



Energy & Environmental Research Center (EERC)

State Energy Research Center (SERC) – Driving North Dakota's Energy Future

Presented to the Senate Appropriations Committee
February 2, 2023

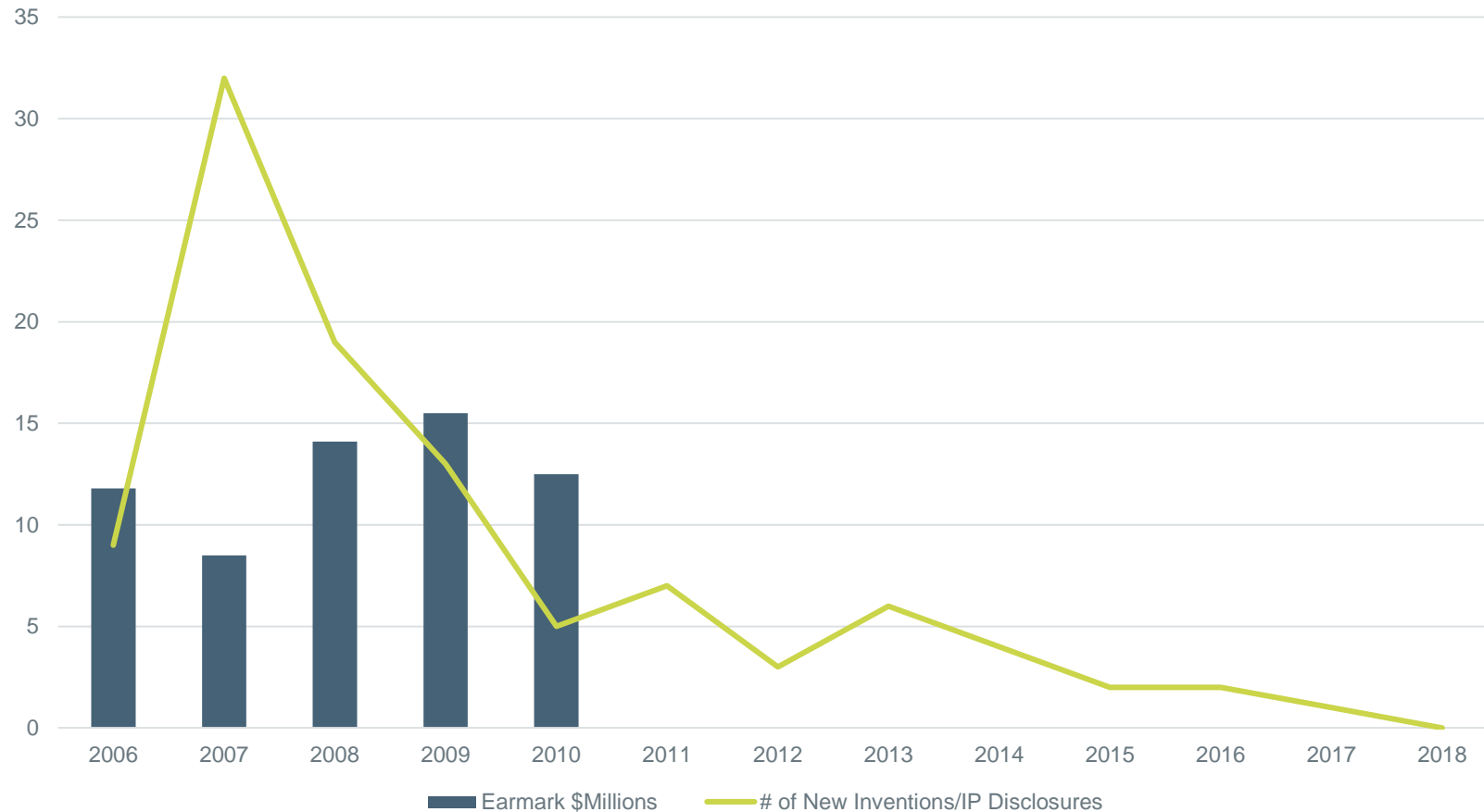
Tom Erickson
COO and VP for Intellectual Property

EERC VISION

TO LEAD THE WORLD IN
DEVELOPING SOLUTIONS
TO ENERGY AND ENVIRONMENTAL
CHALLENGES.

