



Advancing Energy Systems: Role of Supercritical CO₂ Power Cycles in a New Energy Future

Office of Hydrocarbon and Geothermal Energy and NETL Research & Development

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Technology Manager, Advanced Turbines & Supercritical CO₂ Cycles

9th International Supercritical CO₂ Energy Technologies Symposium



U.S. DEPARTMENT of ENERGY

March 4, 2026



Disclaimer

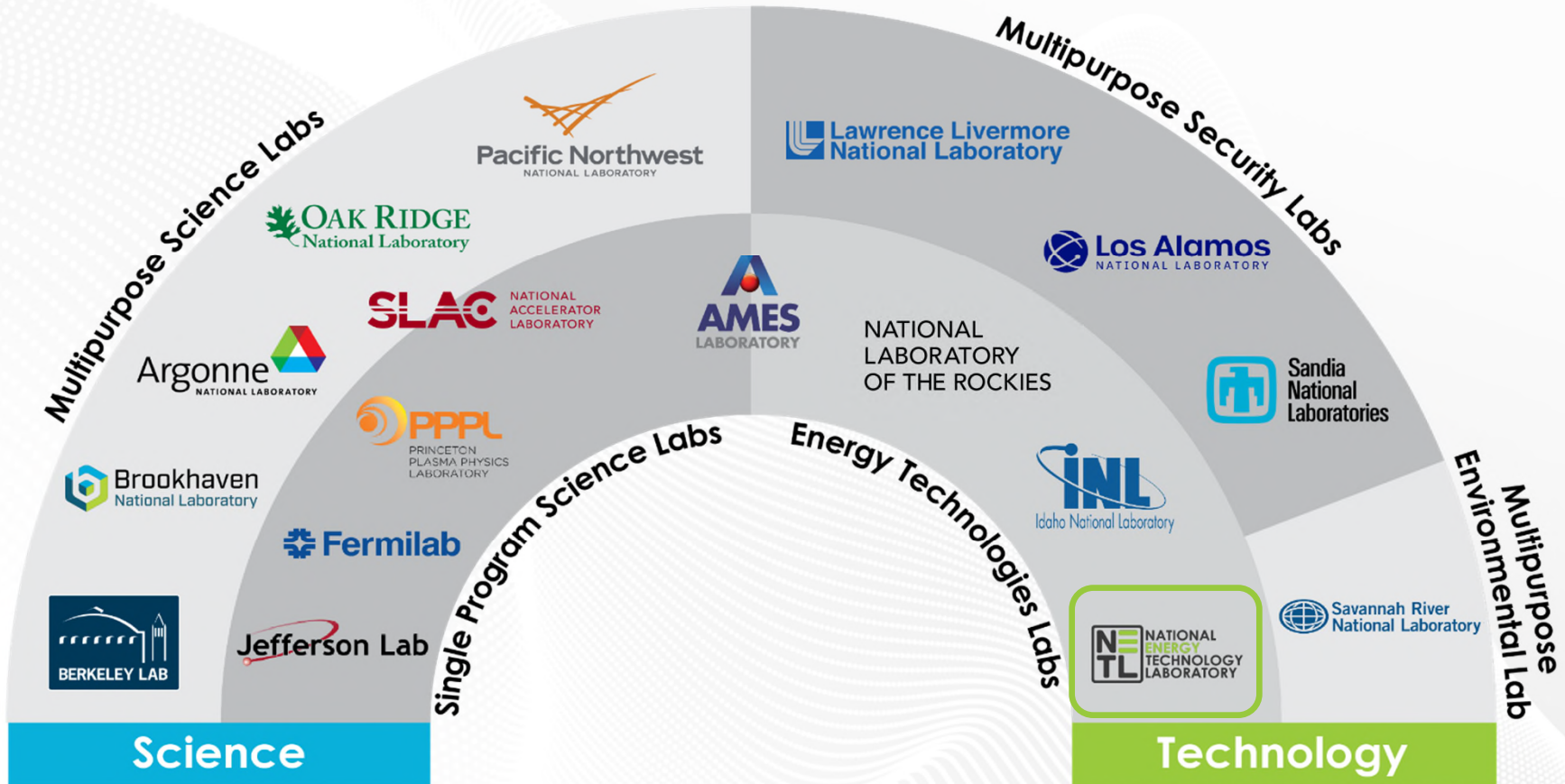


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The DOE National Lab System



The DOE National Lab System

NETL is:

- One of three energy technology national labs
- The only DOE government-owned and operated (GOGO) national lab
- Part of DOE's Hydrocarbons and Geothermal Energy Office

Two primary components:

1. Research & Development
2. DOE Program Execution



Multiple R&D Sites Operating as One Lab



Morgantown, WV



Pittsburgh, PA



Albany, OR

A New Era for Energy



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Focusing on Energy Addition, Reliability, and Environmental Stewardship

- Goal 1: Ensuring a reliable and affordable energy supply for all Americans.
- Goal 2: Advancing technological solutions that enhance energy production while managing environmental impact.
- Goal 3: Leveraging domestic resources, including fossil fuels and geothermal heat, with advanced conversion technologies.
- Goal 4: Maintaining U.S. leadership in high-efficiency power generation technology.

Strategic Imperative for sCO₂ Power Cycles



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A Versatile Platform for High-Efficiency Power Generation

- sCO₂ cycles offer a step-change in thermal efficiency compared to traditional steam cycles, leading to lower fuel consumption and costs.
- Compact turbomachinery reduces plant footprint and capital costs.
- Fuel-flexible applications: Applicable to natural gas, syngas, nuclear heat, concentrated solar, and geothermal energy sources.
- Direct-fired cycles provide an inherent and cost-effective pathway for carbon capture.

Advanced Turbines & STEP Program



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Budget History



SUPERCRITICAL CO₂
POWER CYCLES



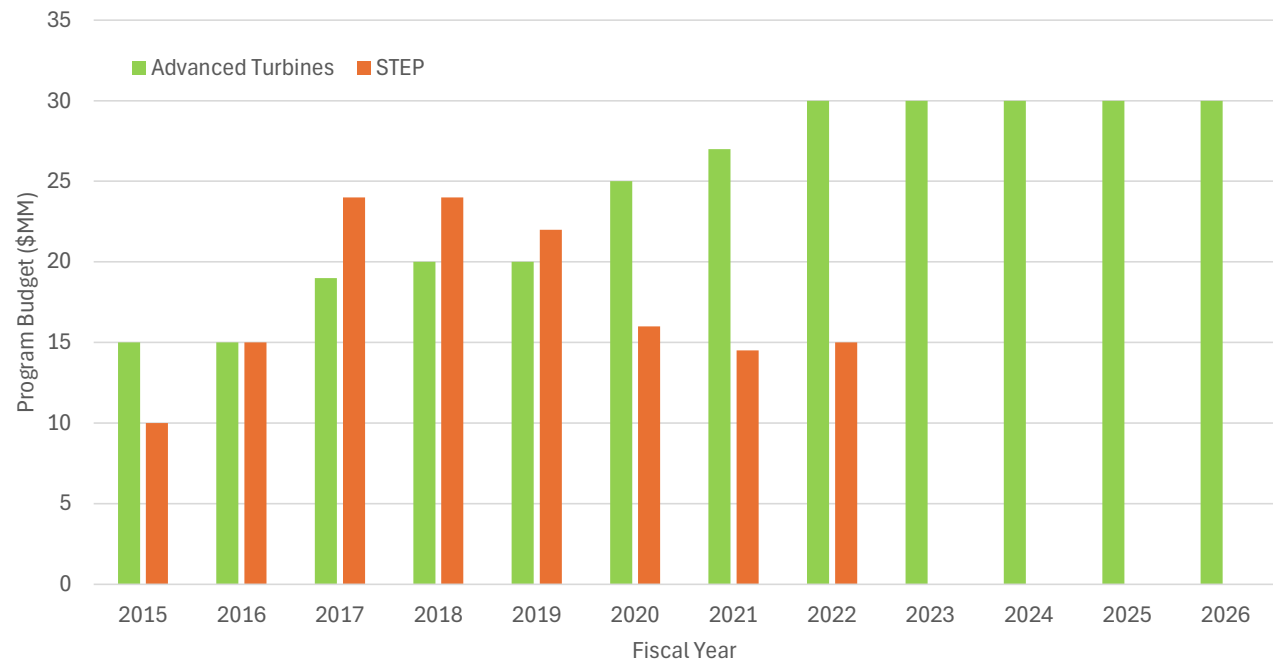
ADVANCED
COMBUSTION
TURBINES

DOE HQ Program Manager:

- Robert Schrecengost

NETL Technology Manager:

- John Crane



Advanced Turbines Supercritical CO₂ Portfolio



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Advanced Turbines Interactive Project Map



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NATIONAL
ENERGY
TECHNOLOGY
LABORATORY

TREE DIAGRAM
by NETL Key Technology
colored by Key Technology and Sized by Total Award \$

Agreements in View
7

Total Award Value in View
\$34.324M

Color By

- All
- Key Technology
- Organization Type
- Fuel Flexibility
- UTSR

Size by

- Count of Awards
- Total Award \$



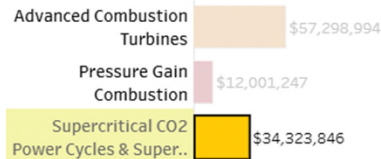
Fuel Flexibility

No \$34,323,846

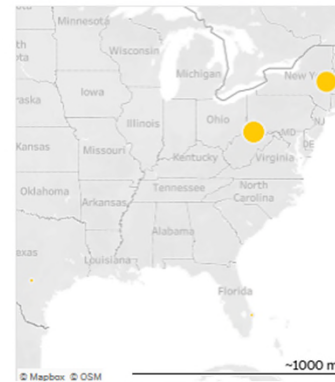
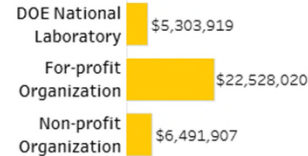
UTSR

No \$34,323,846

Key Technology



Organization Type



Valley of Death



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DOE Applied National Labs Bridge Concept to Commercialization



