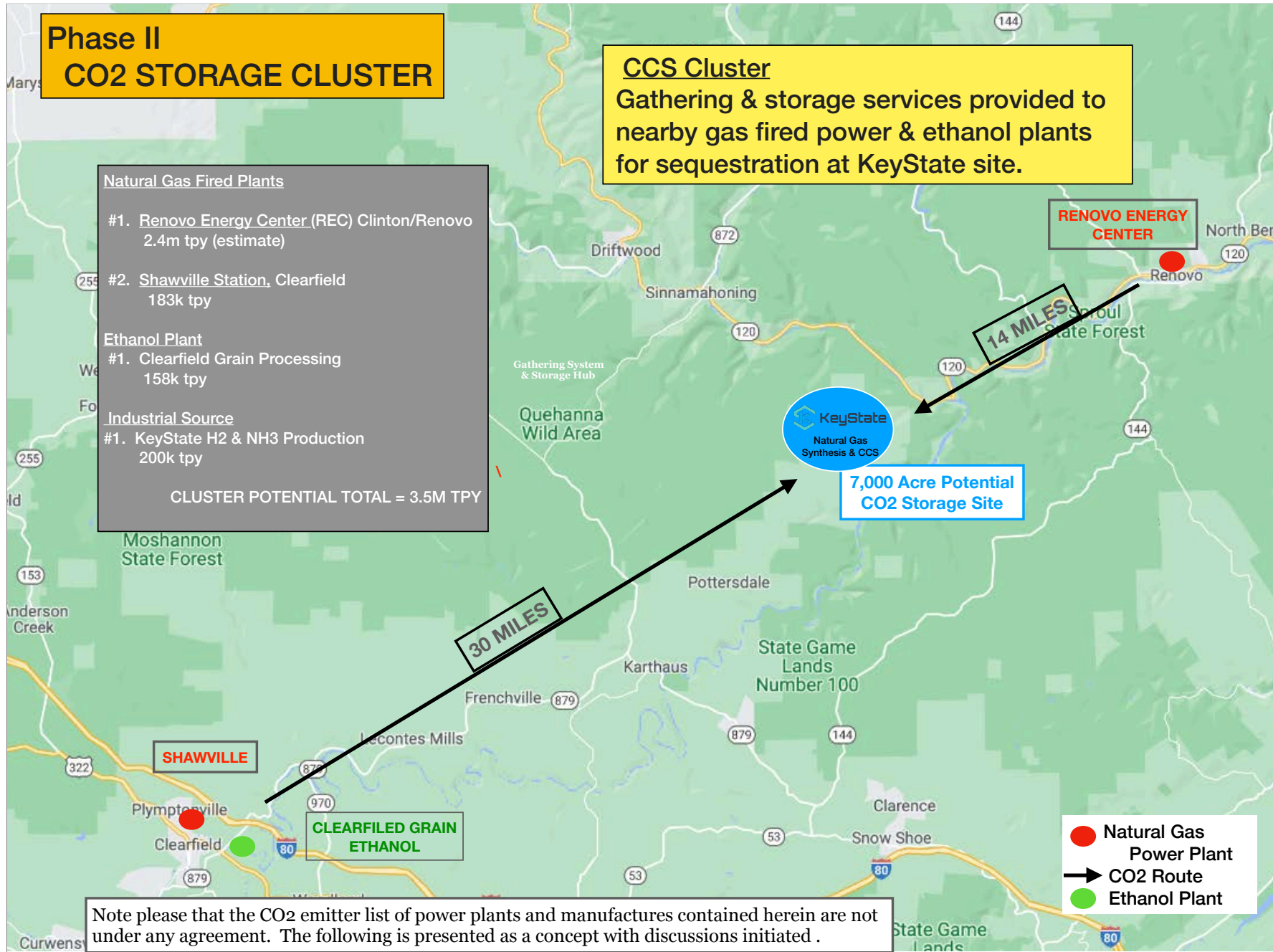
Natural Gas Resource + Manufacturing + Carbon Storage