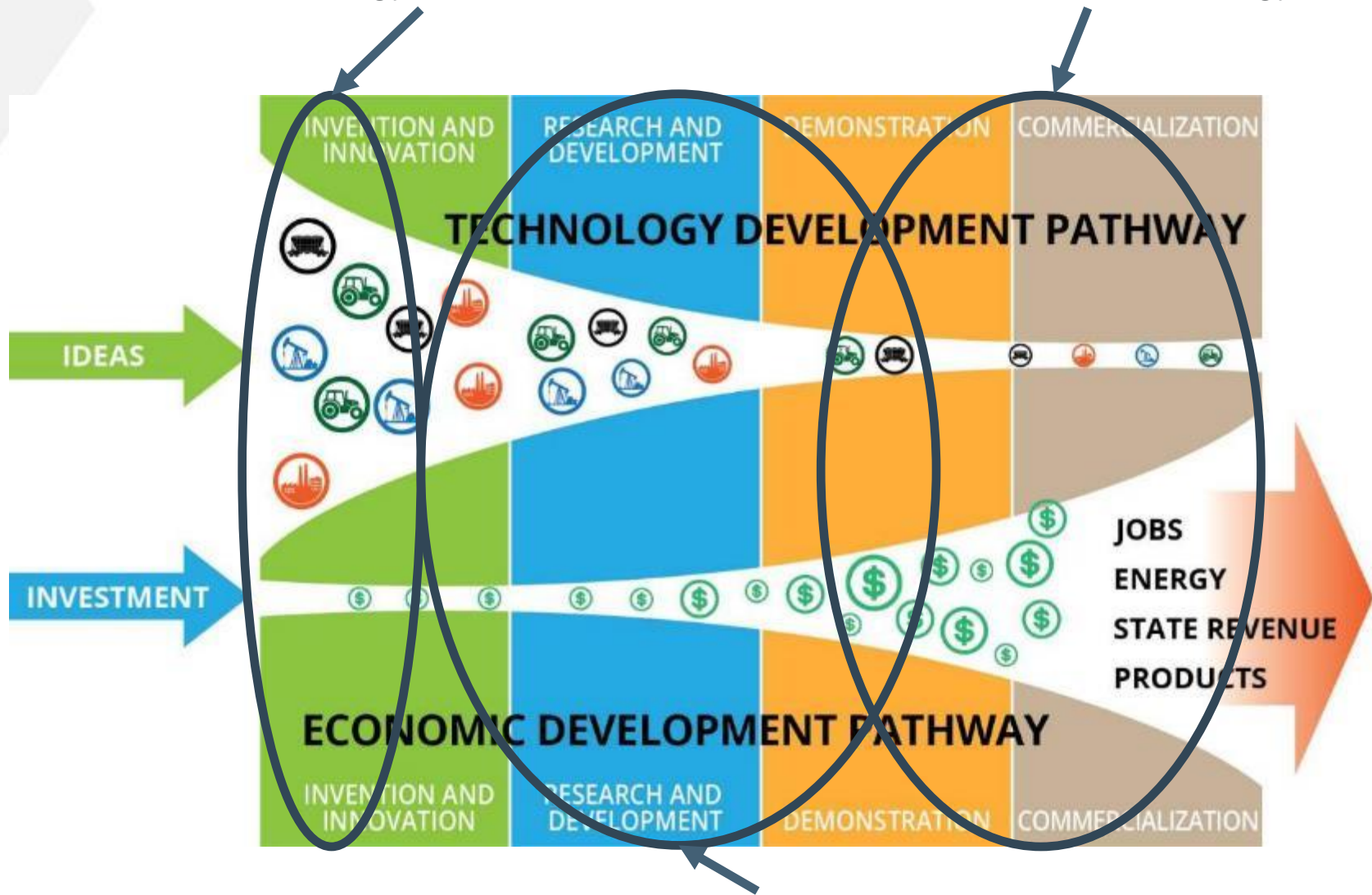
BEFORE SERC: Significant Reduction in New EERC Innovation and Invention

