

UNIVERSITY OF MINNESOTA

EXTENSION

Destination 2025: The Future of Renewable Energy and Materials in Minnesota

Gregg Mast, BioBusiness Alliance of Minnesota

Fueling the Future: The Role of Woody Biomass for Energy Workshop

April 29, 2009

St. Cloud

Sponsored by:

University of Minnesota Extension, Onanegozie RC&D, Minnesota Forest Resource Council, Natural Resource Conservation Service, Soil and Water Conservation District – Stearn County, Minnesota Department of Natural Resources

www.extension.umn.edu/agroforestry



The BioBusiness Alliance

of Minnesota



Destination 2025

***The Future of Renewable Energy
and Materials in Minnesota***

Objectives

- 1. Background**
- 2. BRIEFLY review the process to develop Destination 2025**
- 3. Review the high level global drivers and resultant recommendations**



What is the BioBusiness Alliance?

Industry



Academia

Government

Mission:

Enhance the well-being of our citizens by mobilizing and connecting the community to support the growth of biobusinesses by providing a roadmap for success, infrastructure, and a welcoming environment.

Enriching Minnesota's Future through the Biosciences



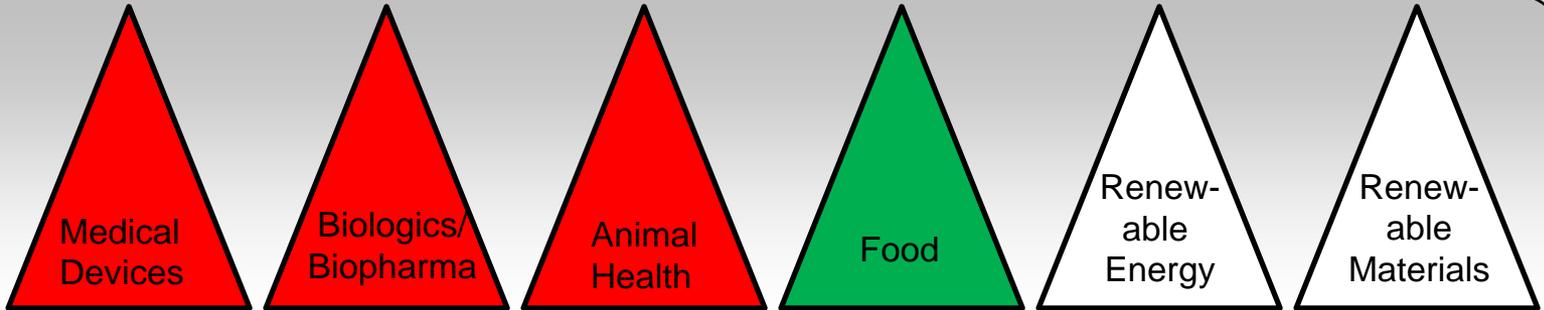
What is Destination 2025?

- **A partnership with Deloitte Consulting, LLC**
- **A twenty year “vision and roadmap” for the lifescience industry in the state of Minnesota that is intended to help ensure our place in the evolving global economy.**

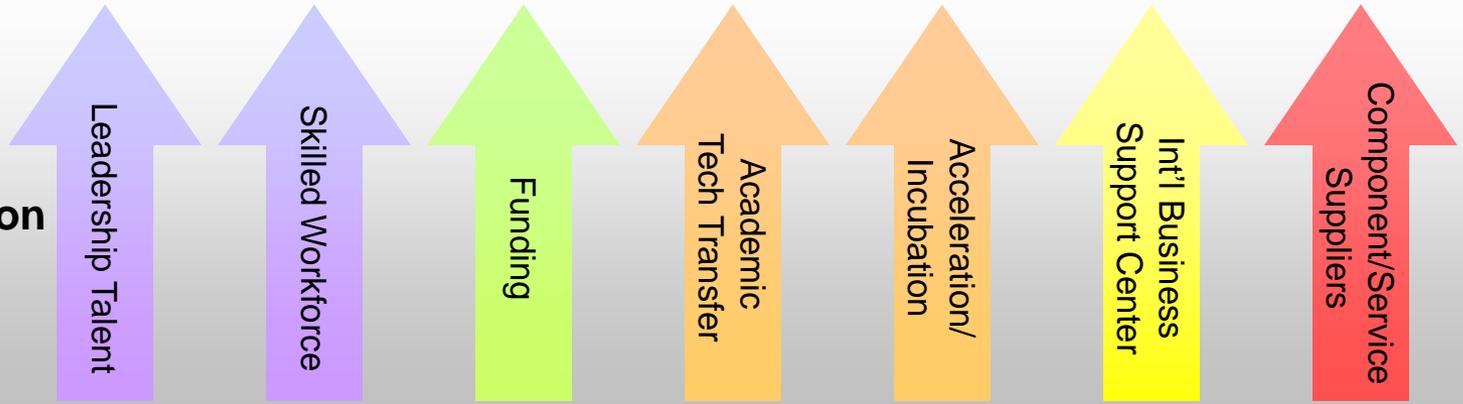


Minnesota Life Science Community

Minnesota Industries



Commercialization Catalysts



Enabling Knowledge Clusters

Catalysis & Synthesis
(Biological & Chemical)

