NATIONAL ENERGY TECHNOLOGY LABORATORY







Plugging End-of-Life Wells Using Cutting-Edge Technology

Example of a Successful State-NETL Partnership

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U.S. DEPARTMENT of ENERGY

The National Energy Technology Laboratory (NETL)

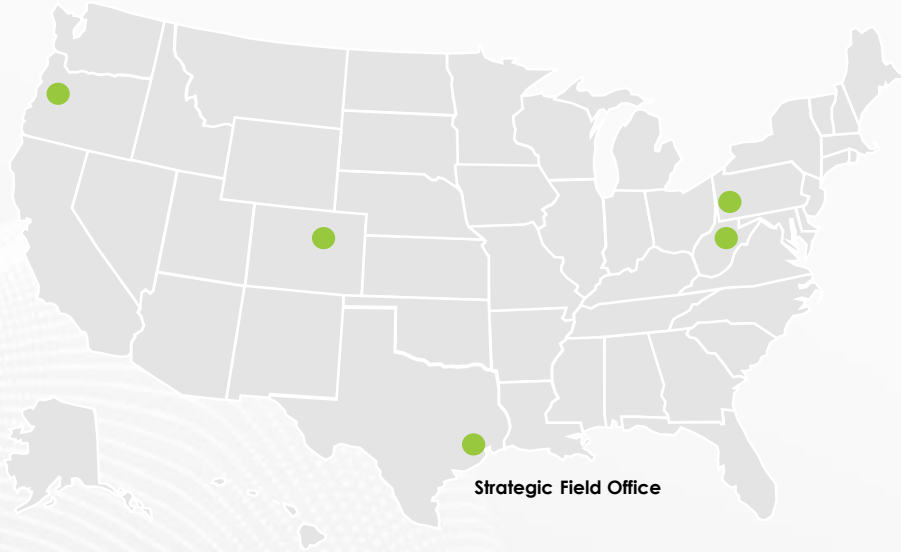
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NETL in a nutshell:

- One of 17 DOE national labs
- The only DOE national laboratory focused on hydrocarbons (coal, oil, gas)
- Part of DOE's Hydrocarbons and Geothermal Energy Office
- Workforce: 1,500+ (Federal and Contractor)

NATIONAL ENERGY TECHNOLOGY LABORATORY

Multiple R&D sites operating as one DOE national laboratory



Three primary components:

1. Applied Research & Development
2. DOE Program Execution
3. Partnerships through Centers of Excellence

Morgantown, WV



COAL CENTER of EXCELLENCE

Pittsburgh, PA



OIL & GAS CENTER of EXCELLENCE

Albany, OR



CRITICAL MINERALS & ADVANCED ALLOYS CENTER of EXCELLENCE

Golden, CO



GEOTHERMAL CENTER of EXCELLENCE

Motivation: End-of-Life Oil & Gas Wells

- **3.7 million oil & gas wells** drilled onshore in the U.S.

  → eventually, all wells must be plugged

- Plugging is **challenging and expensive**

  → average cost: $76k per well

- Most wells are plugged by **responsible operators**

  → but: sometimes owners go out of business

  → states become responsible for end-of-life wells

- Hundreds of thousands of wells **could fall to the states**

  → end-of-life plugging is a major undertaking



Efficiently plugging end-of-life wells benefits the public while also enabling continued hydrocarbon development.