Reduced Exploratory Research Funding Results in Fewer Inventions



State Energy Research Center

Clean Sustainable Energy Authority



Lignite, Oil and Gas, Renewable
Research Programs, and Legislatively Directed Projects

SERC FOCUS AREAS

- **Exploratory energy research**
 - Explore fundamental, transformational ideas to shape the future energy portfolio of North Dakota.
- **Rapid response to critical North Dakota issues**
 - At the request of the North Dakota Industrial Commission (NDIC), conduct research to address emerging issues.
- **Education and outreach**
 - Provide opportunities for all ages and demographics to learn about North Dakota energy – not academic.
- \$5 million/biennium (currently has a sunset clause in 2027)
- Funded by NDIC contract, with reporting requirements to NDIC and the interim Energy Development and Transmission Committee (EDTC)

MANAGING UNCERTAINTY IS THE KEY TO INNOVATION



INNOVATION



Minimize Financial Uncertainty



Risk Acceptance



Agility



**COMMERCIAL
DEPLOYMENT**



Flexibility



Changing
Dynamics of
the Future

Critical Challenges. Practical Solutions.

SERC ACCOMPLISHMENTS

\$21 Million in
Other Proposals

\$9 Million in
Pending Proposals

\$6 Million in
Other Awards

Nearly **60**
Energy Hawks from
5 Higher Education
Institutions

50 Projects
Focused on ND Energy

3 Federal Opportunities
Pursued for the State – Grid,
Hydrogen, Direct Air Capture

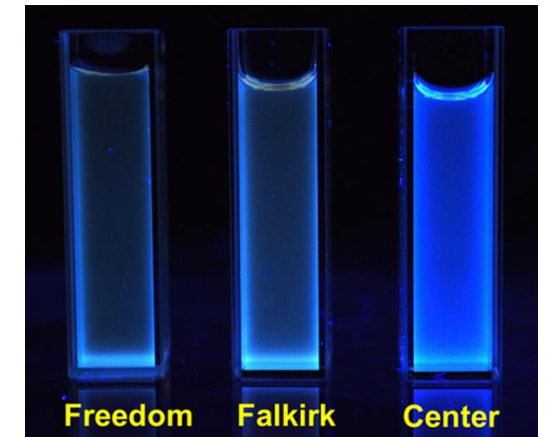
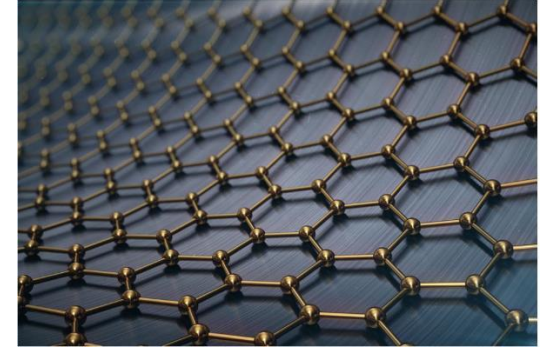
13 Invention
Disclosures

8 Patent
Applications

3 Patents
Granted

GRAPHENE/GRAPHITE

- SERC funded
 - Evaluation of high-value solid carbon products from North Dakota lignite
 - Evaluation of graphene-enhanced low-viscosity engine oil for automotive, aerospace, and unmanned aerial vehicle applications
- Led to:
 - Federal proposal awarded for laboratory-scale graphene production: \$930,000
 - Additional proposal awarded to use North Dakota lignite to produce graphite for lithium battery anodes: \$1.5 million



ENERGY HAWKS – CONCEPT

- Bring together a diverse group of college students and immerse them in all things North Dakota energy, resulting in the following:
 - A new perspective on the energy research needs for North Dakota
 - Future energy leaders
 - Knowledgeable North Dakota energy advocates/peers
 - Knowledgeable voters (North Dakota and beyond) on topics affecting energy



SUMMARY

- SERC has reignited invention and innovation by EERC researchers leading to:
 - New energy technologies for
 - Additional nonstate funding in
 - Technology demonstrations in
 - Student experiences across
- Removing the sunset clause will allow SERC to continue to do the same with certainty.
- Increased funding will be used effectively for even greater results.