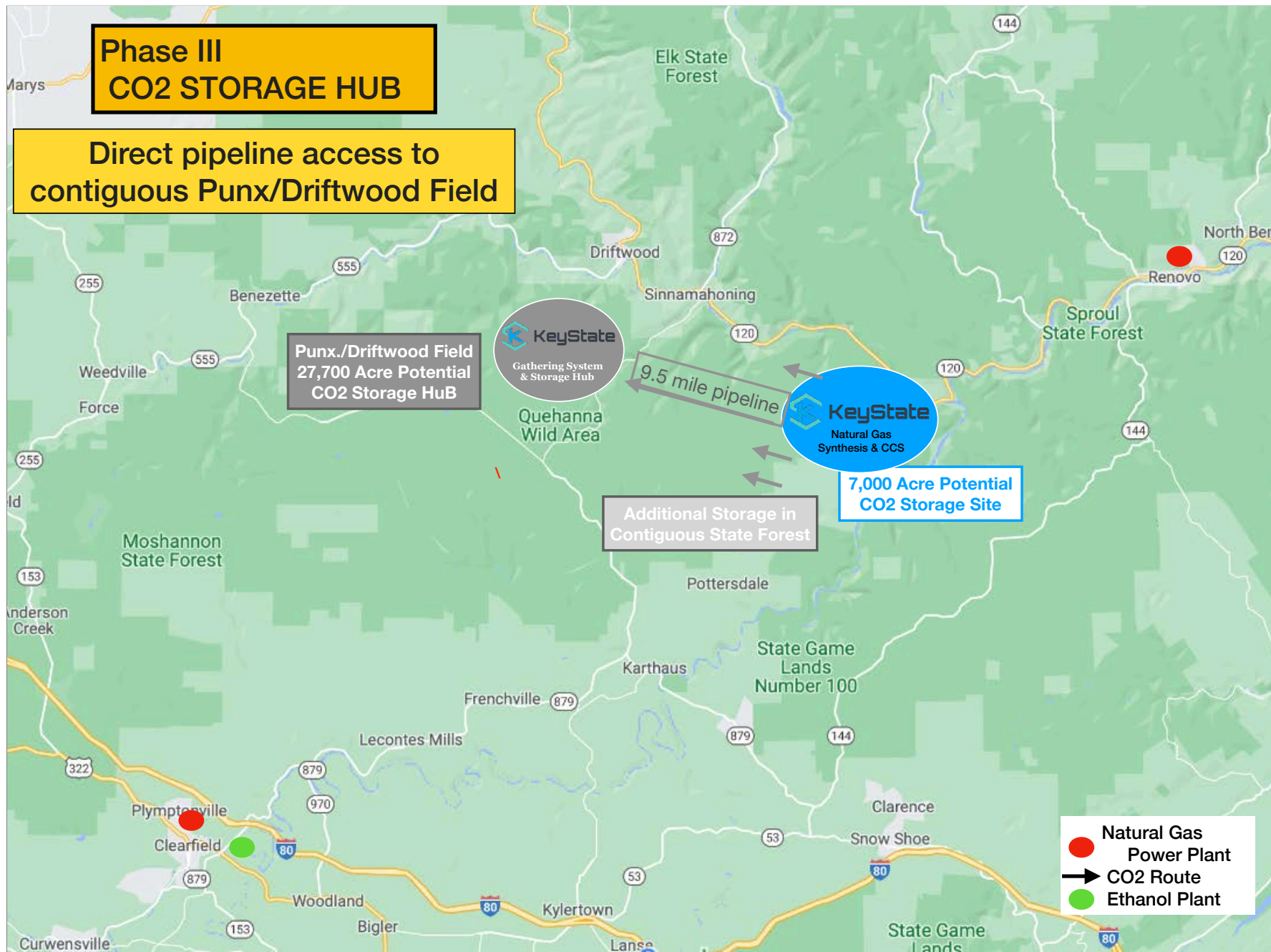
- On-Site Gas Supply, At-Cost
- Onsite Gas Synthesis - H2
- Onsite Carbon Sequestration
- Adjacent to State Forest
- Contiguous with State Forest lands of Punx/Driftwood Field

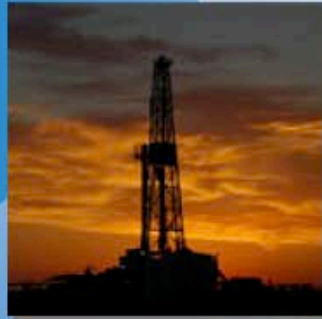
Phase II CO2 STORAGE CLUSTER

CCS Cluster
Gathering & storage services provided to nearby gas fired power & ethanol plants for sequestration at KeyState site.

- Natural Gas Fired Plants**
- #1. Renovo Energy Center (REC) Clinton/Renovo
2.4m tpy (estimate)
 - #2. Shawville Station, Clearfield
183k tpy
- Ethanol Plant**
- #1. Clearfield Grain Processing
158k tpy
- Industrial Source**
- #1. KeyState H2 & NH3 Production
200k tpy
- CLUSTER POTENTIAL TOTAL = 3.5M TPY**







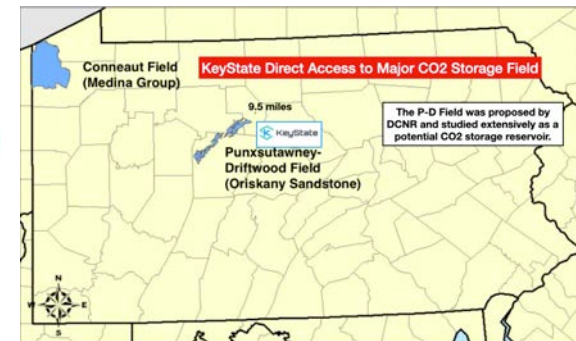
Assessment of CO₂ Storage Site Options in Western Pennsylvania – Reservoir Modeling