NanoTech & Materials Science

Bioengineering & Clinical Capabilities

Bioinformatics & Systems Biology

Genomics, Proteomics & High Throughput Biology

Imaging / Navigation

Foundational Capabilities

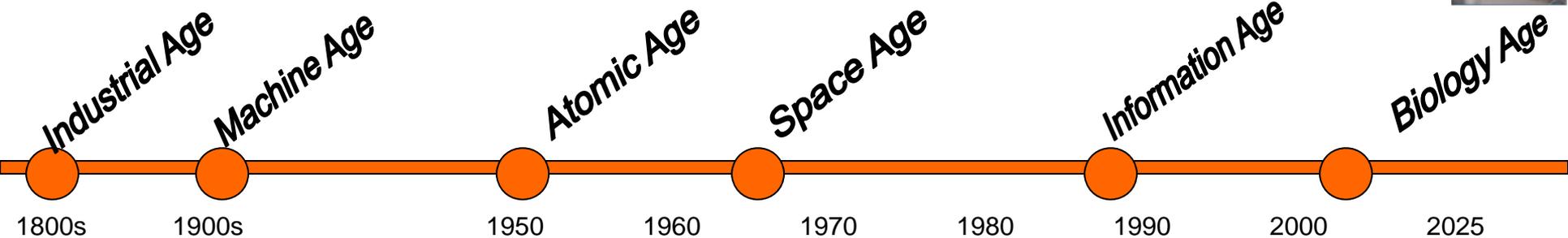
Education

Infrastructure

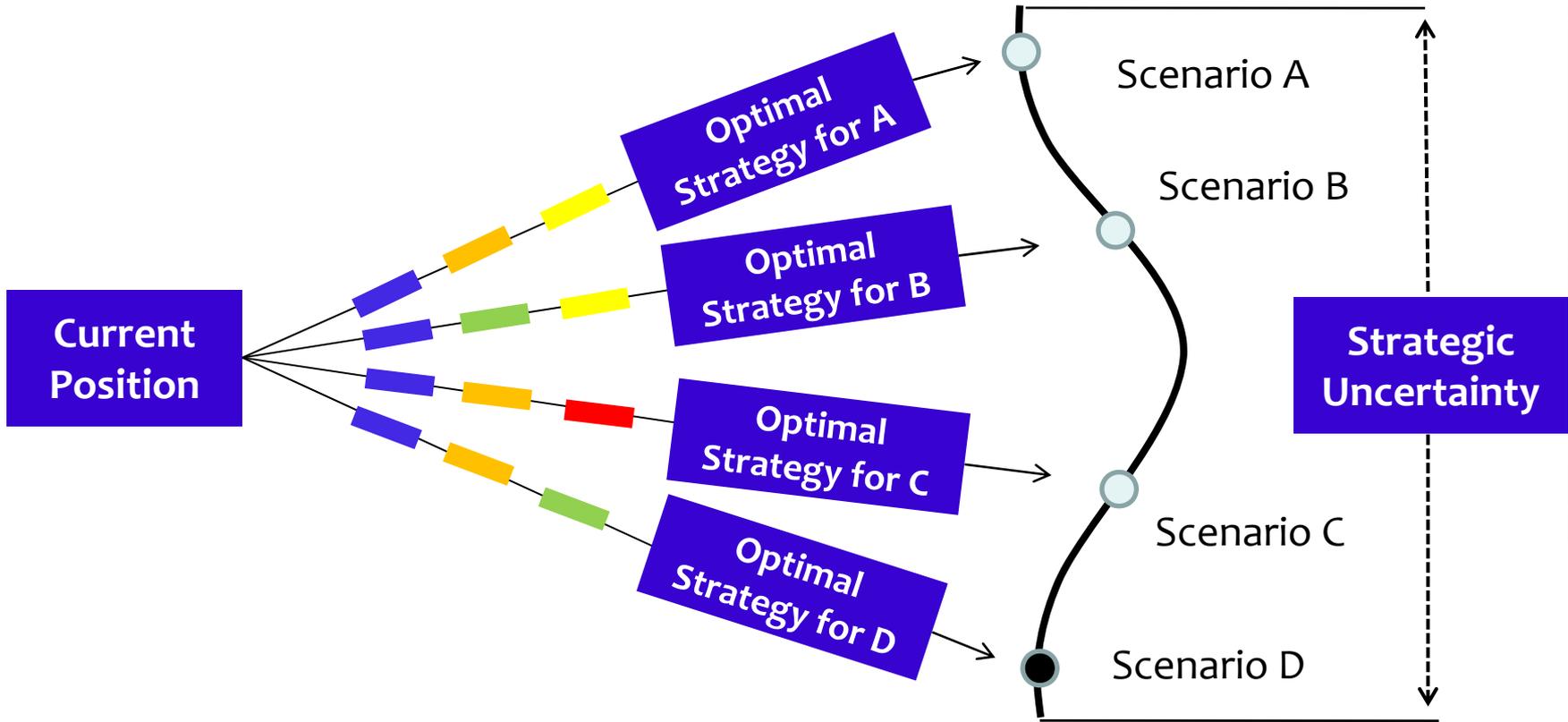
Policy

Industry Evolution through the Ages

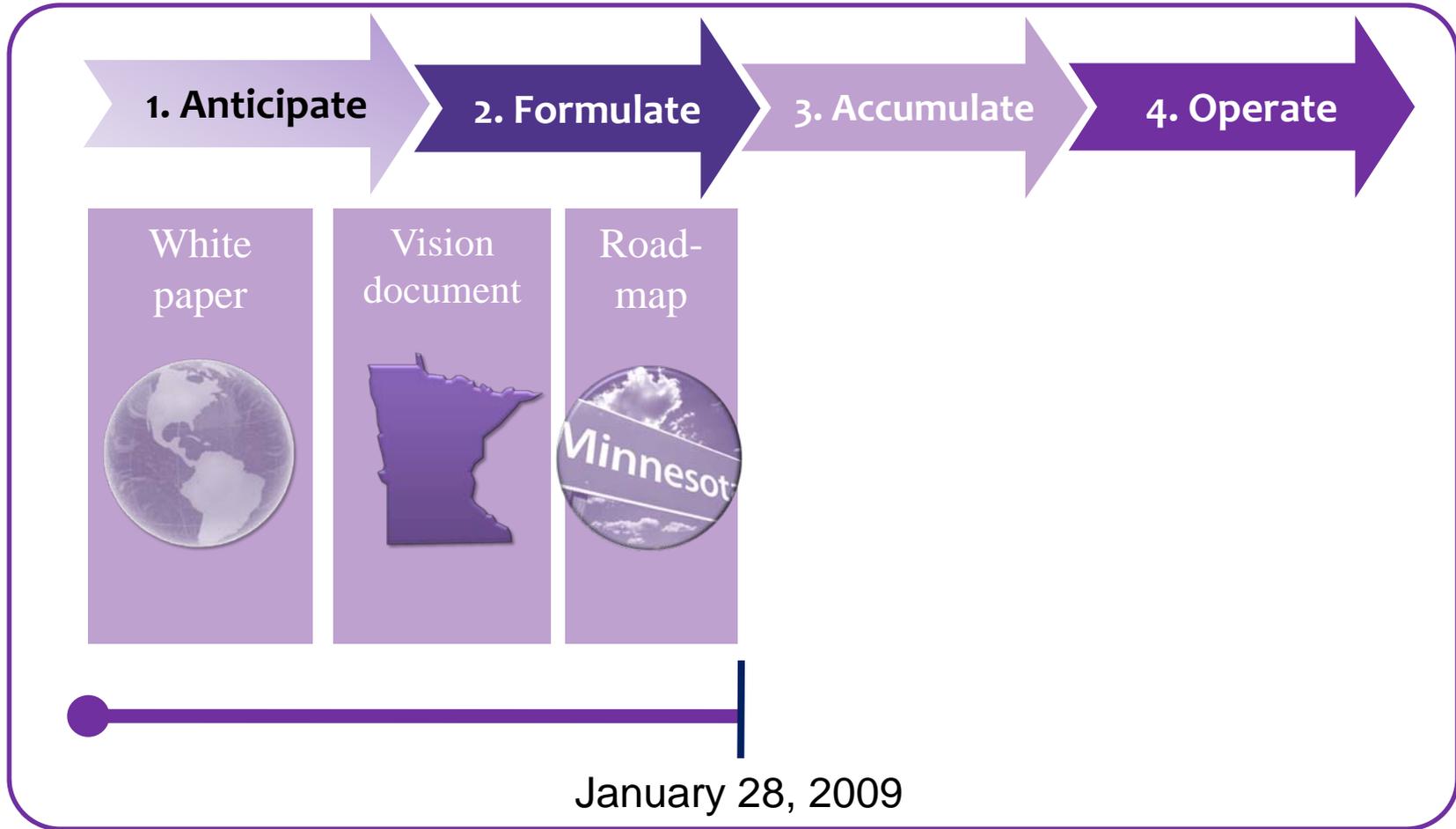
Today's advances leverage the accomplishments of previous states, products or technologies