Reality: Plugging Wells from the State Perspective

1. *(Too)* ***Many end-of-life wells*** *(i.e., must "down-select")*

2. ***Limited data/records available*** *for older wells*

3. *Wells* ***are prioritized using imperfect records***

4. *High-priority wells are* ***geographically dispersed***

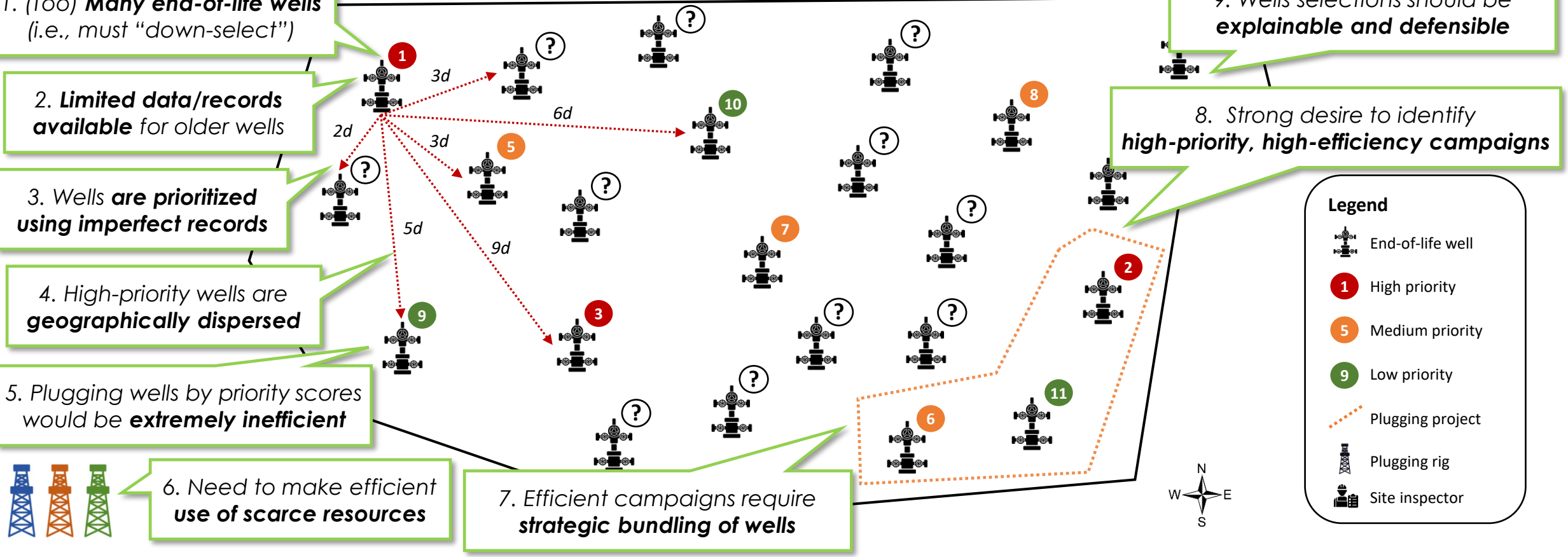
5. *Plugging wells by priority scores would be* ***extremely inefficient***

6. *Need to make efficient* ***use of scarce resources***

7. *Efficient campaigns require* ***strategic bundling of wells***

8. *Strong desire to identify* ***high-priority, high-efficiency campaigns***

9. *Wells selections should be* ***explainable and defensible***



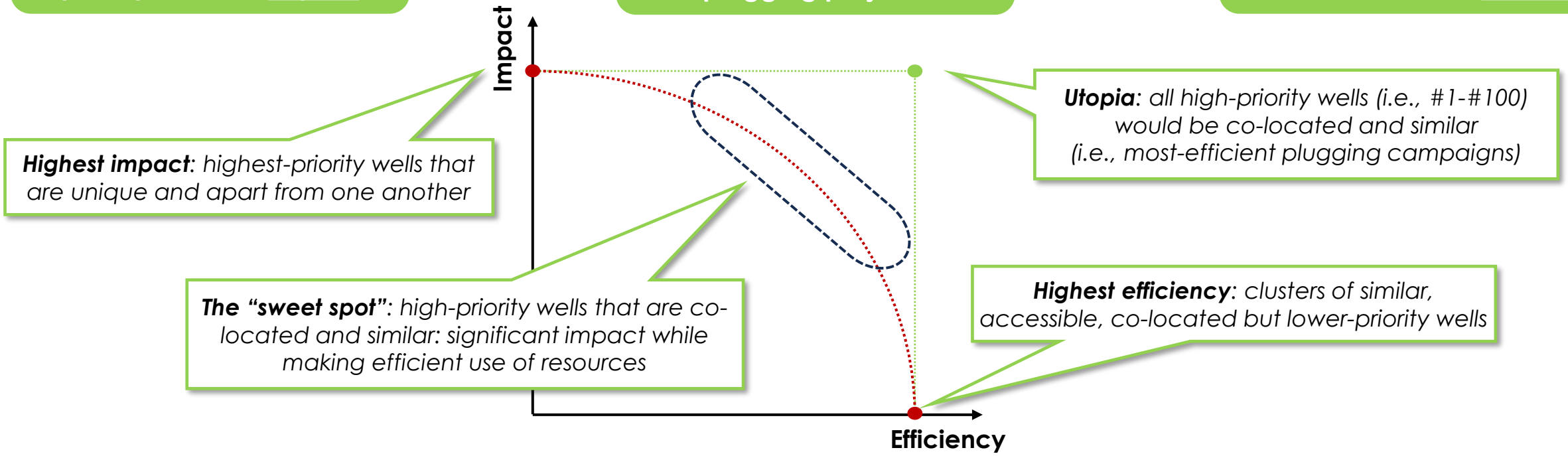
Choosing which wells to plug is easier said than done. What's more:
These well selections and groupings <u>make or break the efficiency</u> of plugging campaigns.