Final Report

Prepared For:
**Pennsylvania Department of Conservation
and Natural Resources**

Prepared By:
**ADVANCED RESOURCES
INTERNATIONAL, INC.**
Arlington, VA

August 12, 2009

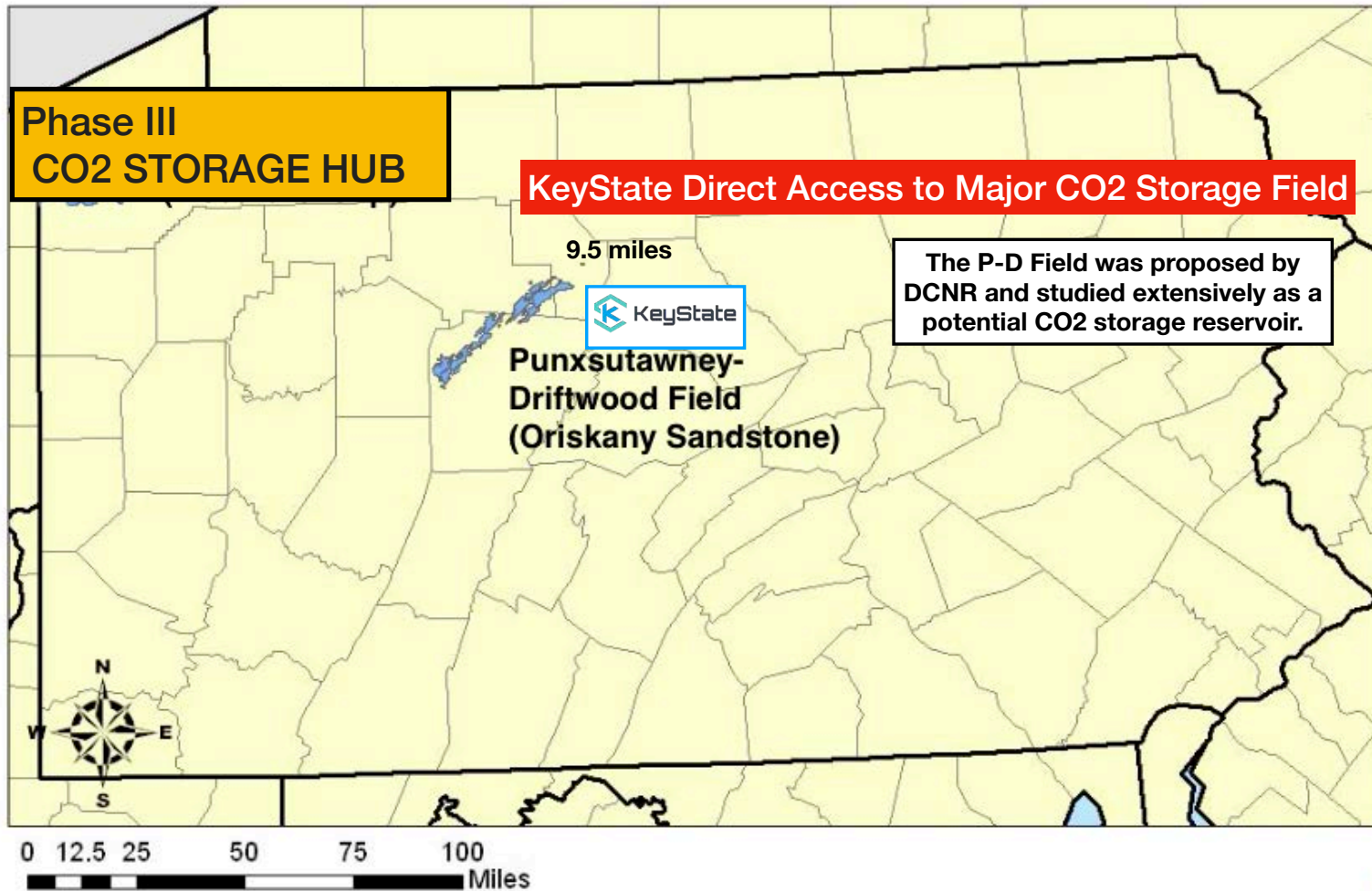


**Advanced Resources
International, Inc.**

Unconventional Resources • Enhanced Recovery • Carbon Sequestration

**Phase III
CO2 STORAGE HUB**

KeyState Direct Access to Major CO2 Storage Field



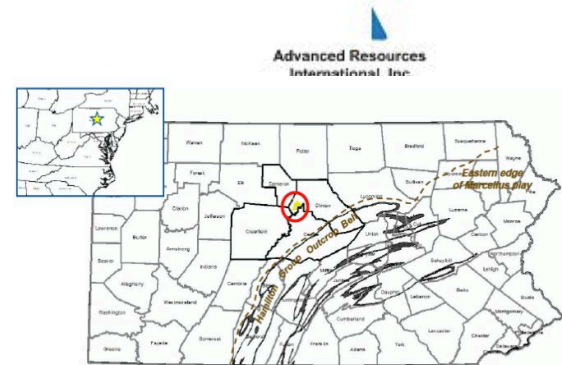
The P-D Field was proposed by DCNR and studied extensively as a potential CO2 storage reservoir.

KeyState will install a 9.5 mile natural gas pipeline along existing BHE right-of-way to connect into BHE gas transmission line.

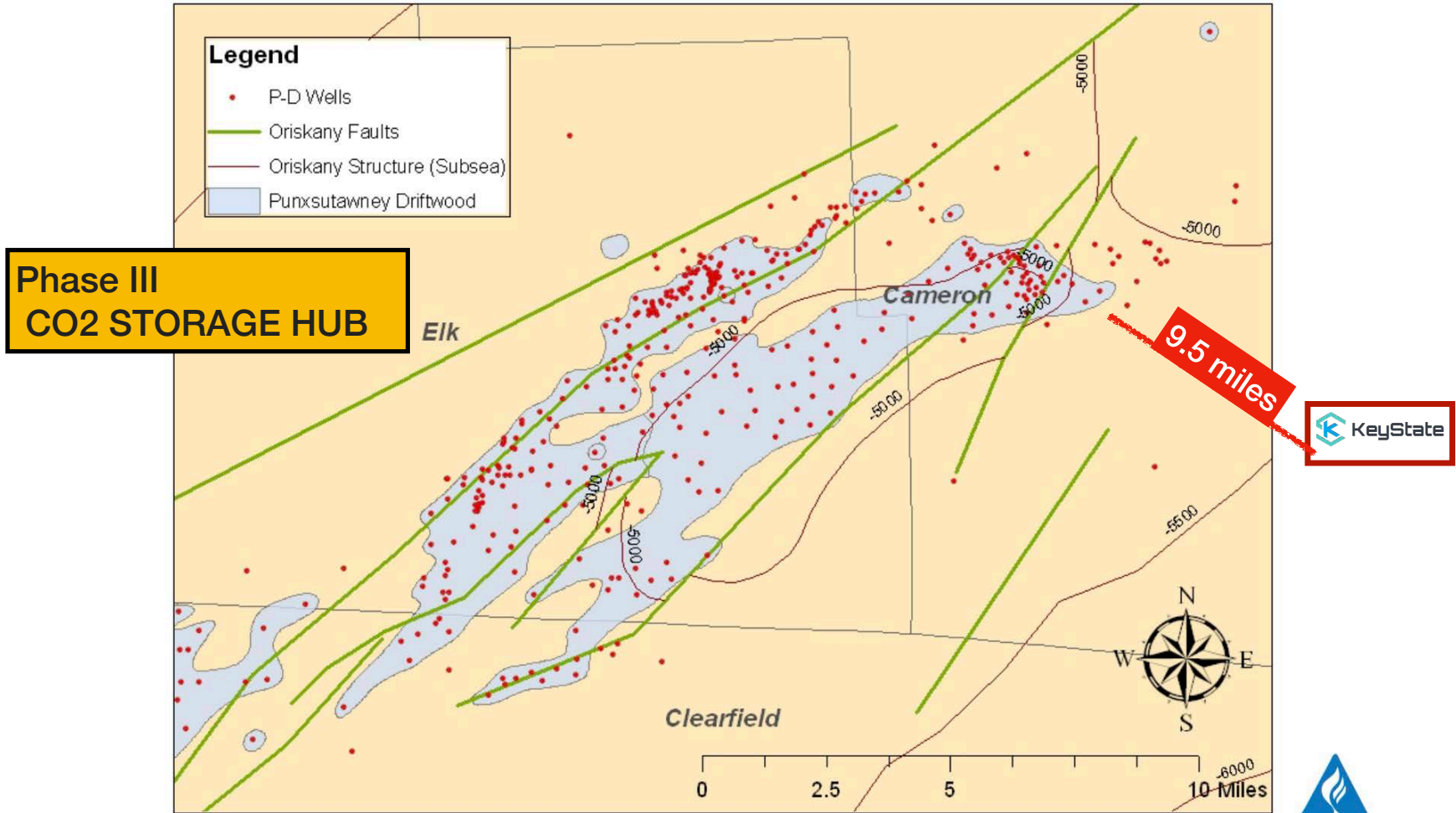
This inter-connection lies within the Punxsutawney-Driftwood Field