Advanced Turbines

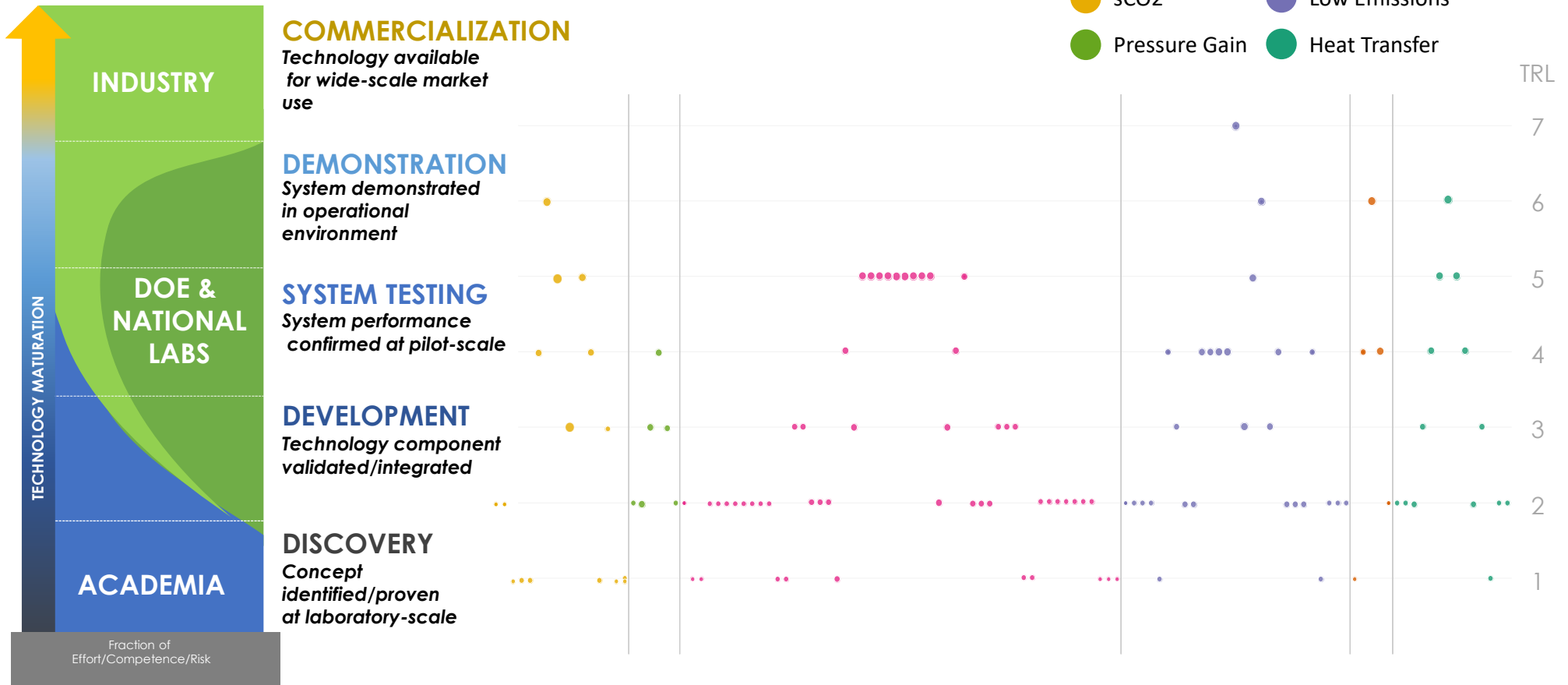


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Technology Readiness Level Progression

- Hybrid Cycles
- Materials & Manufacturing
- sCO₂
- Low Emissions
- Pressure Gain
- Heat Transfer