The Common Dilemma: Balancing Plugging Objectives

1. Intent to plug most "problematic", i.e., high-priority wells → impact

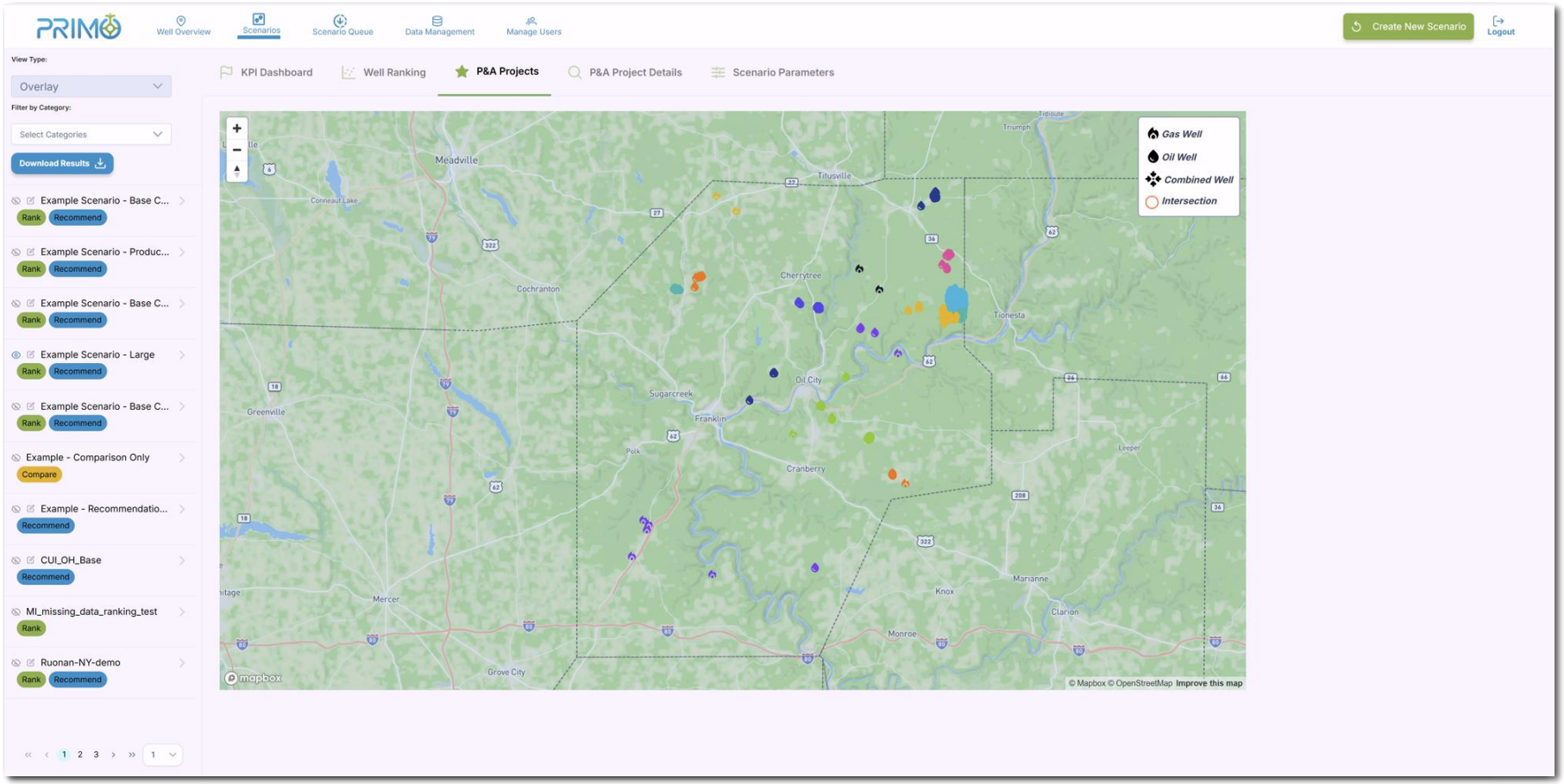
2. Desire to plug as many wells as possible with available funds → efficiency

3. Goal: Identify impactful AND efficient plugging projects



Common state challenge: Which specific wells make for the best candidates for plugging based on state priorities and realities? How to plug these as efficiently as possible?