Punx/Driftwood Field is 27,700 acre old gas lease of State Forest Land.

Frontier/KeyState mineral/pore space lease is adjacent to the same State Forest and contiguous with the Punx/Driftwood Field



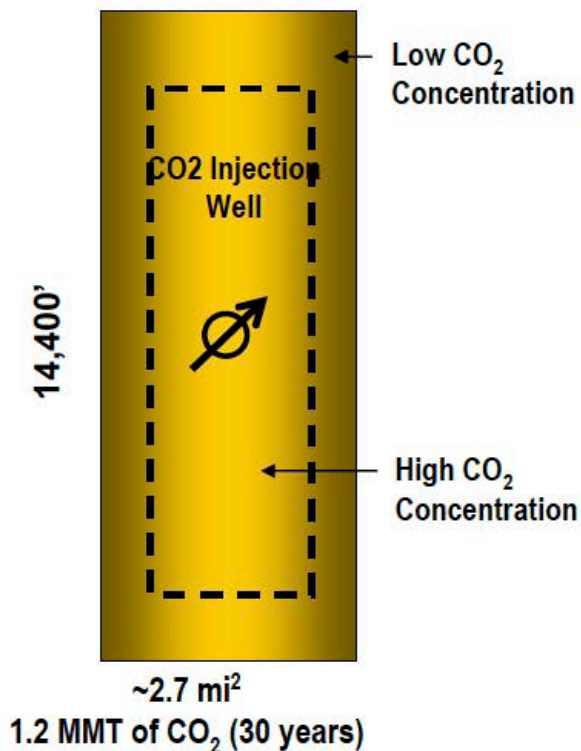
Punxsutawney-Driftwood (Oriskany) Field Driftwood-Benezette Pools



CO₂ Storage at Punxsutawney-Driftwood (Oriskany)

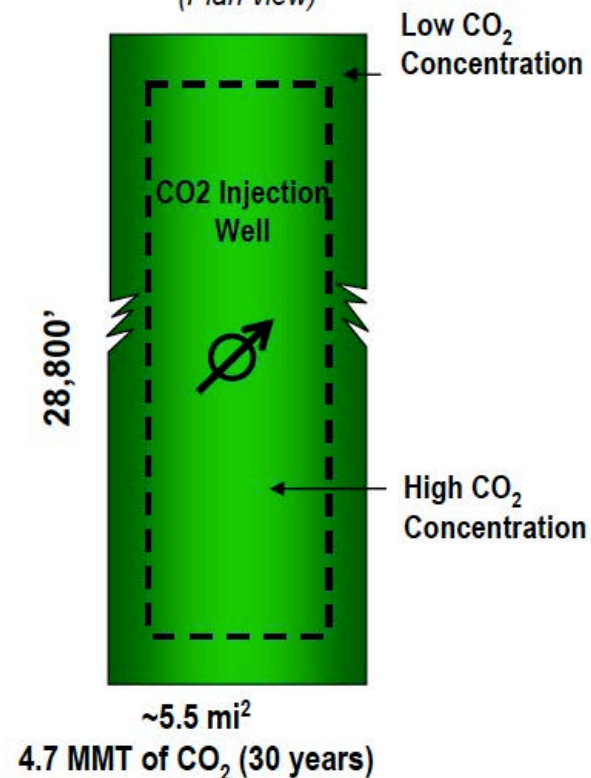
Vertical Well Pattern

(Plan view)



Horizontal Well Pattern

(Plan view)