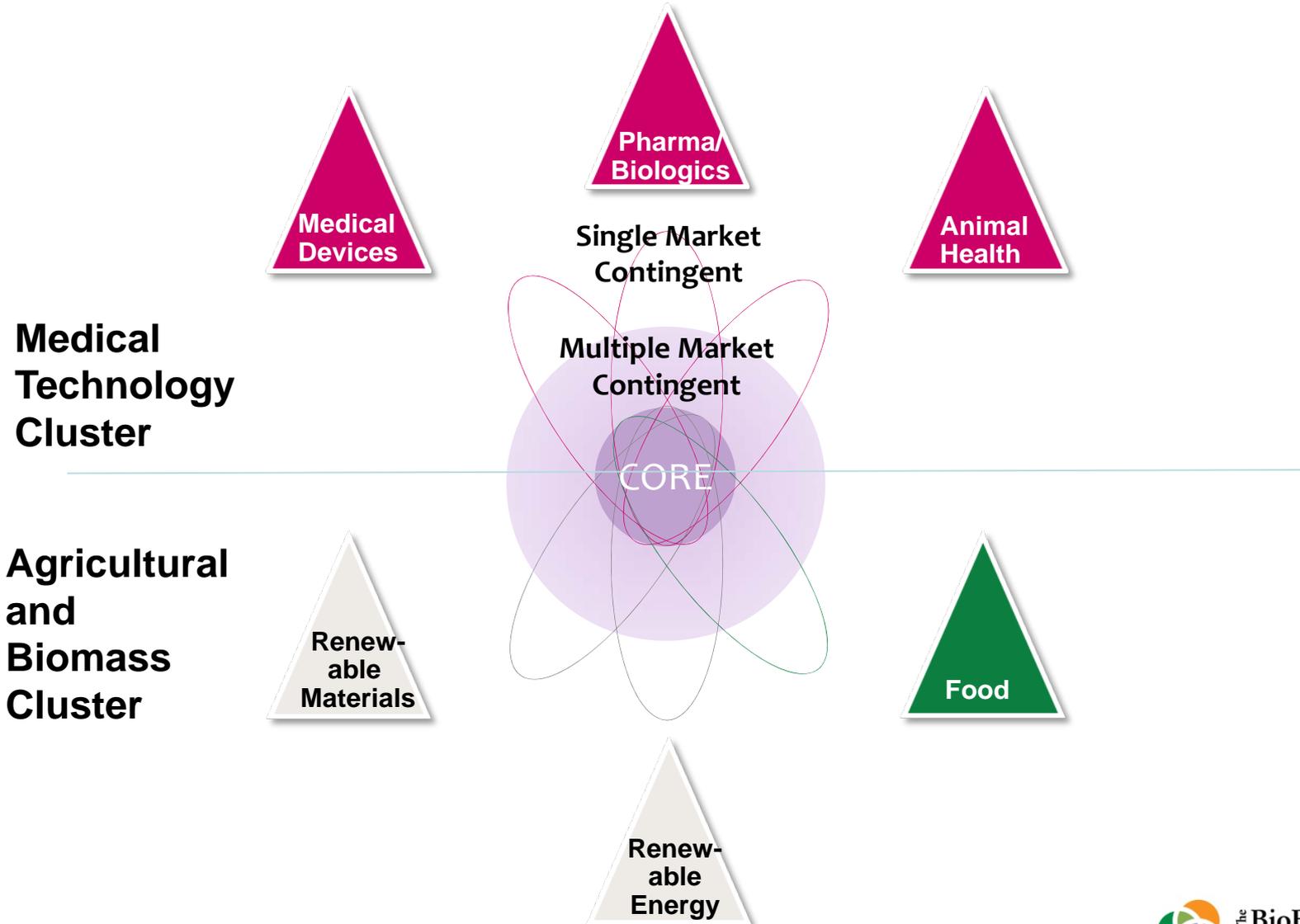
Strategic Flexibility



Implementation Is Underway



Minnesota Bioscience Industries



Did You Know?

<http://thefischbowl.blogspot.com/2008/08/did-you-know-music-industry-remix.html>



What Did We Find?

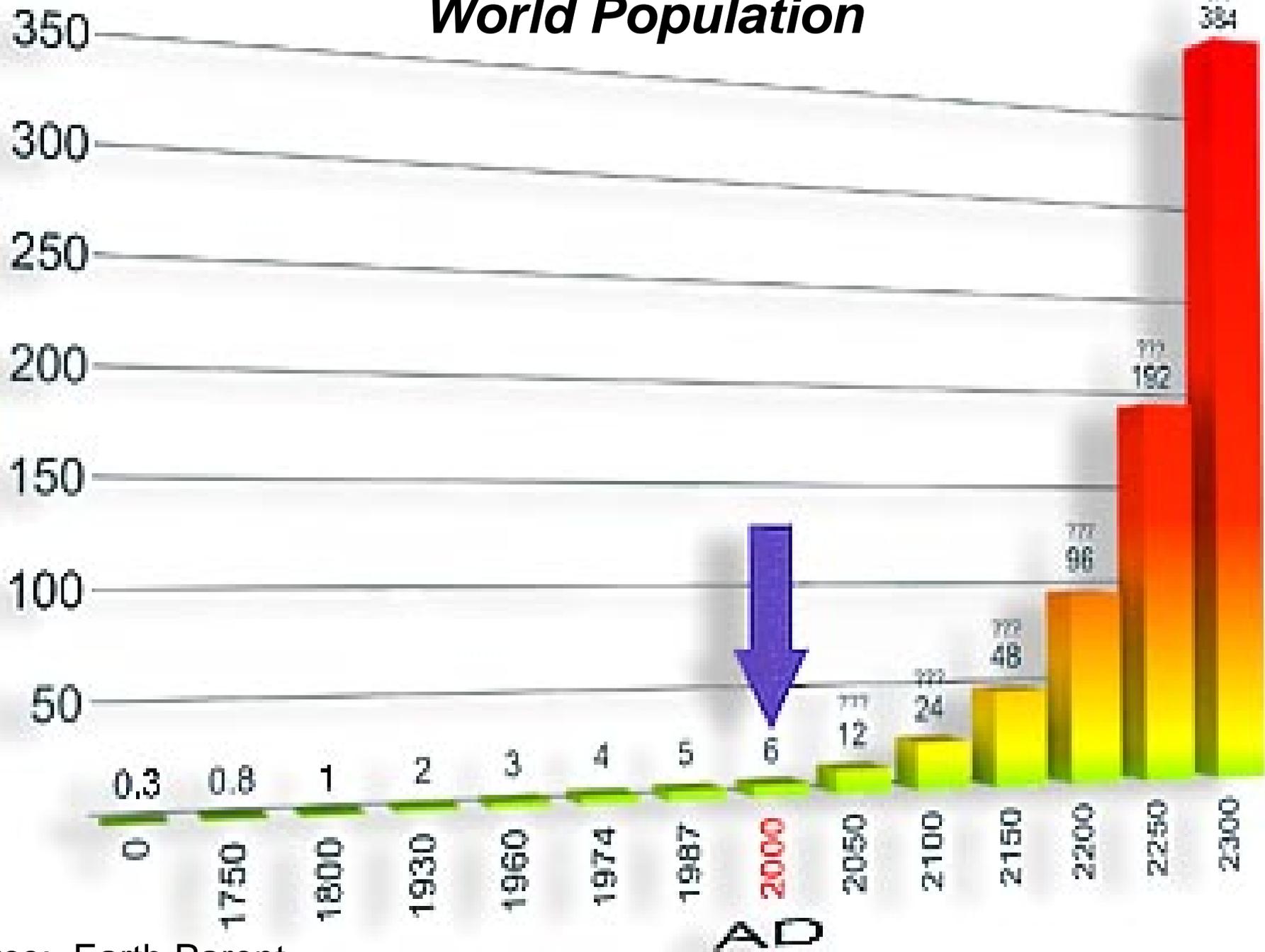
“The greatest shortcoming of the human race is the inability to understand the exponential function”

