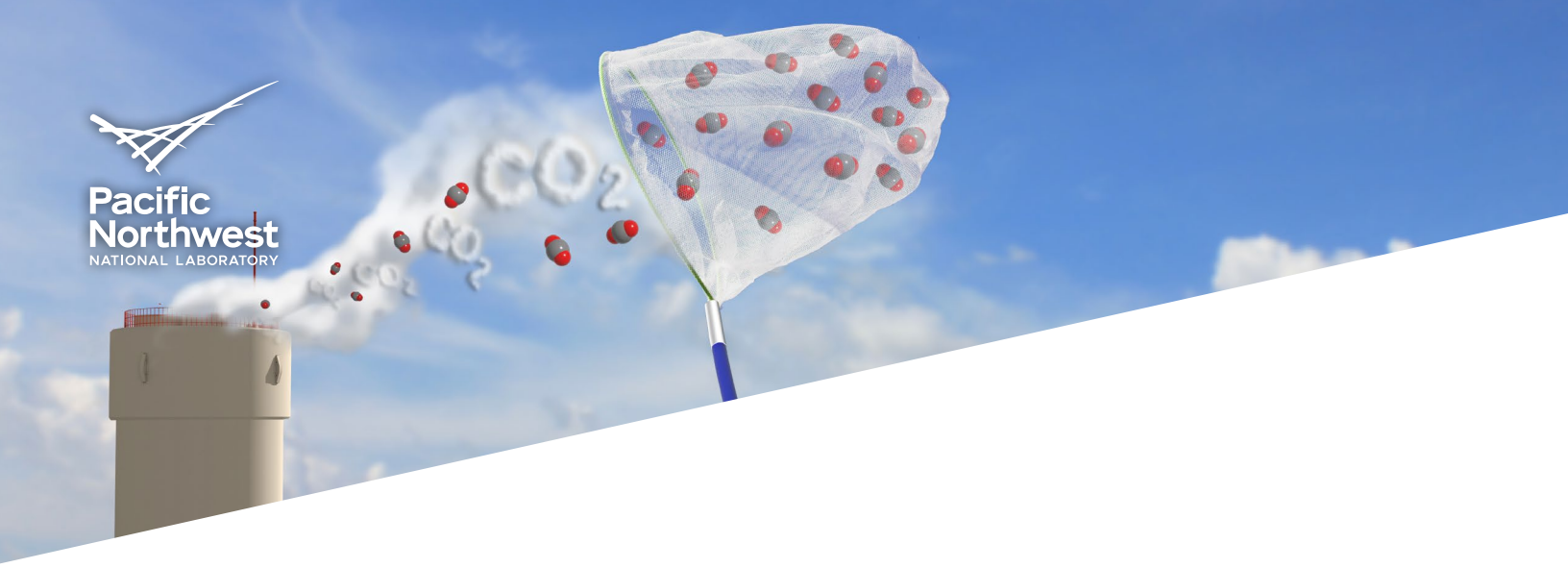
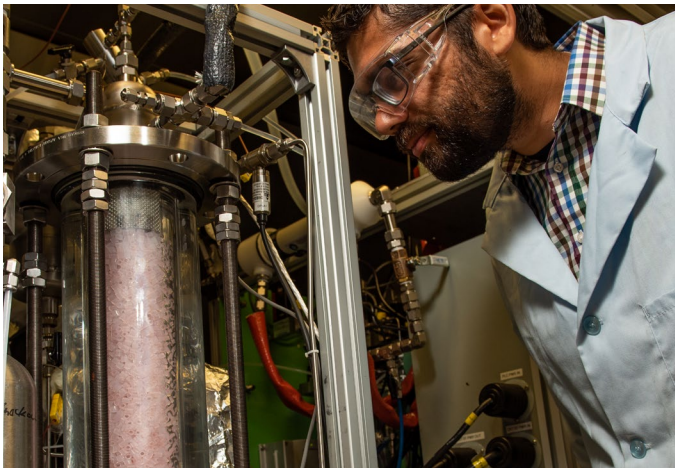


Carbon Capture and Utilization: Simple, Cost-Efficient Solvents Reduce CO_2 from Stationary Emitters

PNNL offers custom, drop-in solvents for existing CO_2 capture systems that are 15% cheaper

Ideal solvents for capturing carbon dioxide and other acid gases are cheap, durable, efficient, nontoxic, and easy to manufacture. Pacific Northwest National Laboratory's (PNNL's) drop in solvents are 15% cheaper and 26% more energy efficient than current commercial second-generation technologies.[1]

PNNL's solvents are designed for maximum efficiency and reduced toxicity while still being simple. These "water lean" solvents contain less than 5% water, reducing the energy required to release the captured carbon dioxide by boiling. This results in a more efficient, less energy intensive process. PNNL's solvents are also 99% less viscous, resulting in a lower solvent circulation rate, reduced pumping cost, and ultimately a less energy intensive process.