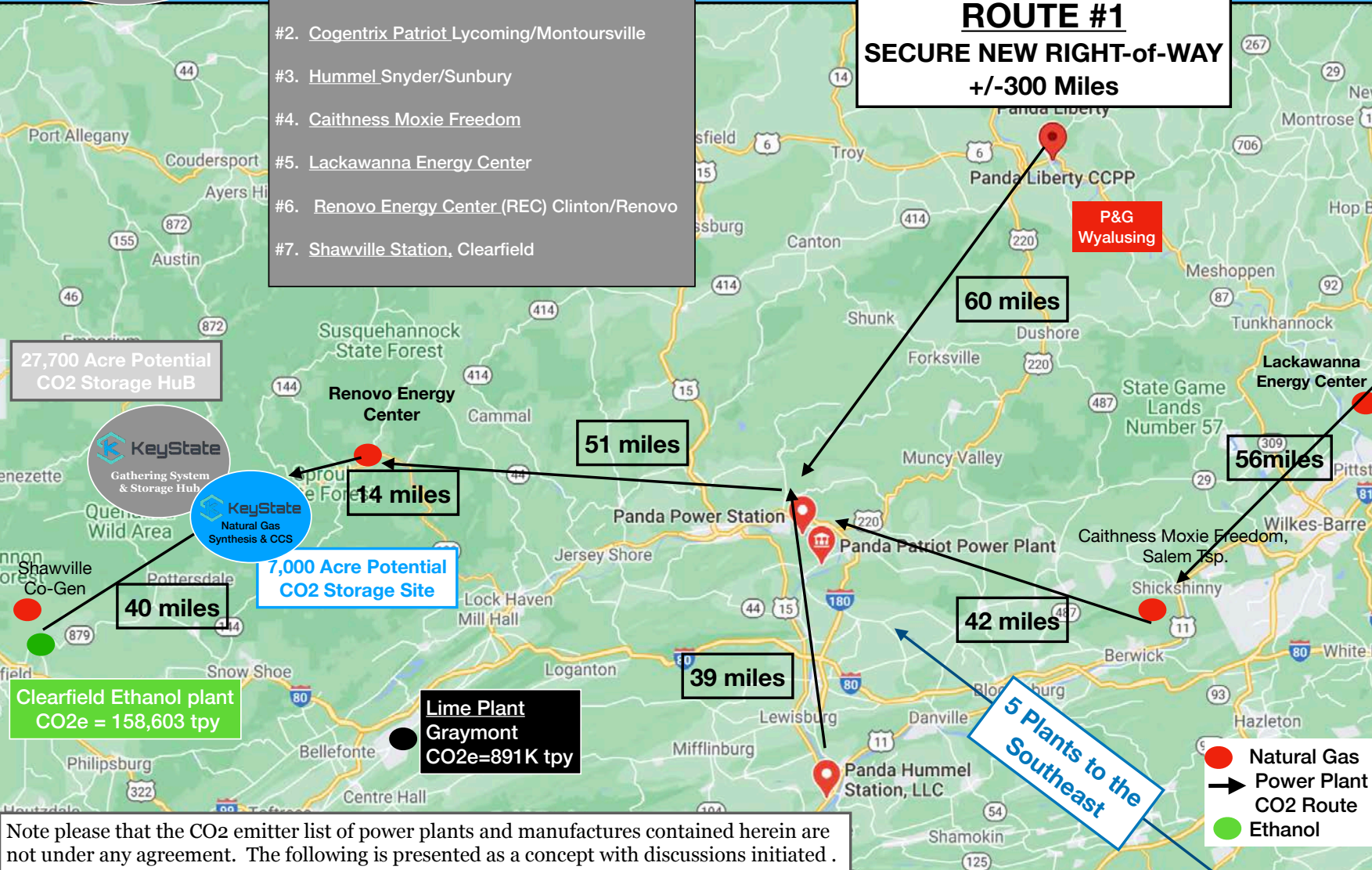
KeyState
Carbon Management
Gathering System
& Storage Hub

CONCEPT

**KeyState Carbon
Carbon Gathering System & Storage Hub**

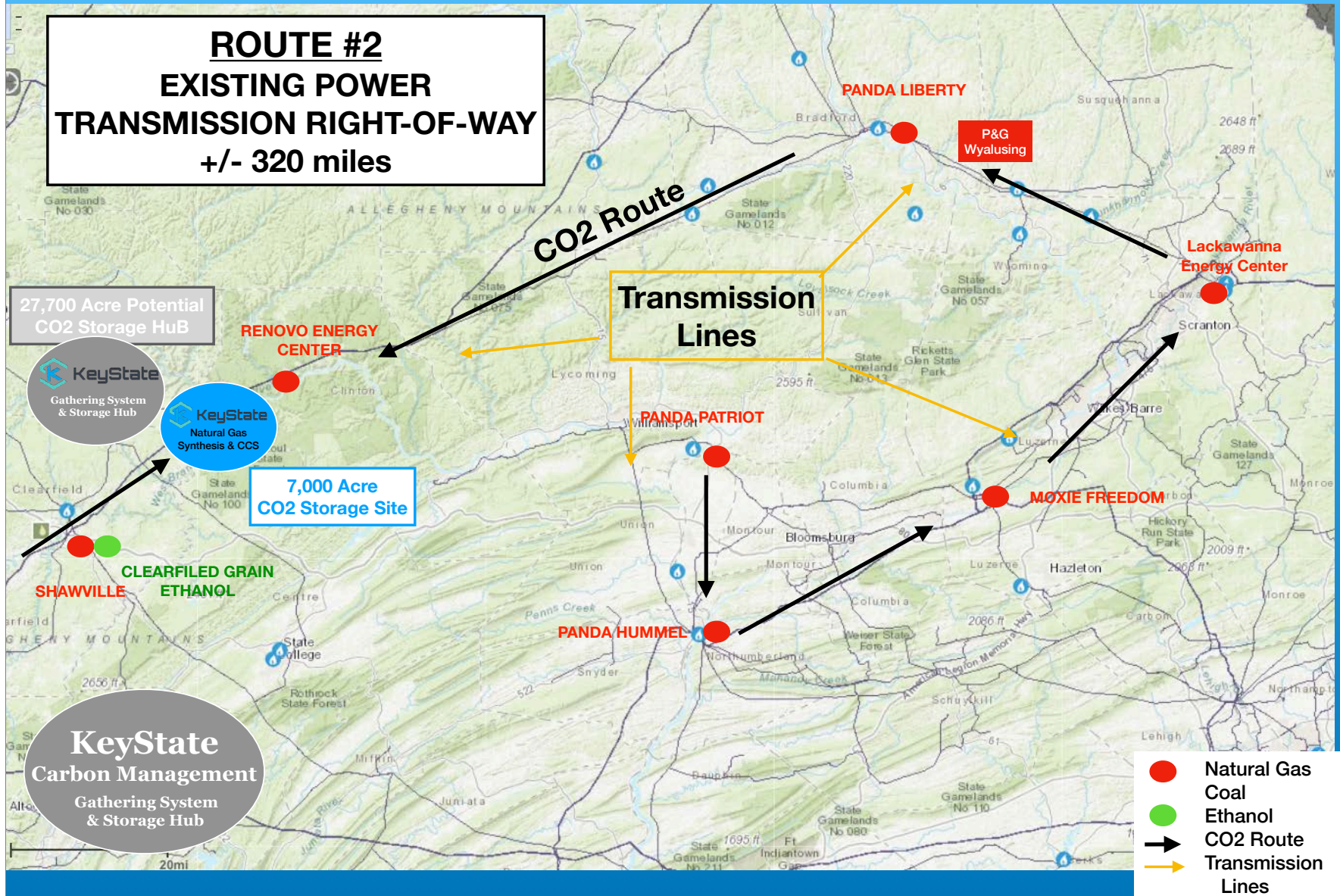
- Natural Gas Fired Plants
- #1. Cogentrix Liberty Bradford/Towanda
 - #2. Cogentrix Patriot Lycoming/Montoursville
 - #3. Hummel Snyder/Sunbury
 - #4. Caithness Moxie Freedom
 - #5. Lackawanna Energy Center
 - #6. Renovo Energy Center (REC) Clinton/Renovo
 - #7. Shawville Station, Clearfield