North Dakota!



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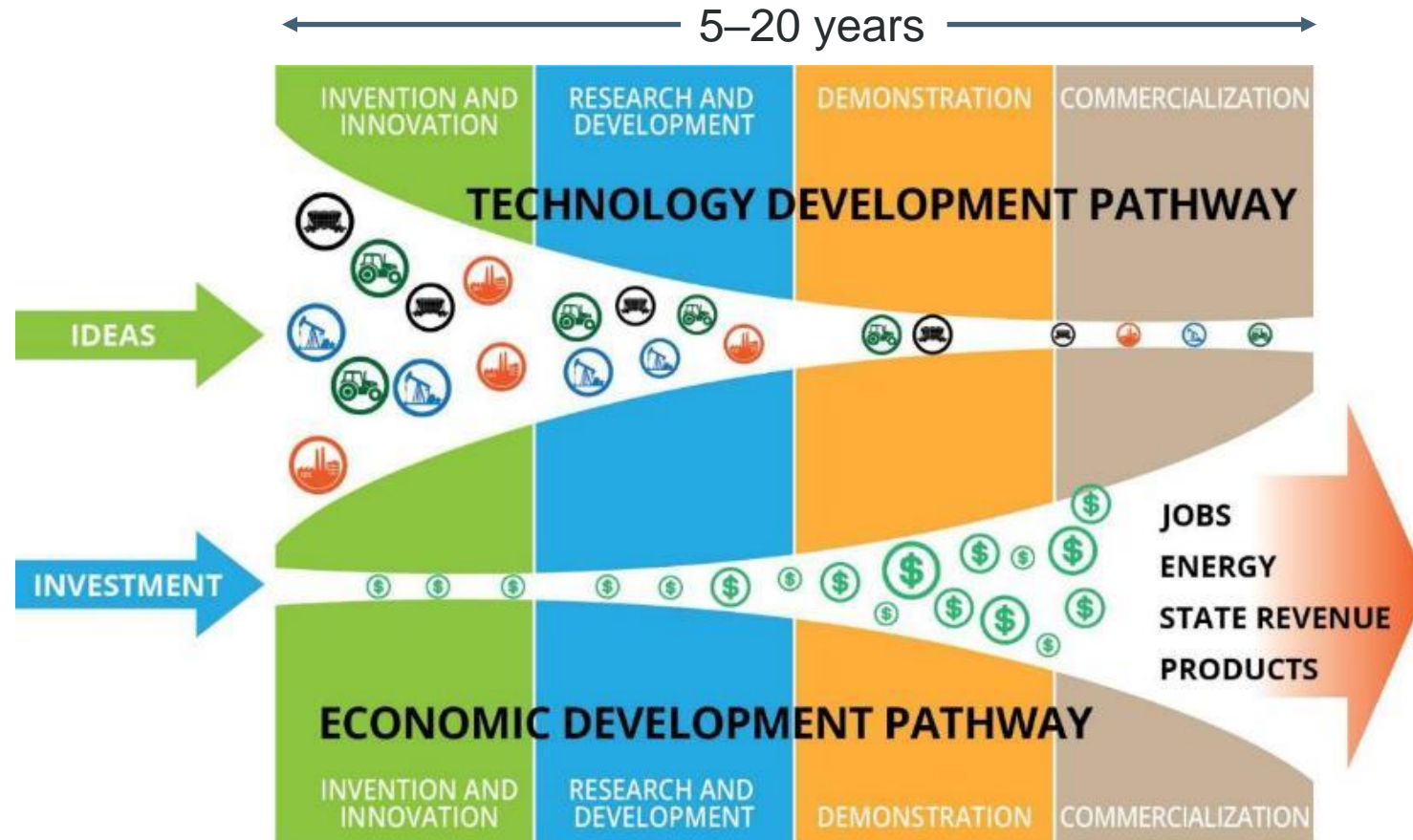
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A wide-angle photograph of a university campus at sunset. The sun is low on the horizon, casting a warm glow over the scene. In the foreground, there are large trees with some yellowing leaves. In the background, there are several large, multi-story brick buildings and a parking lot filled with cars.