Advanced Turbines

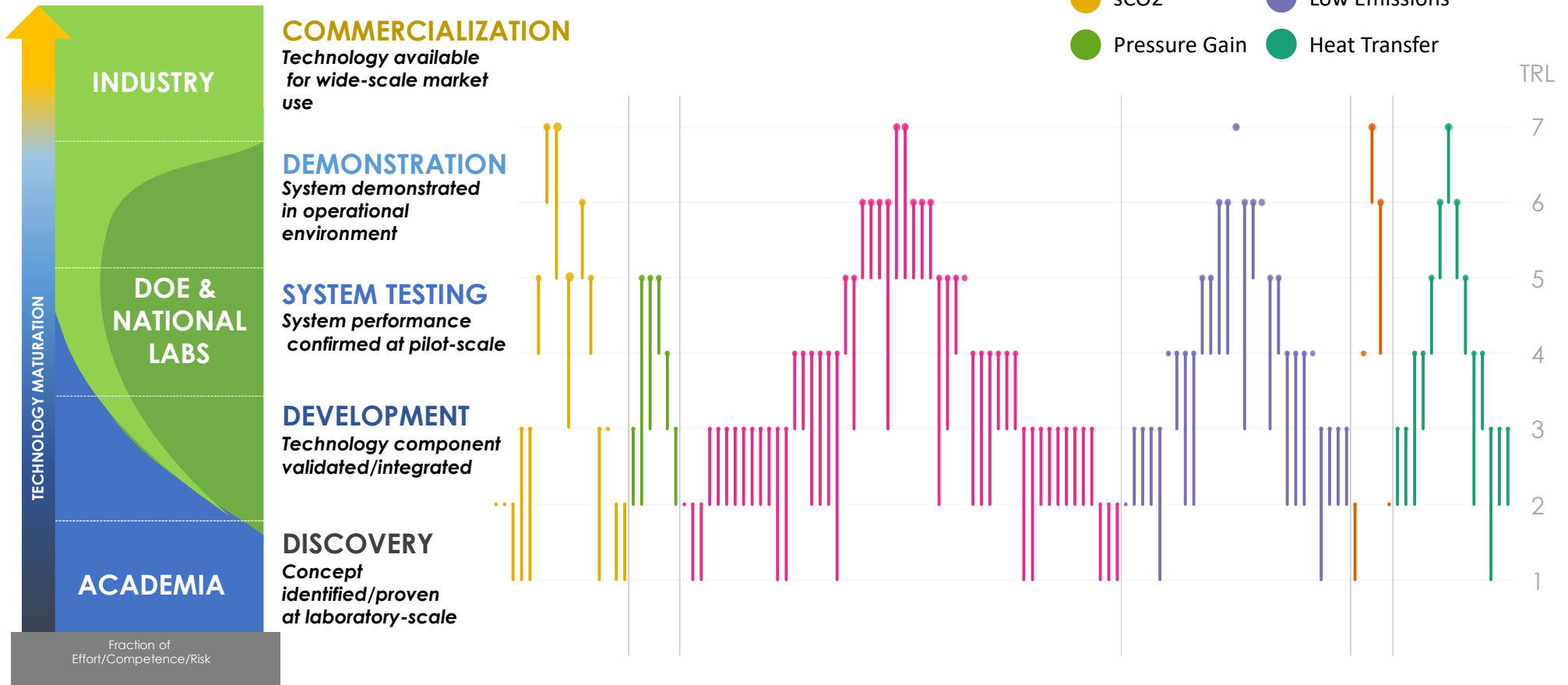


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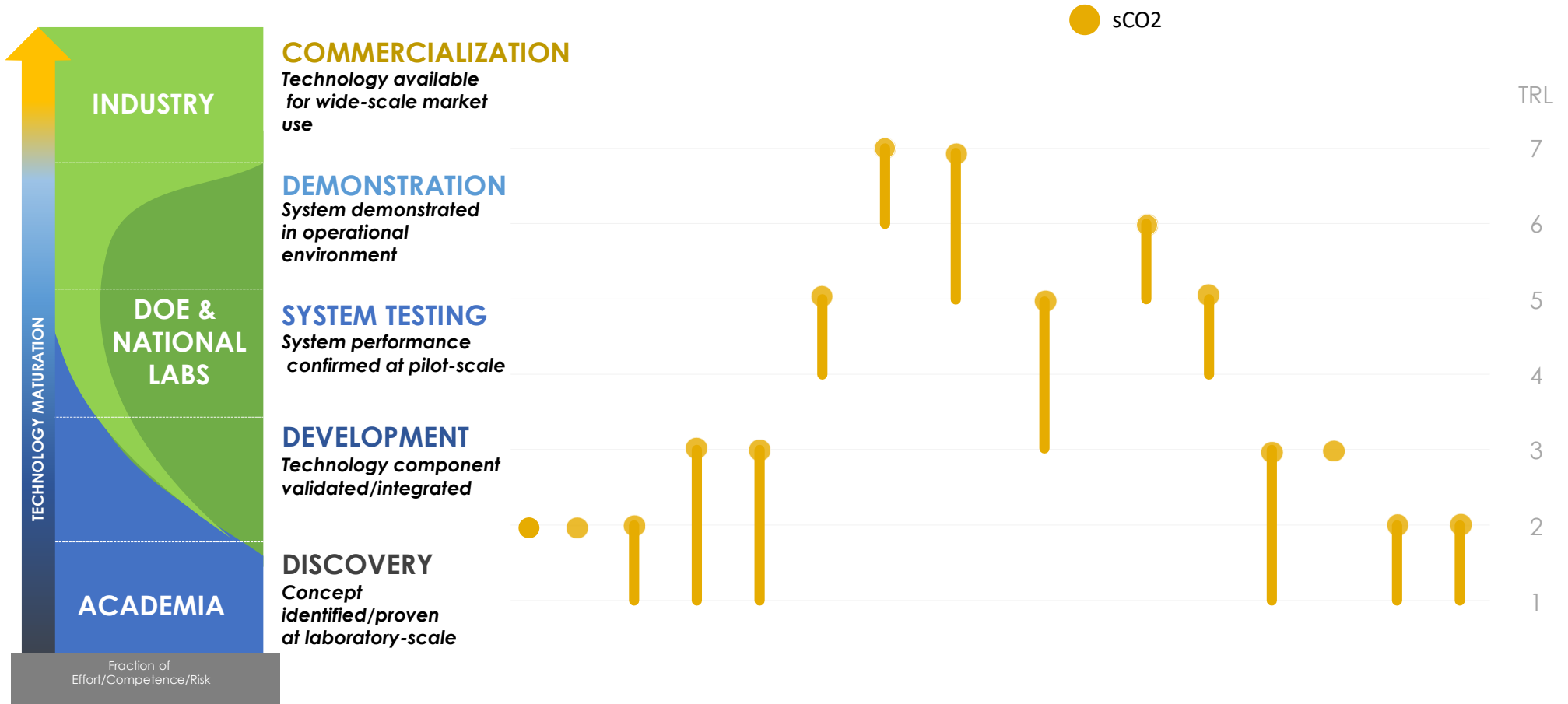
Advanced Turbines



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Technology Readiness Level Progression