ROUTE #1
SECURE NEW RIGHT-of-WAY
+/-300 Miles

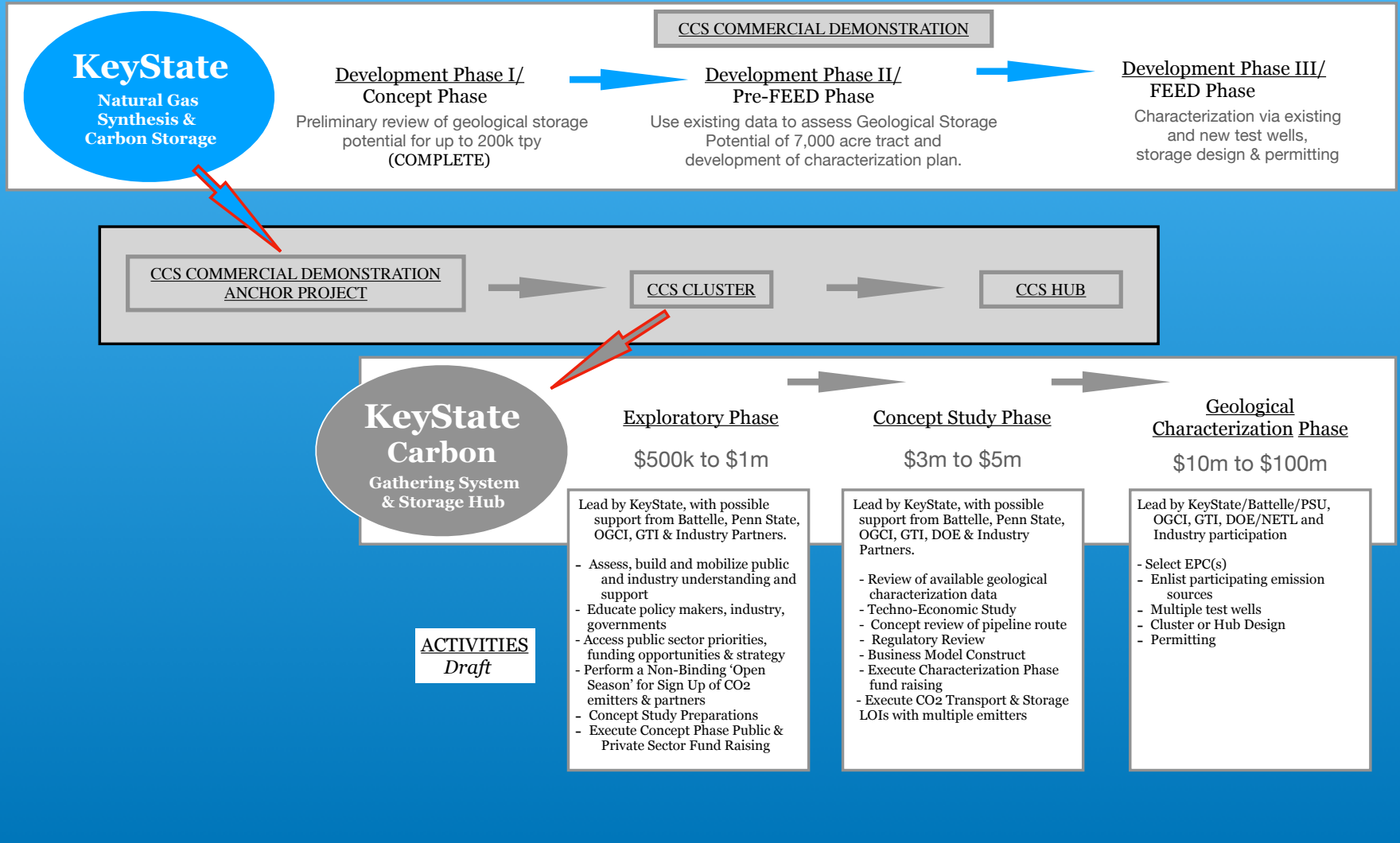


Note please that the CO2 emitter list of power plants and manufactures contained herein are not under any agreement. The following is presented as a concept with discussions initiated .