Dr. Albert Bartlett



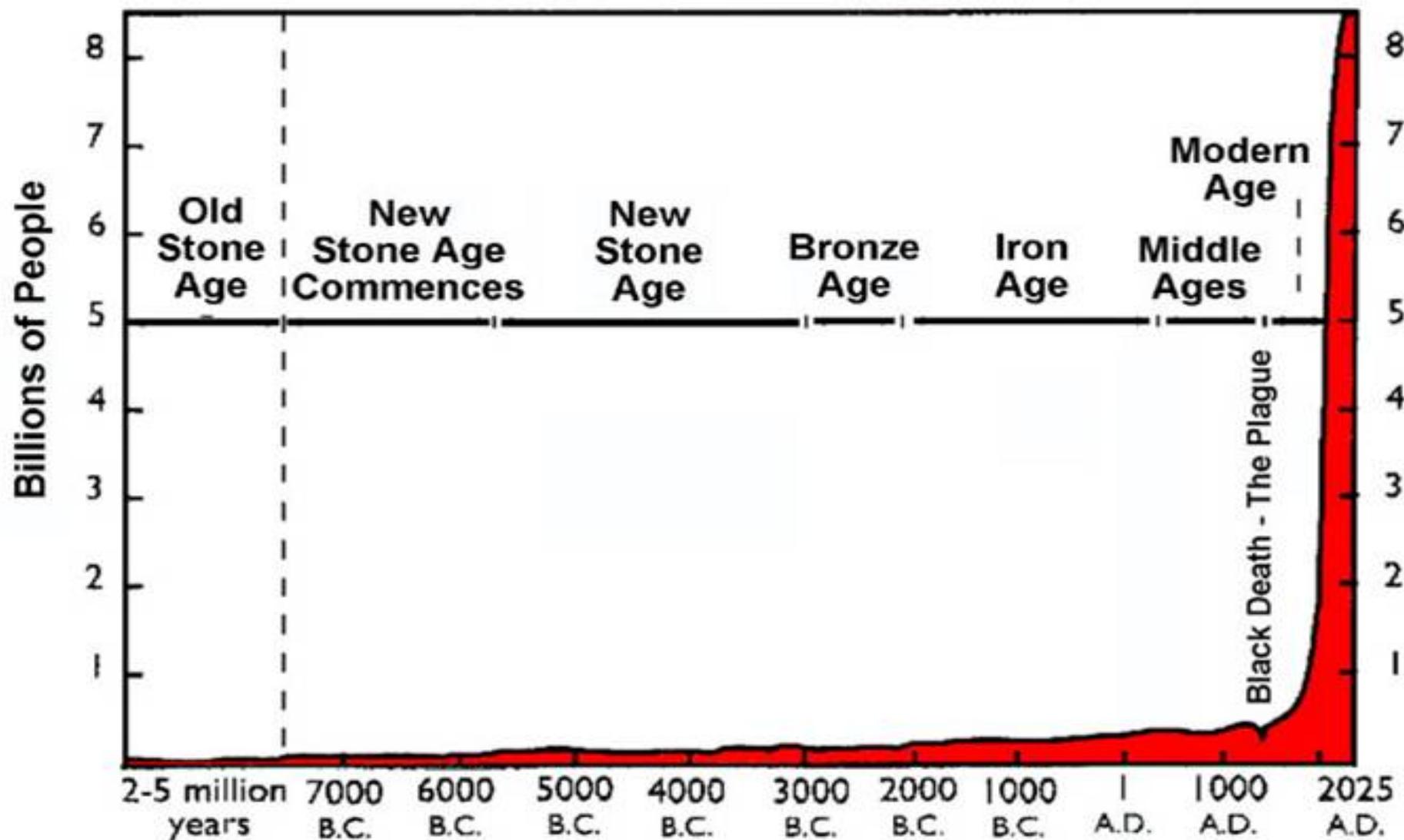
World Population

Billions



Source: Earth Parent

World Population Growth Through History

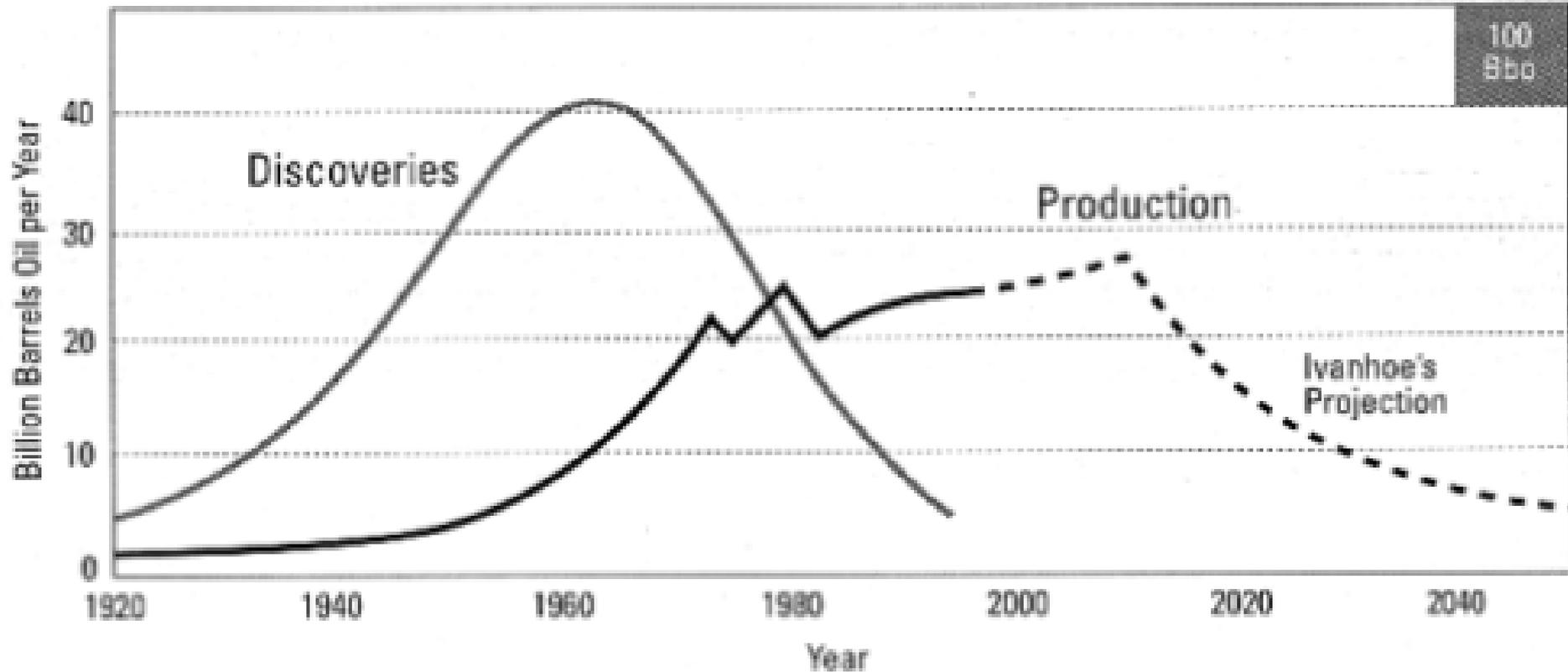


From "World Population: Toward the Next Century," copyright 1994 by the Population Reference Bureau