PNNL researchers use custom-built systems like this one to parametrize and validate models of how solvents and CO_2 move through packing materials.

PNNL's solvents are custom-tailored individual chemicals, not complex mixtures of different compounds. This makes it simple to track each solvent's properties–such as boiling point and evaporation rate–using a single set of data. Plus, the solvents can be dropped into existing infrastructure because they are designed to work with what's already there.

Bottom Line: PNNL's expertise in modeling, designing, building, and testing carbon capture solvents has resulted in:

- 15% reduction in capture costs relative to the commercial second-generation technologies
- 26% increase in capture efficiency over current baseline[1]
- Very low viscosity solvents that require less energy for pumping
- Drop-in alternatives for existing systems
- Accelerated commercialization potential via reuse of existing infrastructure

Aqueous capture solvents exist commercially but still have a high energy cost. PNNL has developed a new class of chemistry and transformational technology within 10 years, which is a process that normally takes 30 years to develop.

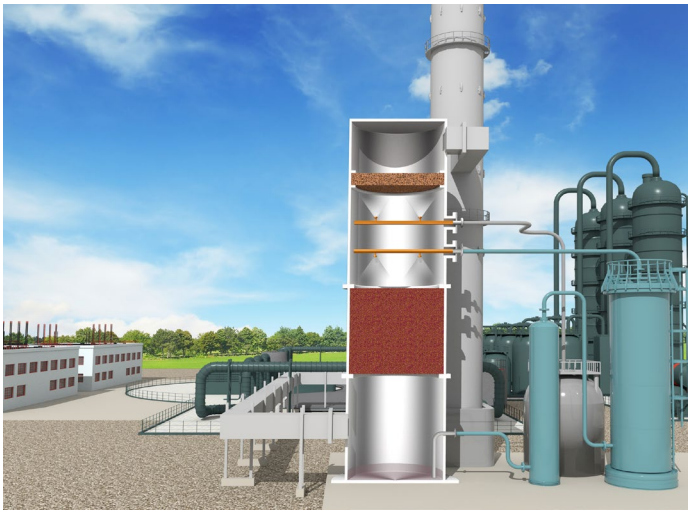
Carbon Conversion: Turning Captured Carbon into Products

Captured carbon dioxide is primarily injected into the subsurface to enhance oil recovery, or for long-term storage. Finding ways to transform it into valuable products offers another pathway for captured CO_2. PNNL's related integrated carbon capture and conversion technology has been used to make methanol, plastics, and battery additives from captured carbon. Instead of releasing the CO_2 captured in the solvent by boiling, it can be converted directly into a usable product.

1 Compared to DOE Case 12 amine baseline case technology

Nontoxic, Biodegradable Solutions to Efficiently Convert Captured Carbon to Methanol and More

In addition to the technologies described above, PNNL has a deep expertise tailoring catalytic processes applicable to waste CO_2 and other acid gases. Converting these products into low-carbon fuels or chemical feedstocks could offer a cost effective path for carbon utilization, particularly for important commodity products, such as methanol. As an example, PNNL researchers made methanol from captured carbon dioxide using a capture solvent medium based on chitosan/PEG_{200}, which is derived from wasted shrimp shells. This is a green alternative to more toxic carbon conversion solutions and uses chitosan and ammonia with hydrogen over captured carbon dioxide to make a valuable chemical.



PNNL's low viscosity solvents can be dropped into existing infrastructure because they are designed to work with what's already there. They are designed for maximum efficiency and reduced toxicity while still being simple.

LET'S CONNECT

If you have questions, regarding this technology, please send inquiries to commercialization@pnnl.gov. You can view all PNNL technologies available for licensing at www.pnnl.gov/available-technologies.

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