Phase III. KeyState Carbon Gathering System & Storage Hub



KeyState CO2 GATHERING SYSTEM & STORAGE DEVELOPMENT MILESTONES





Justice40 Impacts

KeyState Carbon - Phase I

Pennsylvania's NEXT Energy Jobs

Direct use of natural gas as feedstock and power source for onsite manufacturing and CO₂ capture & storage

**800 Construction & Permanent Jobs
+ Indirect + Induced Jobs**
www.pamanufacturers.org/nepanatgas

KeyState

Pennsylvania's
Next Energy
Revolution

Presidential Executive Order 14008 Sec. 218

‘...Coal and Power Plant Communities and Economic Revitalization’.

INITIAL REPORT TO THE PRESIDENT ON EMPOWERING WORKERS THROUGH REVITALIZING ENERGY COMMUNITIES

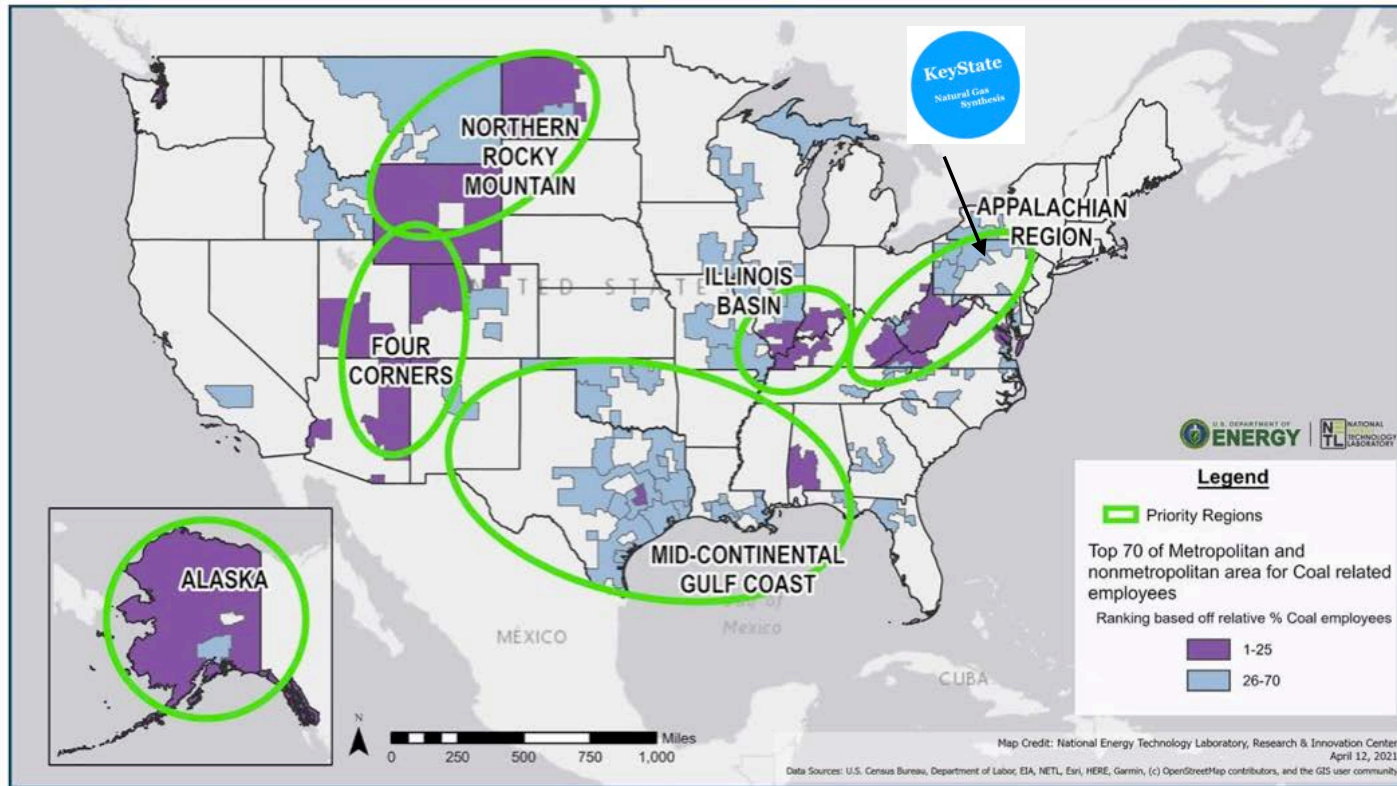


Figure 2. Shading highlights BLS metro and non-metro areas that are communities vulnerable to impacts from coal-specific job losses.

<https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/>



Justice40 Impacts

ECONOMIC IMPACT ANALYSIS:

NATURAL GAS SYNTHESIS MANUFACTURING PLANTS

Presented by: Carl A. Marrara
Vice President of Government Affairs, Pennsylvania Manufacturers Association

DURING CONSTRUCTION

Total economic output: construction of natural gas synthesis plants combined

Location	Labor Income	Value Added	Total Economic Output
Clinton County	\$137,977,974.67	\$180,842,342.55	\$364,962,192.10

Total jobs related to construction of natural gas synthesis plant combined

Location	Direct	Indirect	Induced	Total
Clinton County	800	78	143	1,021

KeyState Carbon - Phase I

Independent Study
Economic Impact
Gas Synthesis Plant
in Clinton Co.

DURING OPERATIONS

Total economic output: combined-permanent jobs from natural gas synthesis plant

Location	Labor Income	Value Added	Total Economic Output
Clinton County	\$83,009,918.22	\$118,909,211.18	\$260,995,083.52

Total jobs related to completion of natural gas synthesis plant (combined-permanent)

Location	Direct	Indirect	Induced	Total
Clinton County	150	144	232	526

“Based on the results, it’s clear that these projects would be transformative to northeast Pennsylvania, and the commonwealth as a whole. Entire economies are centered around this type of economic activity and will sustain regions for generations to come. Attracting and retaining natural gas synthesis manufacturing ought to be a priority of policymakers at the state and federal level to ensure this prosperity occurs in our commonwealth as opposed to a competitor state.”