Enter: PRIMO – A Custom-Built Decision-Support Application



NETL developed PRIMO specifically to help states turn their priorities into optimized plugging campaigns.

PRIMO 101: How It Works

*PRIMO can be **fully customized** based on any user's programmatic goals and constraints*

1. Plug in data

- Well data/records
- GIS data/shapefiles/layers
- Well plugging resources
- Available budget
- …

2. Specify user preferences for …

a) Ranking Wells

- Well age/depth/…
- Owner well count
- Proximity to development areas
- …

b) "Ideal" Plugging Projects

- Large number of (high-priority) wells
- Similar-characteristic wells
- Accessible well sites
- …

3. Get recommendations



- Well candidates based on user priorities, objectives
- High-impact, high-efficiency plugging projects (w/ scores)
- …

PRIMO was custom-built by NETL to help states design transparent, defensible, impactful and efficient well plugging campaigns.

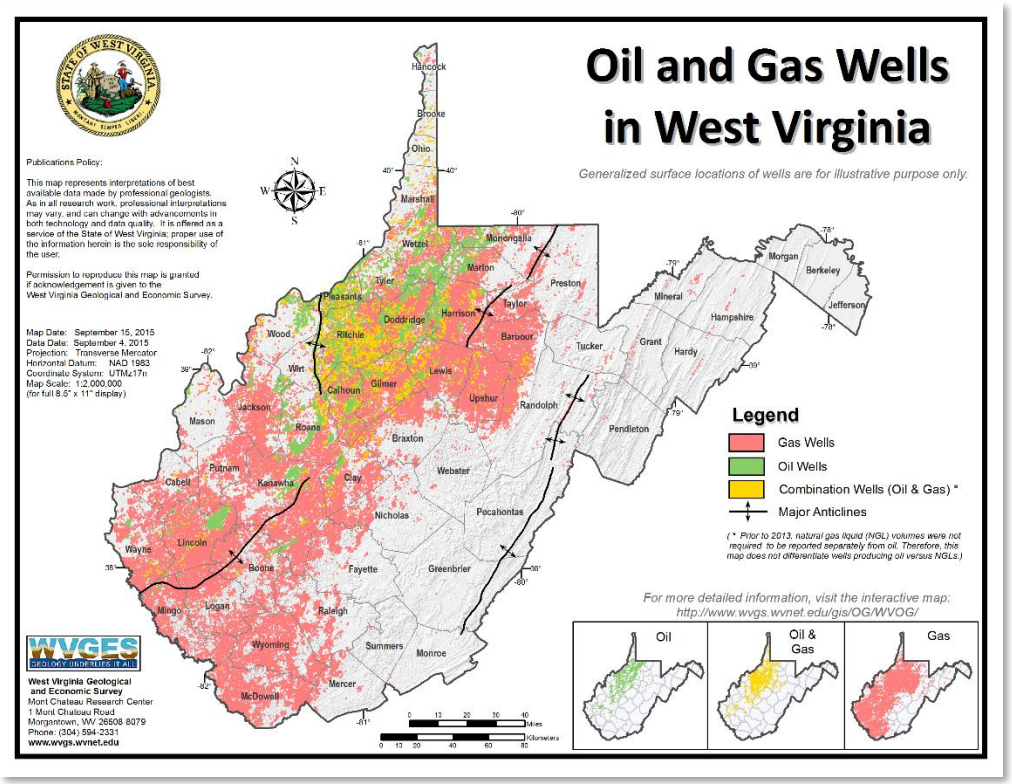
The WV DEP and Its Federally Funded Plugging Program

- **Motivation**: WV DEP received $38MM through a federally funded program to plug end-of-life wells
- **Reality**: 55,000 theoretically eligible wells
- **Expectation**: plug 500-600 wells w/ available funds

  → need for defensible down-selection

- **Goal**: maximize impact and efficiency of WV's end-of-life well plugging campaigns