THANK YOU

Critical Challenges. Practical Solutions.

GENERAL Distribution of Federal Funding for Energy Research



As a nonprofit, 100% of all revenue received by the EERC is spent conducting the research we are contracted to do.

| | | | |
|---------------------------------|------------------------|------------------------|------------------------|
| 100% Federal, State, University | 80%/20% Public/Private | 50%/50% Public/Private | 20%-80% Public/Private |
|---------------------------------|------------------------|------------------------|------------------------|

5%–10% of EERC Workload

60%–70% of EERC Workload

20%–35% of EERC Workload

CO2 Removal/Precipitation Technology

- SERC Funded:
 - Developing Value from North Dakota Geologic Brines - **\$60,000**
- Follow-On Funding
 - ARPA-E, Total Funding **\$500,000 DOE** (100% DOE)
- Two additional proposals submitted
 - **Total Funding \$600,000: \$500,000 DOE, Talos Energy - \$100,000**
 - **Total Funding \$250,000: \$250,000 DOE, Talos Energy - \$50,000**

RARE-EARTH ELEMENTS

- SERC funded
 - Recovery of REEs from coal ash
 - Quantifying REEs in coal seams and shale
 - Electrochemical extraction of REEs from coal and produced water
 - Tunable electrochemical extraction for purification of REEs and CM
- Led to:
 - Williston Basin CORE-CM: \$1.5 million federal funding with additional cost share from Lignite Research Program, North American Coal, BNI, Basin Electric Cooperative, and Minnkota Power

The image shows a periodic table with several elements highlighted. A legend in the top right corner defines the categories:

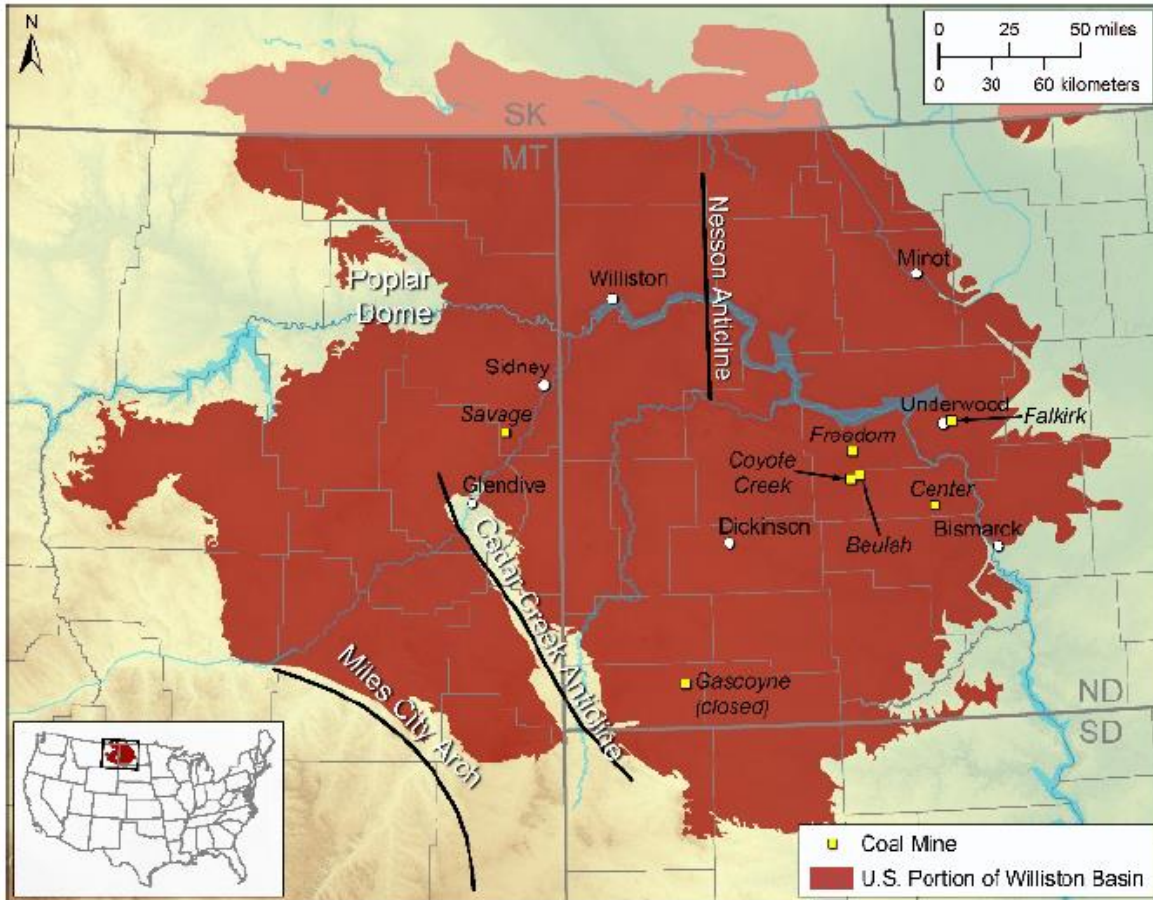
- Light Rare Earth Elements (blue background)
- Heavy Rare Earth Elements (dark blue background)
- Critical Rare Earth Elements (green background)
- Critical Minerals (black background)

The highlighted elements include Scandium (Sc), Yttrium (Y), and the lanthanide series (La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu). Other critical minerals shown include Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Tellurium (Te), and Uranium (U).

* Gd, Rf, Pa, Cm, Bk, Cf, Es, Fm, Md, No, Lr

Image Credit: DOE NETL

WILLISTON BASIN CORE-CM INITIATIVE



- 1) Assess the existing information available for resource characterization, waste streams, and technologies and identify options for business development, innovation centers, and stakeholder engagement.
- 2) Identify the gaps where additional research and technology development are necessary.
- 3) Create a series of plans to provide a pathway for future development.
- 4) Initiate stakeholder engagement.



