

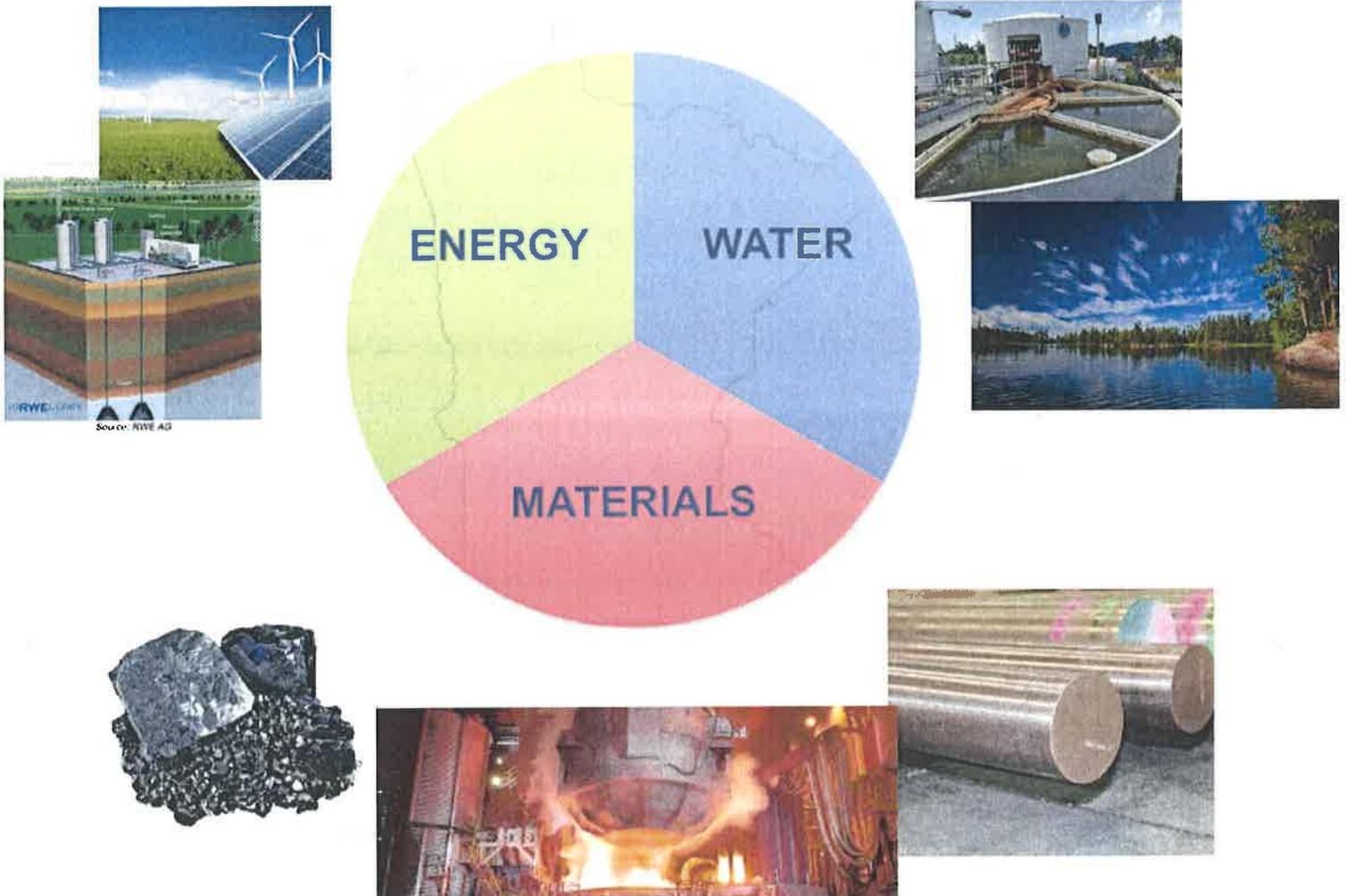


What will NRRI do to follow the 2016 Mining and Water Innovation Initiative?

Investment in continued progress ...

- Water quality improvements to meet sulfate standards
- Minnesota iron products of the future
- New hydrometallurgy for high-value mineral products
- Large-scale energy storage options for Minnesota's renewable energy economy

THE ECONOMIC NEXUS *Minnesota's Economy of the Future*



Minerals & Water Innovation Initiative (HF 1321; SF 1884)

Water Quality Improvement

- Build and deploy pilot unit to demonstrate sulfate removal via precipitation/filtration technology in regional water treatment facilities
- Field-pilot biological processes to reduce sulfate in Minnesota waters

Next Generation Minnesota Iron Products

- Initiate long term project portfolio to (1) characterize western Mesabi iron resources, (2) develop new technologies to efficiently extract iron, (3) develop portfolio of Minnesota iron products

Develop Emerging Hydrometallurgy Technology

- New technology features reduced energy and water consumption and higher purity metal extracts
- Offers Minnesota new opportunities for high value mineral products

High Capacity, Cost-Effective Energy Storage

- Utilize Minnesota historical auxiliary mine lands as high capacity pump-hydro/compressed air energy storage to support Minnesota's drive to a renewable energy economy
- Identify and characterize Minnesota sites for potential development as mid-America energy storage facilities

Our Research Goes to Work for You

OUR MISSION:

Deliver research solutions balancing Minnesota's economy, environment and resources for resilient communities.

A UNIQUE APPLIED RESEARCH APPROACH: TO DEVELOP AND DELIVER

NRRI was chartered by the Minnesota State Legislature in 1983. Its original mission is as relevant as ever. Employing over 140 scientists, engineers, technicians and students, NRRI performs applied research to develop and deliver the understanding and tools needed to utilize the state's resources in a balanced and responsible manner.



OUR RESEARCH TEAMS:

NRRI provides research and development, tools and data to stakeholders in the following areas:

- Minerals & Metallurgy
- Water
- Forest & Wildlife
- Wood Products & Bioeconomy
- Energy
- Business Support

"What NRRI brings us is the chemical and technical expertise we just don't have in-house."

- Peggy Jones

American Peat Technology
Aitken, MN

Innovative Research. Minnesota Value. Global Relevance.

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TWO INDUSTRIAL RESEARCH SITES:

NRRI has extensive capabilities to research and deliver at the bench-to-pilot scales, reducing risks inherent to commercializing innovations. NRRI Duluth has 19 labs to meet the needs of land, wildlife, water and minerals research. NRRI's Coleraine facility is a 27-acre former industrial site focused on minerals processing and bio-based energy research.



NRRI IMPACT

In FY 2018, NRRI's project portfolio engaged collaborated with more than 80 regional clients, including industry, small to mid-size businesses, state and federal agencies and non-profits.

"It's great to have an independent research facility that can help us pursue a product or design or idea that helps our process."

- Dave Hanskala

ME Elecmetal, Duluth, MN

"NRRI helps us stay competitive and streamline as we grow."

- Kelly Bartz

Loll Designs/Epicurean, Duluth, MN

**Natural Resources
Research Institute**

UNIVERSITY OF MINNESOTA DULUTH

Driven to Discover