  → opportunity to leverage NETL's PRIMO

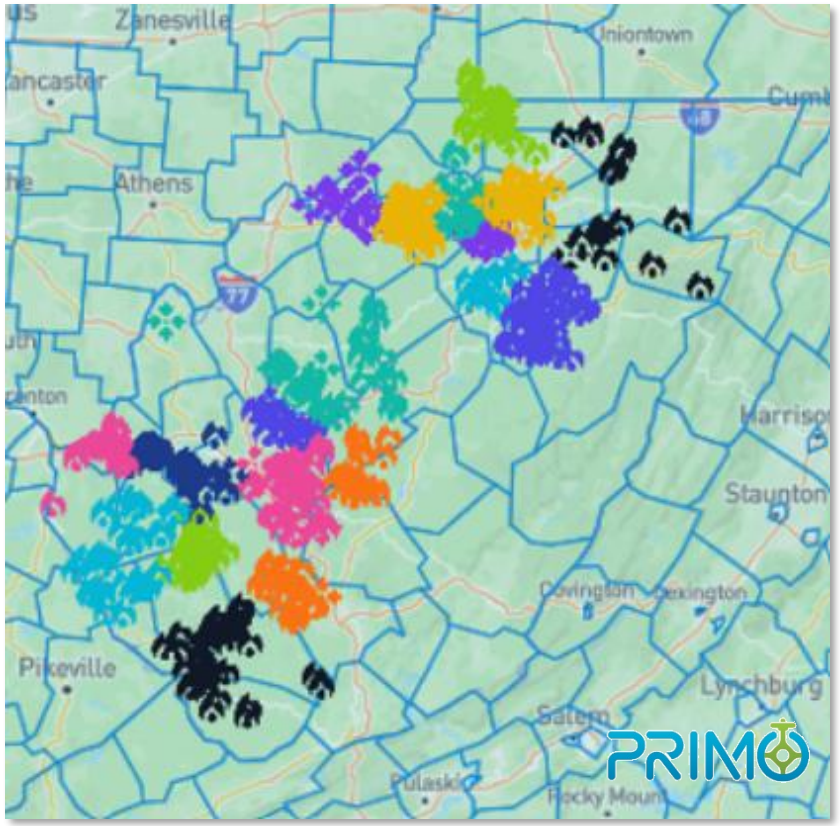


The DEP's grant administrator for this program worked closely with NETL in configuring and ultimately leveraging PRIMO for West Virginia's specific needs and realities.

Real-Life Experience: PRIMO in Use at the WV DEP

- DEP grant administrator ultimately received **850 well nominations** for participation in the program
- In May 2026, the administrator ran PRIMO based on the **DEP's requirements and preferences**
- PRIMO generated **20 high-impact, high-efficiency projects** involving 591 top-ranked wells
- Internal assessments suggest PRIMO-generated plugging projects **improve efficiency by 16%**

  → more wells plugged with the same budget



NETL's PRIMO empowered the DEP and its grant administrator to design optimized plugging projects in record time using the latest available science and technology.

States Are Already Seeing Value in PRIMO

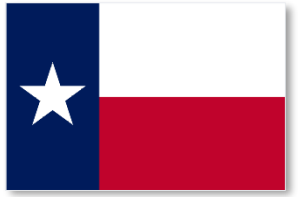
"…*PRIMO will be* ***instrumental in helping us design optimized well-plugging campaigns****…"*

"…*PRIMO enables more end-of-life wells…to be plugged…thereby …* ***supporting future oil and gas development opportunities****…"*

"…*We intend to use PRIMO…as a* ***core component of our current well plugging program****…"*

"…*PRIMO will* ***save taxpayers and stakeholders money*** *…"*

PRIMO is valued by state agencies and the oil & gas industry.



Texas - TCEQ



West Virginia – DEP



Michigan - EGLE



Illinois - DNR



New York - DEC

Industry Also Sees PRIMO as a Value-Adding Solution

"…The PRIMO team…has built a ***highly accessible*** and ***broadly applicable*** software that should not only appeal to state agencies, ***but also to private-sector oil & gas companies***…"

"…The PRIMO team is a great example of how NETL…***support[s] the oil and gas industry***…has been ***crucial*** to the success…"

"…I am convinced that PRIMO will ***empower the oil & gas community to ensure the resilience of the U.S. oil and natural gas industry***…"

"…our expectation is that PRIMO will contribute to ***reducing the cost of plugging end-of-life wells*** – which ultimately ***enables further oil & gas development in legacy plays***."