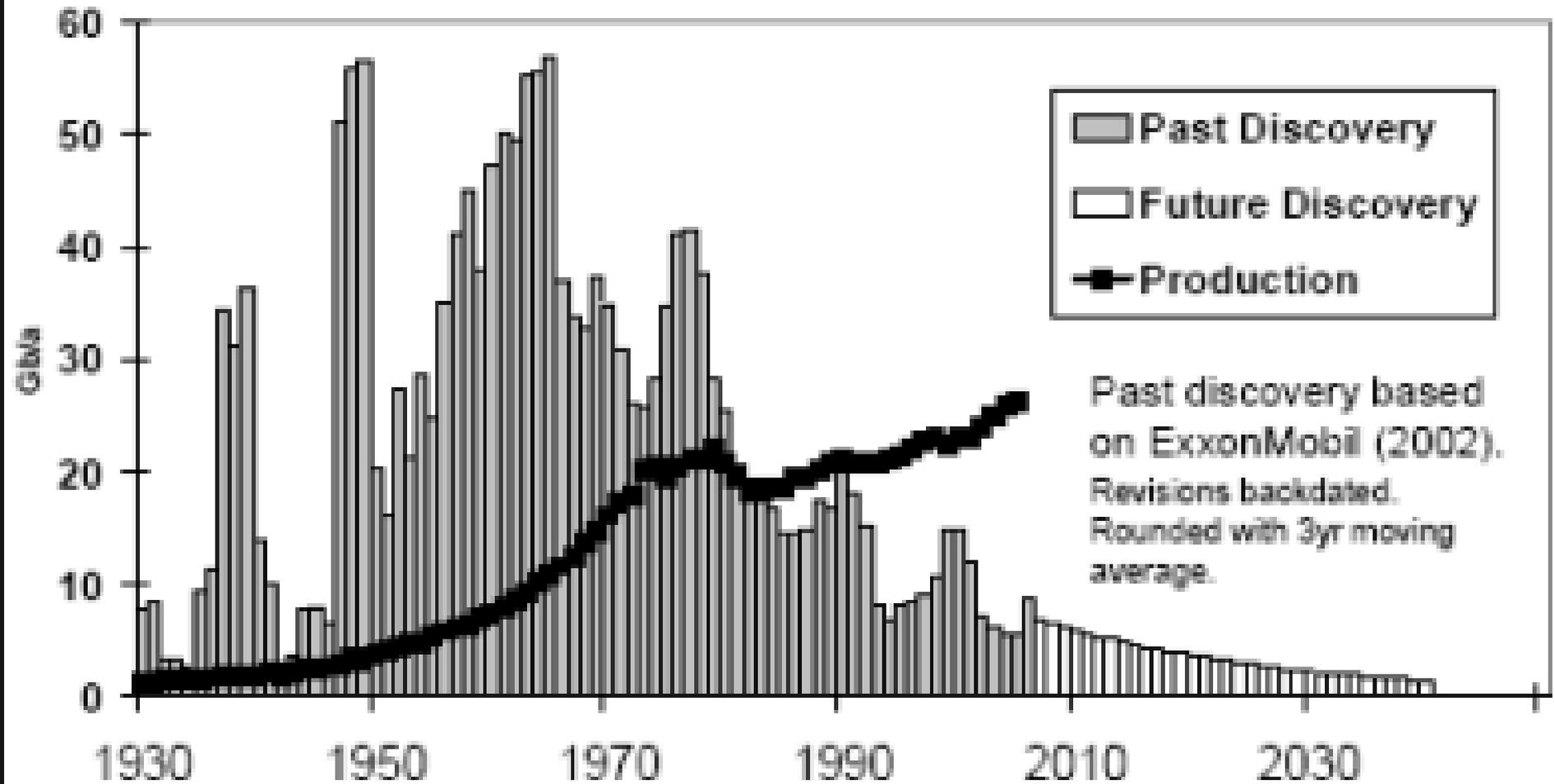


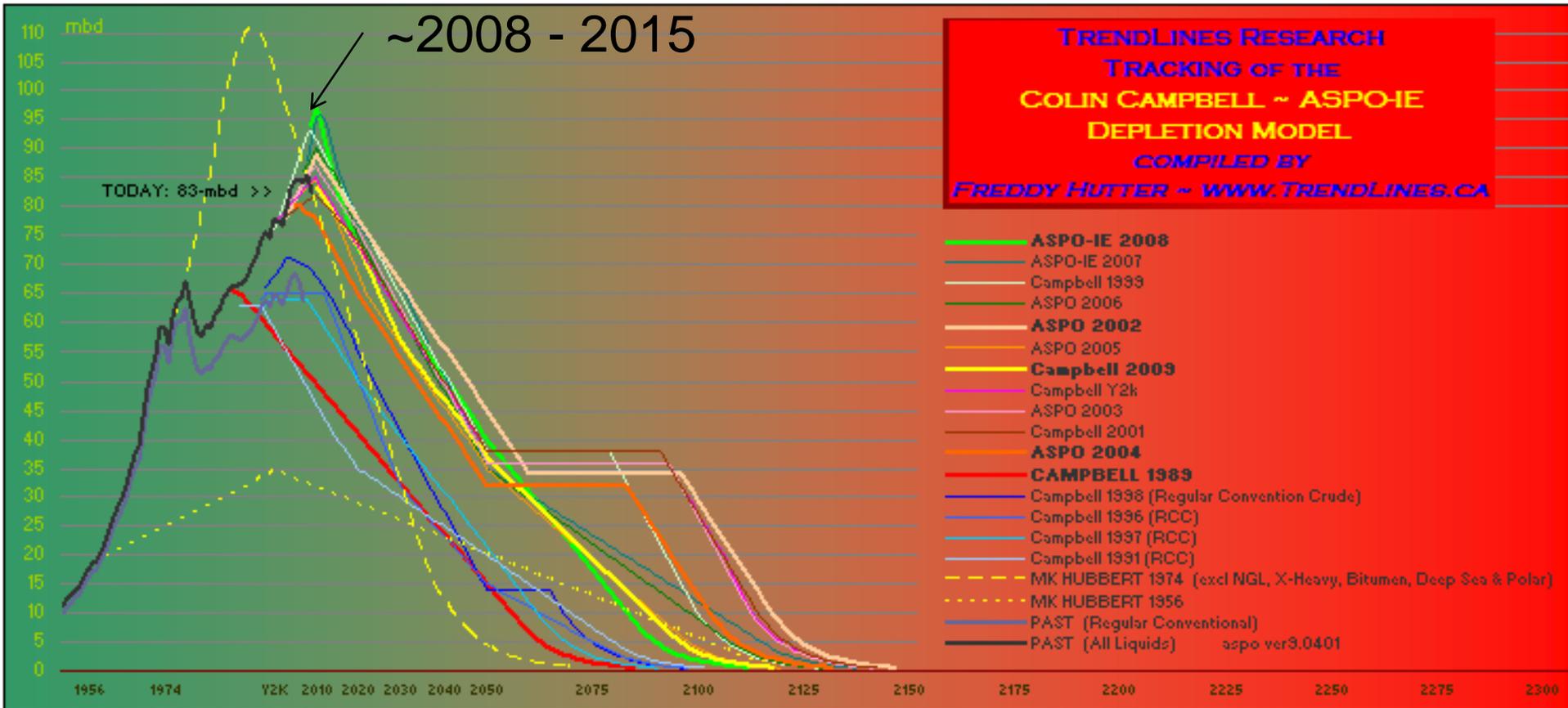
World Oil Supply

The two areas (Discoveries and Production) must ultimately be equal, since one cannot produce more oil than has been discovered.



SOURCES: Discoveries Curve adapted from USGS/Masters, 1994. Production Curve extrapolated by author to match Discoveries volume (area under Discoveries Curve).





Emerging Global Drivers

Food, Energy & Health Care

- Global changes in demographics, cost, political environments and evolving economies will increase demand

Employment

- Shaped by workforce availability and globalization

Healthcare and Patient Therapy

- Reshaped by: personalized medicine, convergence between different technologies and lifestyle



Emerging Global Drivers

Clean, Green & Renewable Energy & Technology

- Will increase driven by increasing energy prices, environmental concerns, and public policy to support economic growth