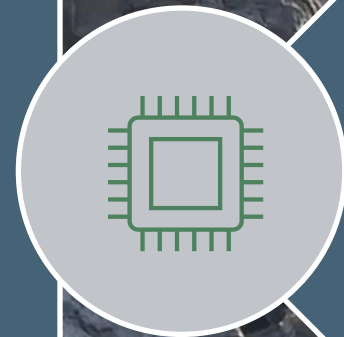
Assessment of Resources



**Strategies for
Infrastructure, Industries,
and Business**



**Strategies for
Waste Stream Reuse**



Technology Innovation Centers



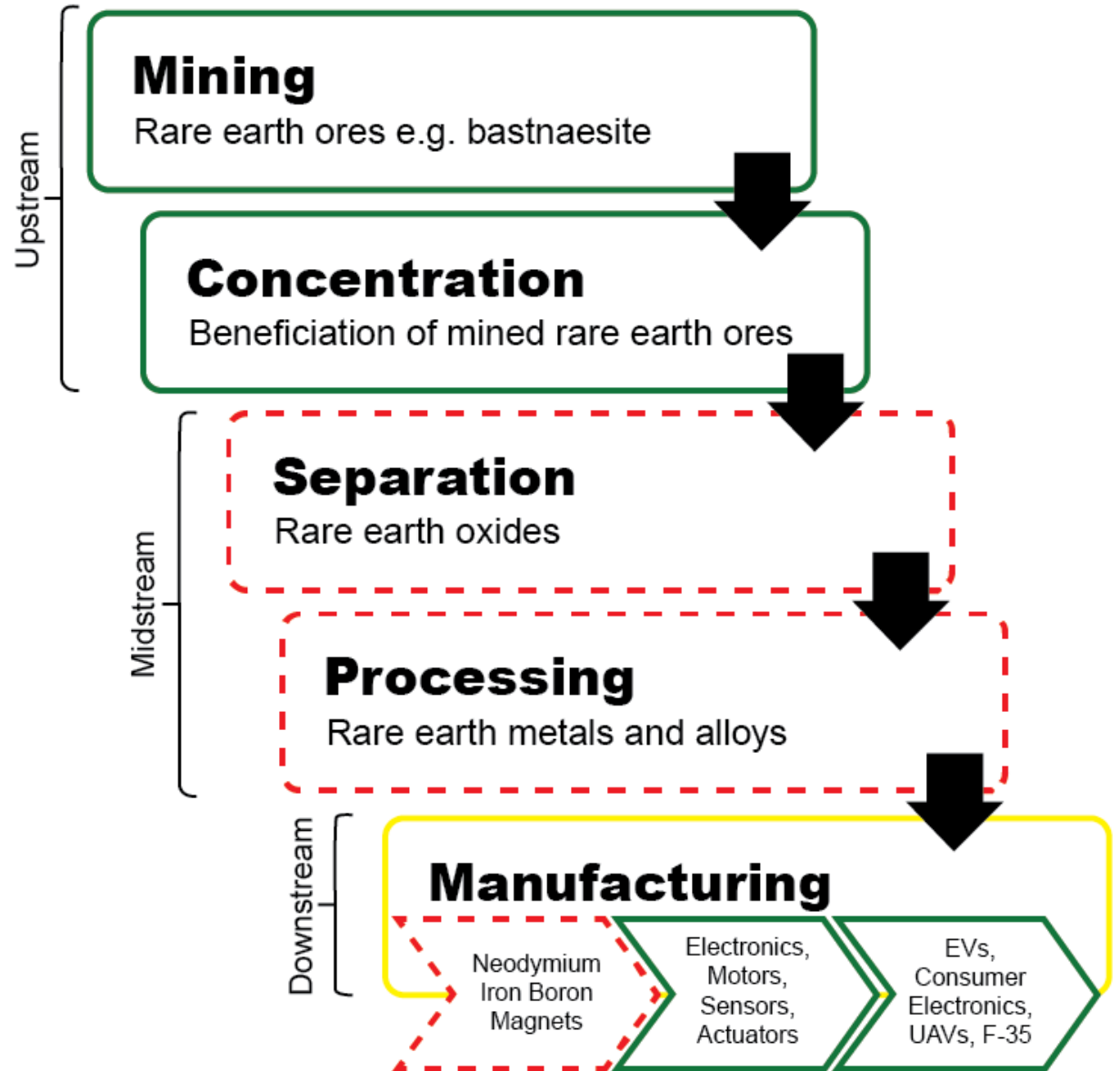
**Technology Assessment,
Development,
and Field Testing**



**Stakeholder Education
and Outreach**

What Are We Trying to Achieve?

- Identify technologies across supply chain.
- How do we fill these gaps?



ZERO EMISSIONS FROM WELL PADS

- SERC funded
 - Robust adaptive technology to economically capture flare gas
- Note: Additional work also done through OGRP (BPOP project)

Led to:

- First commercial prototype planned within the next few months
- Joint development agreement with Steffes Corporation
- Recent federal proposal submitted for \$1 million to expedite commercial development and deployment



STATE-LEVEL PROPOSAL DEVELOPMENT



- Formula grant for transmission reliability
 - submitted October 2022
 - \$3.7 million/year for 5 years
- Heartland Hydrogen Hub – submitted concept paper November 2022
 - Anticipated April submission of full proposal for up to \$1.25 billion of federal funding (with at least 50:50 cost share)
- Direct air capture hub – TBD, in preparation
- Other opportunities being considered