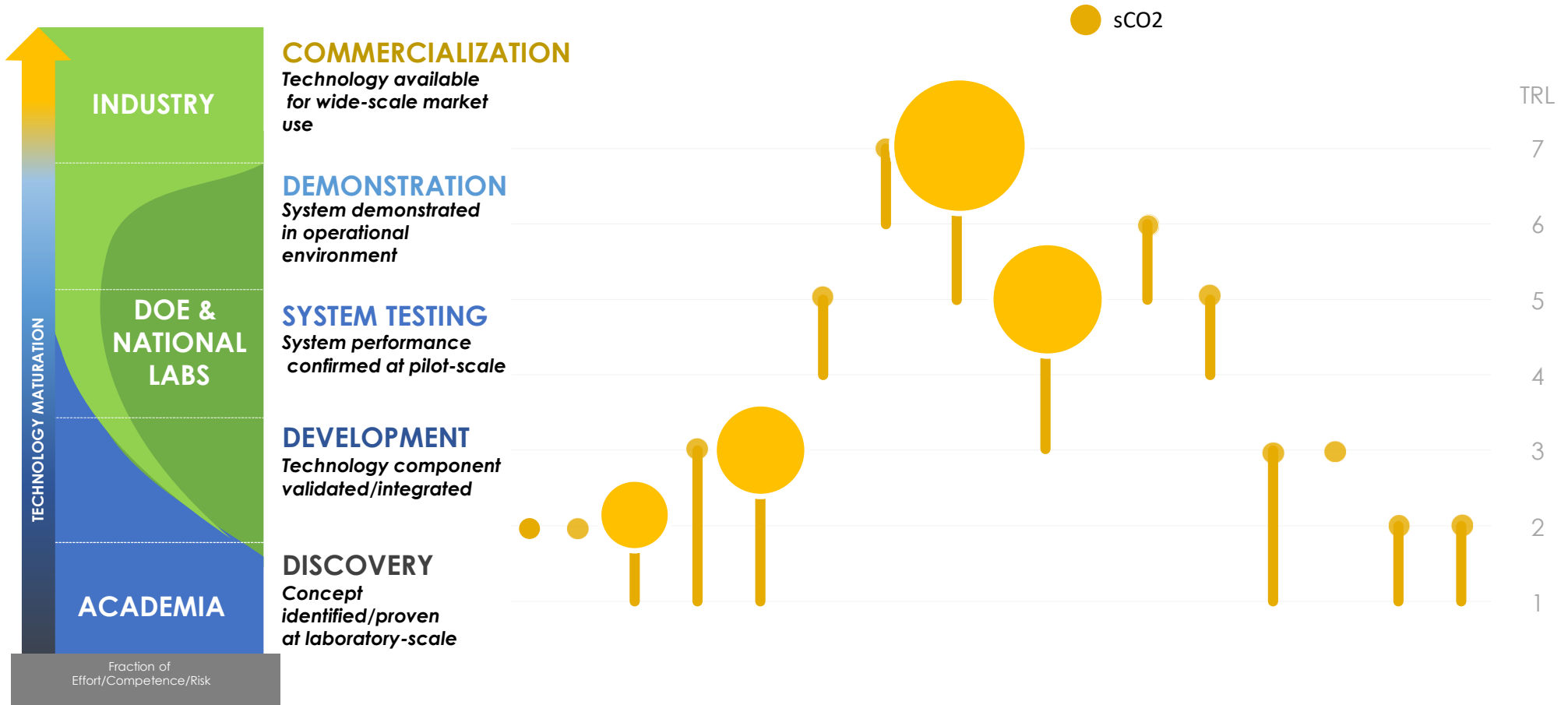
Advanced Turbines



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Technology Readiness Level Progression



Advanced Turbines – sCO₂ Power Cycles



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Technology Readiness Level Progression

● sCO₂

COMMERCIALIZATION

Technology available
for wide-scale market
use

DEMONSTRATION

System demonstrated
in operational
environment

SYSTEM TESTING

System performance
confirmed at pilot-scale

DEVELOPMENT

Technology component
validated/integrated

DISCOVERY

Concept
identified/proven
at laboratory-scale

TECHNOLOGY MATURATION

Concurrent Development of Direct- and Indirect- sCO₂ Cycles