DAVID N. TAYLOR, PRESIDENT & CEO - PMA



full report: www.pamanufacturers.org/nepanatgas

<http://www.pamanufacturers.org/NEPANatgas>

- Major Rural Economic Impact
- Multi-County Impact
- The New Energy Jobs
- Industry Breakthrough
- Manufacturing Breakthrough



A Disciplined Pathway to Decarbonization and Development of Pennsylvania's Carbon Storage Industry



First to Demonstrate Commercial Scale, Industrial Source CCUS in Pennsylvania

- FIRST to demonstrate the commercial potential of Pennsylvania's 'several hundred years' of carbon storage geology at KeyState's 7,000 acre site.
 - FIRST to integrate shale gas production and carbon storage
 - FIRST in the Marcellus Region to demonstrate the link between CCUS and the new Hydrogen economy
 - FIRST Blue Hydrogen/Blue Ammonia production in the Marcellus
 - FIRST to demonstrate a lower-carbon-lower-priced product directly displacing a higher-carbon-higher-priced product.
 - FIRST to demonstrate 'clean' natural gas production via a 'Closed Methane System' of sole-source gas production, transport & manufacturing, allowing for continuous monitoring of potential fugitive methane emissions.
 - FIRST to provide ongoing, onsite setting for academic study and R&D in CCUS, EGR, Blue/Green H₂/NH₃ & workforce development
 - FIRST to demonstrate that both major GHG emissions reductions objectives and natural gas production with CCS can work together resulting in massive longterm job creation and economic development, particularly in chronically poor, former coal mining, rust-belt areas.
- FIRST to demonstrate a low-carbon future for Pennsylvania's natural gas

First to Demonstrate a Natural Gas Asset as also a Geological CO₂ Storage Asset

7,000 Acre CO₂ Storage Asset

- FIRST to provide a CO₂ storage solution to Pennsylvania Gas-Fired Power Generation & Manufacturing
- GATHER CO₂ from multiple, major emission sources for central geological storage
- PROVIDE a solution for the decarbonization of 60% of Pennsylvania's Gas-Fired Power Generation + major industrial emitters.
- PREPARE Northeast Pa. gas-fired power generation for upcoming CO₂ emissions rules, mandates, fees, and markets.
- DEMONSTRATE a Circular Carbon Economy:
 - natural gas production
 - natural gas usage in power and manufacturing
 - capture and storage of related CO₂

Phase 1 KeyState Natural Gas Synthesis & CCS

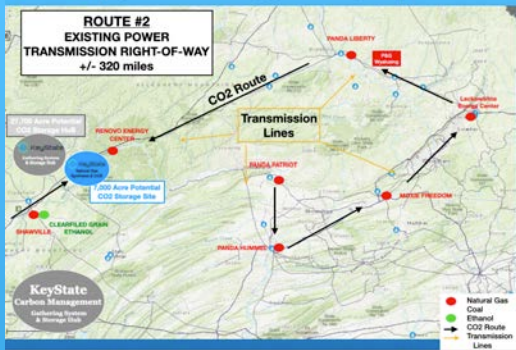
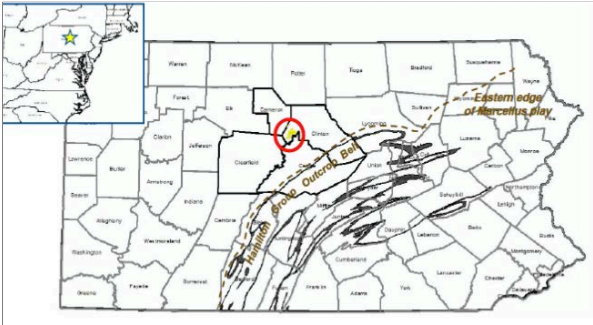
Phase 2 KeyState Carbon Cluster

Phase 3. KeyState Carbon Storage Hub

**KEYSTATE to Zero
DEVELOPMENT TIMELINE**

9.12.21

	2021	2022	2022	2022	2023	2024/2025
	4th qt	2nd qt	3rd qt	4th qt	1st qt	COMMERCIAL OPERATIONS
<u>CCS Anchor Project</u> DEV. PHASE II	COMMENCE	COMPLETE				
<u>CCS Anchor Project</u> DEV. Phase III		COMMENCE	COMPLETE			
<u>CCS Anchor Project</u> Begin Air and CCS Permitting			COMMENCE		COMPLETE Air Permit	COMMERICAL OPERATIONS
<u>CCS Cluster</u> 7,000 ac. Max Storage Capacity Study	COMMENCE	COMPLETE				COMMERICAL OPERATIONS
<u>CCS Cluster</u> Max Storage Capacity Test Well #1			COMMENCE	COMPLETE		
<u>CCS HUB</u> Colaborator Engagement	CURRENTLY UNDERWAY	COMMENCE CONCEPT STUDY	EXECUTE FORMAL COLLABORATOR ENGAGEMENT		COMMENCE STORAGE FEED & PERMITTING	
<u>CCS HUB</u> Emitter Engagement	CURRENTLY UNDERWAY	OPEN SEASON FOR EMITTER INTEREST	EXECUTE FORMAL CUSTOMER- EMITTER ENGAGEMENT		COMMERCE GATHERING SYSTEM FEED & PERMITTING	
<u>CCS HUB</u> Political Engagement	CURRENTLY UNDERWAY	SECURE RIGHTS TO FIELD STUDY	PENNSYLVANIA HOUSE & SENATE RESOLUTION			



KeyState
 Natural Gas
 Synthesis &
 Carbon Storage

KeyState
 Carbon Management
 Gathering System
 & Storage Hub



Pathway for Multi-Industry Adoption of Carbon Capture, Use and Storage

Perry Babb
 KeyState
 Natural Gas Synthesis
 President & Acting CEO
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