Agricultural products for food

- Social change will drive niche and organic markets, and demographics will drive access, globalization, cost control and volume.

Forest and agricultural biomass for energy and materials

- Climate change and land degradation will increase demand for efficiency and sustainability



What Does It Mean?

Demographics will drive access, globalization, cost control and volume.

Reshaped by: personalized medicine, convergence between different technologies and lifestyle

Increasing energy prices, environmental concerns, will drive public policy: "polluters pay"

The future economy will be shaped by workforce availability, globalization and developing economies

Climate change and land degradation will increase demand for efficiency and sustainability

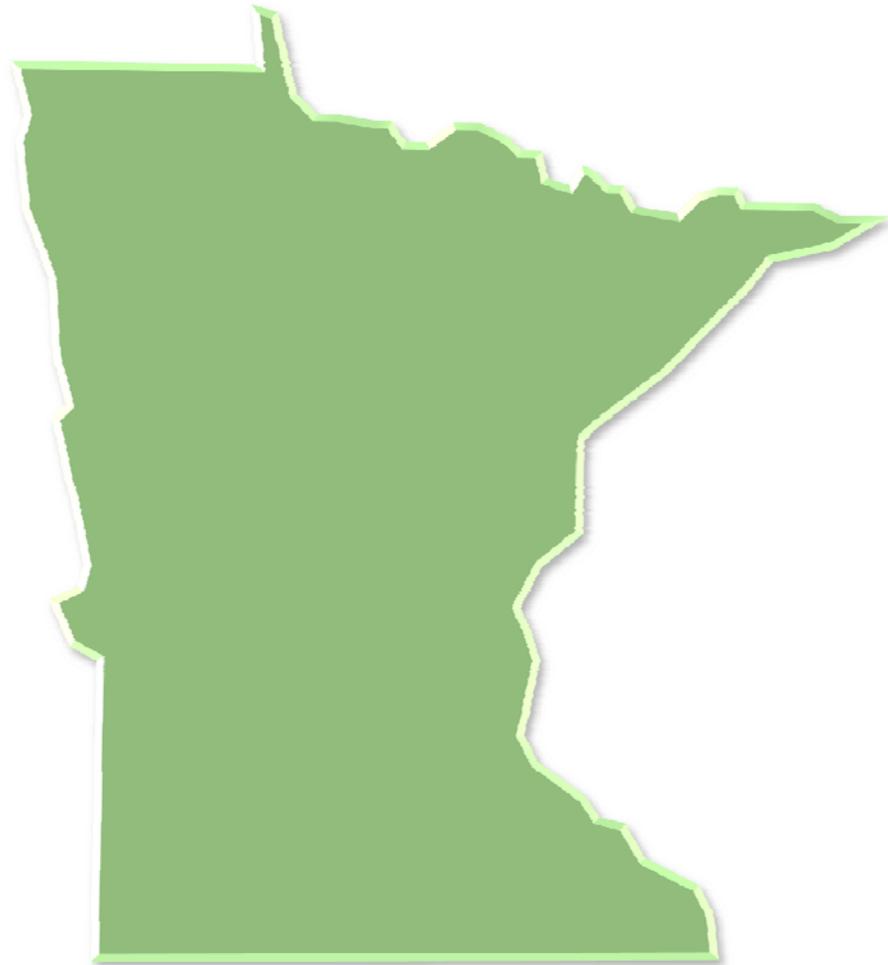
Changes in demographics and political environments will increase demands in some economies, and instability in others.