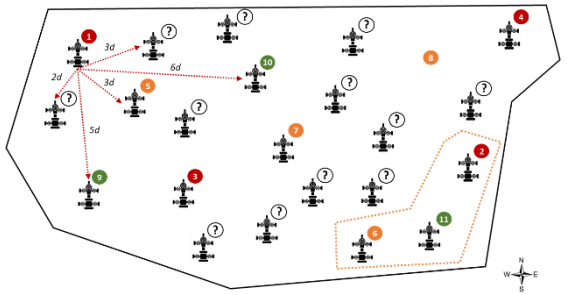
PRIMO demonstrates how NETL can translate R&D into practical tools valued by states and industry.

NETL's Technical Assistance Portfolio for States

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End-of-Life Oil & Gas Wells

Decision-Support Tools



build open-access databases, develop software decision-support tools

Hydrocarbon Loss Prevention

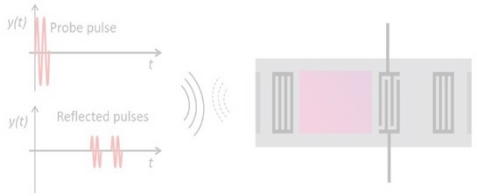




field surveys, well monitoring and plugging best practices guides

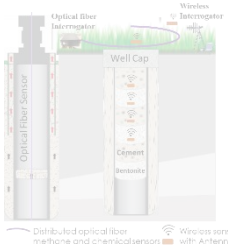
Broader Oil & Gas Systems

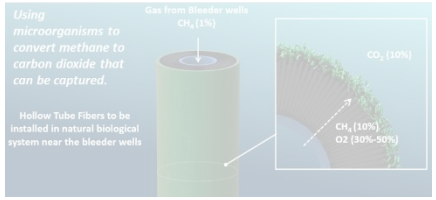
Advanced Sensor Technologies



sensor technologies demonstration and deployment at scale

Advanced Loss Prevention Technologies





novel loss prevention methods, optimization-based decision-support tools

Ad-Hoc Technical Assistance



Natalie Pekney
Loss Prevention Expert



Ruishu Wright
Advanced Sensors Expert



Jennifer Bauer
Geo-Data & Expert



Eilis Rosenbaum
Advanced Remediation Expert



Markus Drouven
Oil & Gas Systems Expert



Greg Lackey
Well Integrity Expert

And many more…!

"1-800-NETL-HELP" resource for oil & gas state agencies

PRIMO is just one example of NETL's technical assistance portfolio for states. From software to sensors, NETL can help states tackle technology challenges.

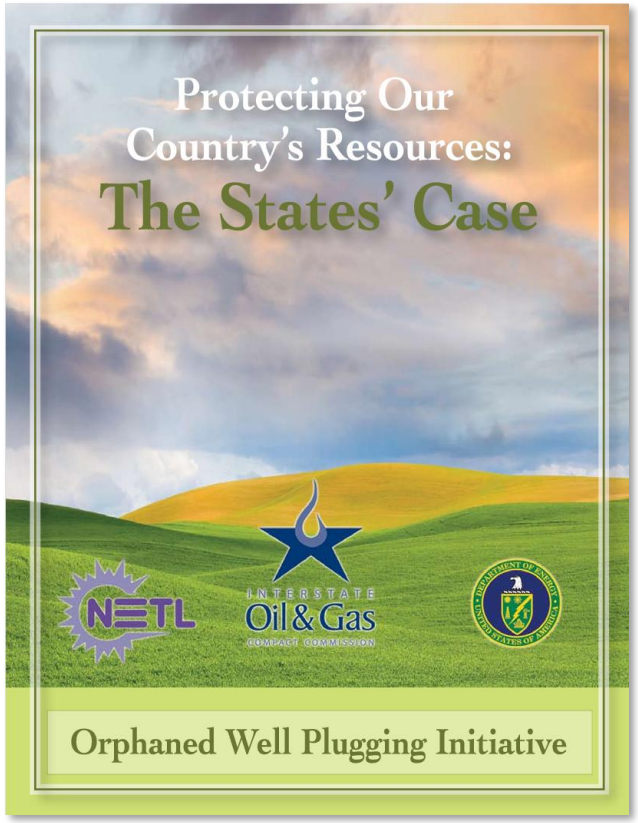
NETL as the States' Technology Workbench

- **Deep hydrocarbons expertise**
  → accessible through "Centers of Excellence"

- **Passionate scientists and engineers**
  → individuals who care and are driven by impact

- **Proven state, IOGCC, GWPC partnerships**
  → develop tailored solutions that meet unique needs

- **Open and transparent technology solutions**
  → enable maximum transparency and defensibility



Have a technology challenge?
Call on NETL as your technology workbench!