Renewable Energy

1. Establish decision making capability for Biomass Management

2. Heat generation as part of “25 X 25”



Renewable Materials

1. Engineering and product manufacturing

2. Support expansion of new chemistry



Agricultural and Biomass Cluster



Forests

Existing Markets: Lumber, Paper, Energy

Growing Markets: Bioactives & Renewable Materials and Energy

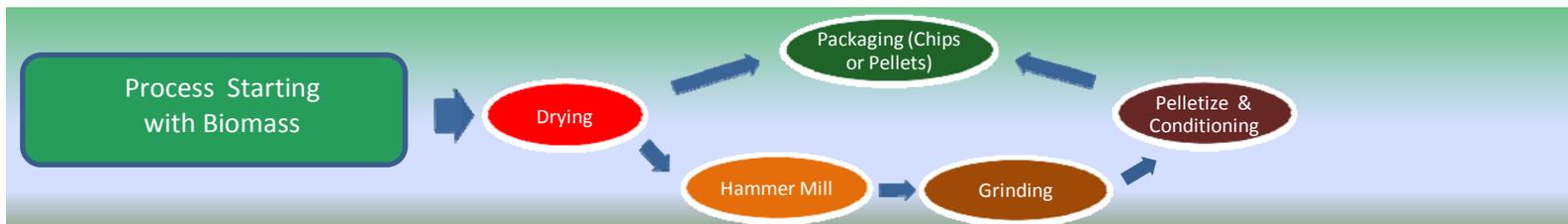
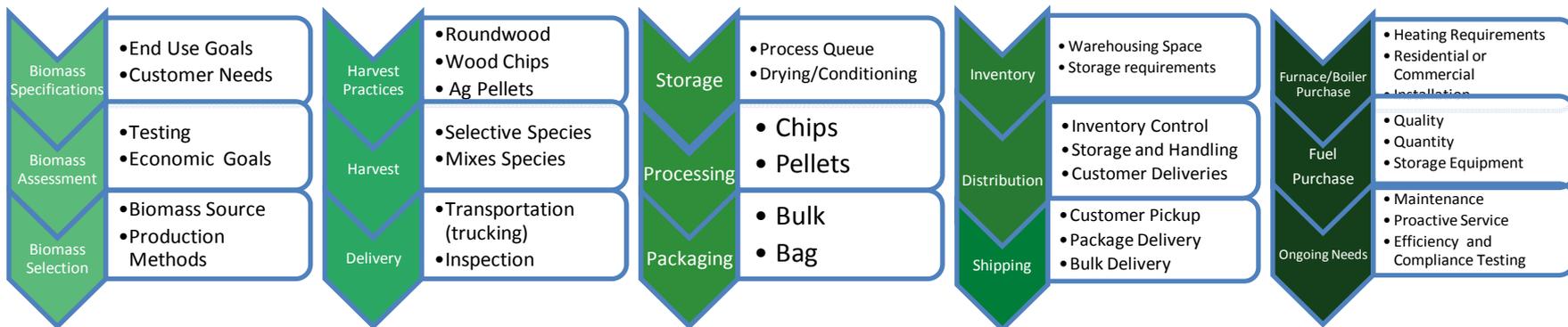
Agricultural Plants

Existing Markets: Human & Animal Food, Energy

Growing Markets: Functional Foods & Renewable Materials and Energy

Enriching Minnesota's Future through the Biosciences

SOLID FUEL BIOMASS SUPPLY CHAIN



Key Performance Indicators (KPI's): Efficiency (\$/unit produced); Quality of Biomass (\$/ton or pound); Equipment Capacity (tons/hour)

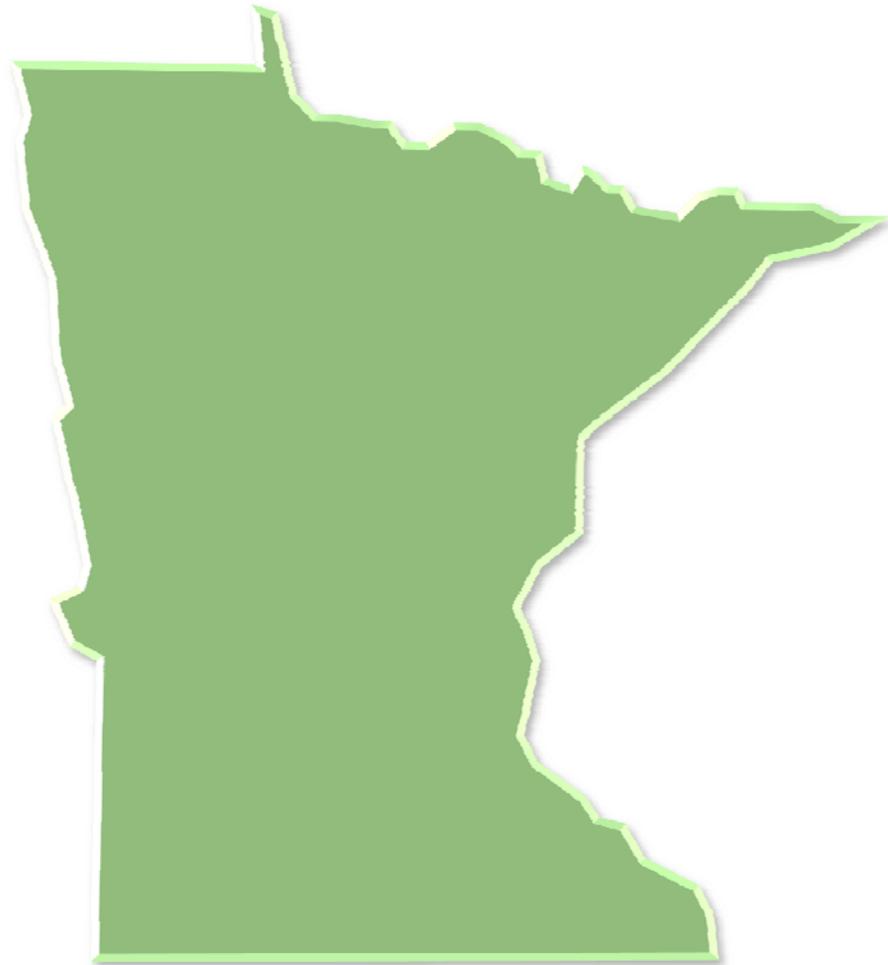
At Step 3, biomass feedstock may be delivered to a **biorefinery** where it may be converted through biochemical or thermochemical processes for combined heat and power (CHP) or fuels, chemicals, and renewable materials.

Step 3 may include the processing of biomass feedstock that results in **densification**, whereby, further steps may be required to get a product to end market for use in biomass heating appliances (reflected in Steps 4 & 5).

Medical Devices

1. Expand the application of active implantable device technology

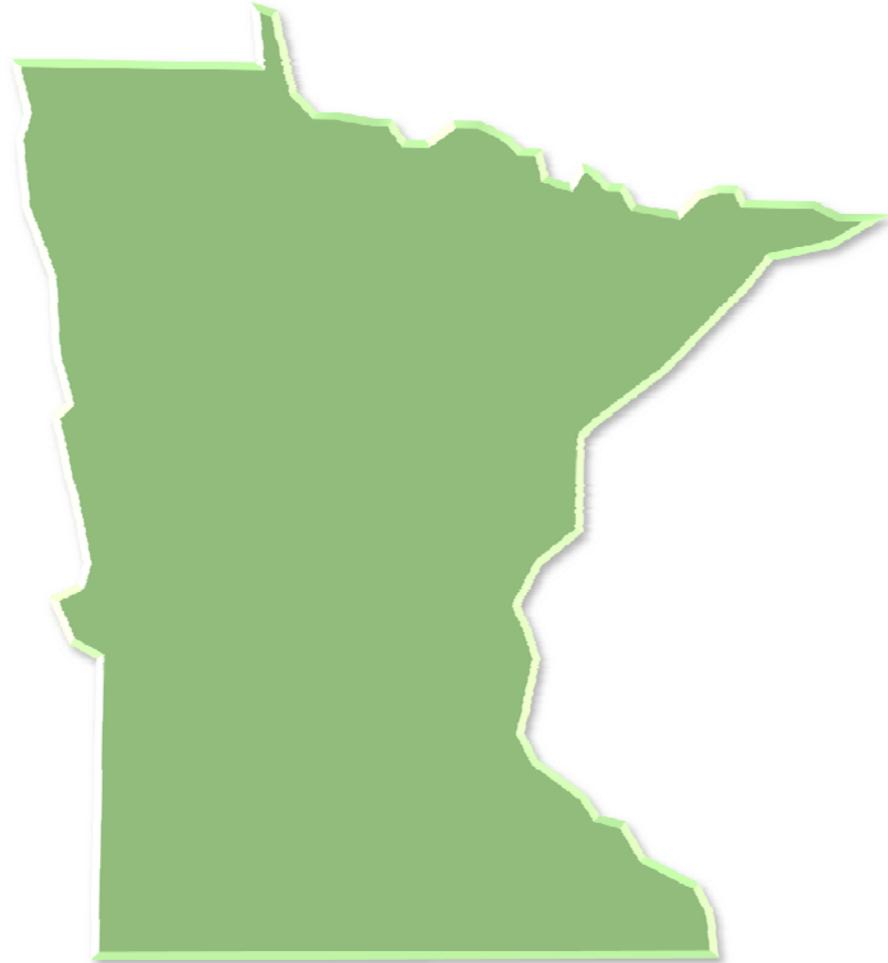
2. Establish leadership in next generation technology



Biologics & Biopharmaceuticals

1. Diagnostics and
Monitoring

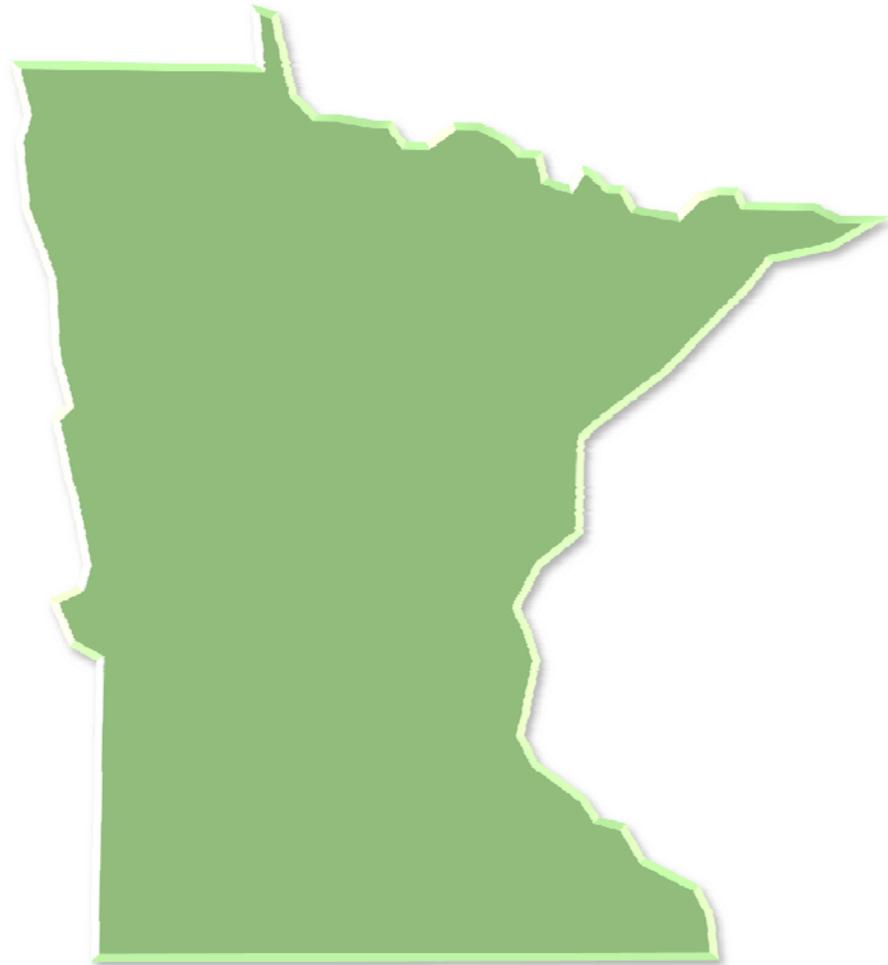
2. Metabolic Disease
Management



Animal Health

1. Convergence with
Human Health

2. Growth (vaccines)



Food

1. To be determined...



Community Capabilities



Center for Nanotechnology

Seed Funds

Center for Device Engineering

Center For Bioinformatics

R & D Tax Credits

Biosciences Education-
Industry Partnership
Council

Center for Biomass
Management

Enabling Knowledge Clusters

Enabling
Knowledge
Clusters

Catalysis &
Synthesis
(Biological &
Chemical)

NanoTech &
Materials
Science

Bio-
engineering
& Clinical
Capabilities

Bio-
informatics
&
Systems
Biology

Genomics,
Proteomics
& High
Throughput
Biology

Imaging /
Navigation

Core Enabling Knowledge Clusters

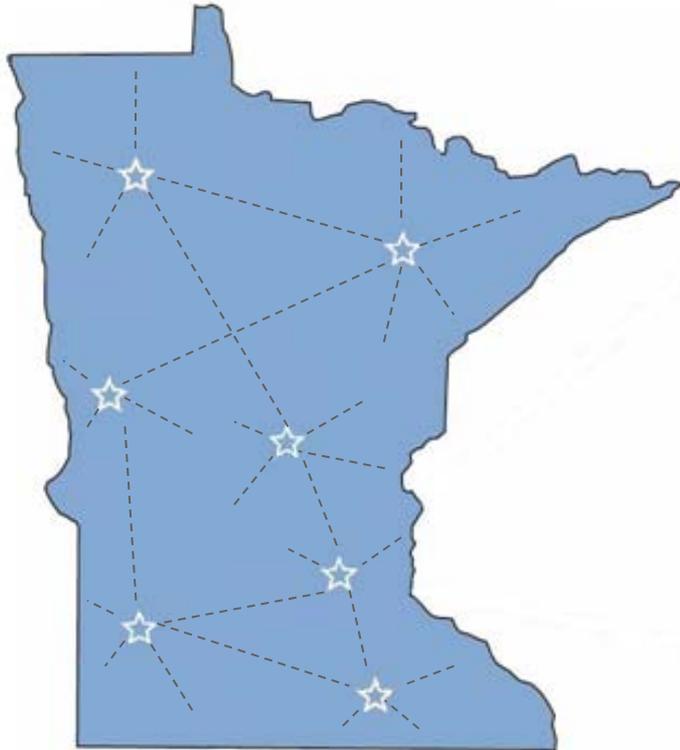
- NanoTech
- Bioinformatics
- Systems Biology

Enriching Minnesota's Future through the Biosciences



Minnesota Life Science Community

Mission: Drive growth of a knowledge based economy



Critical Components:

- **CHAMPIONS** with significant technical and industry knowledge
- Inventoried **strengths and capabilities**
- **Academic support** for work force, research, technology
- Acceleration capability (**money, management, technical know-how**)
- Appropriate **policies**
- A **strategy** and **community** that supports it

Enriching Minnesota's Future through the Biosciences





The BioBusiness Alliance
of Minnesota



Thank You!

www.biobusinessalliance.org