

Seizing the New Bio-Economy

Regional Partnerships Driving New Opportunities

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Technology is the “necessary” for the new bio-economy.

But regional partnership is the “sufficient.”



- **Technology is unleashing a powerful new bio-economy.**
- **However, the opportunities have regional footprints.**
- **Seizing them takes regional partnerships—to help coordinate investment, re-shape regulation, and create shared long-term vision among businesses.**
- **Such partnerships are rare in rural America, but there are often strong starting points.**

Seizing the New Bio-Economy in Rural America

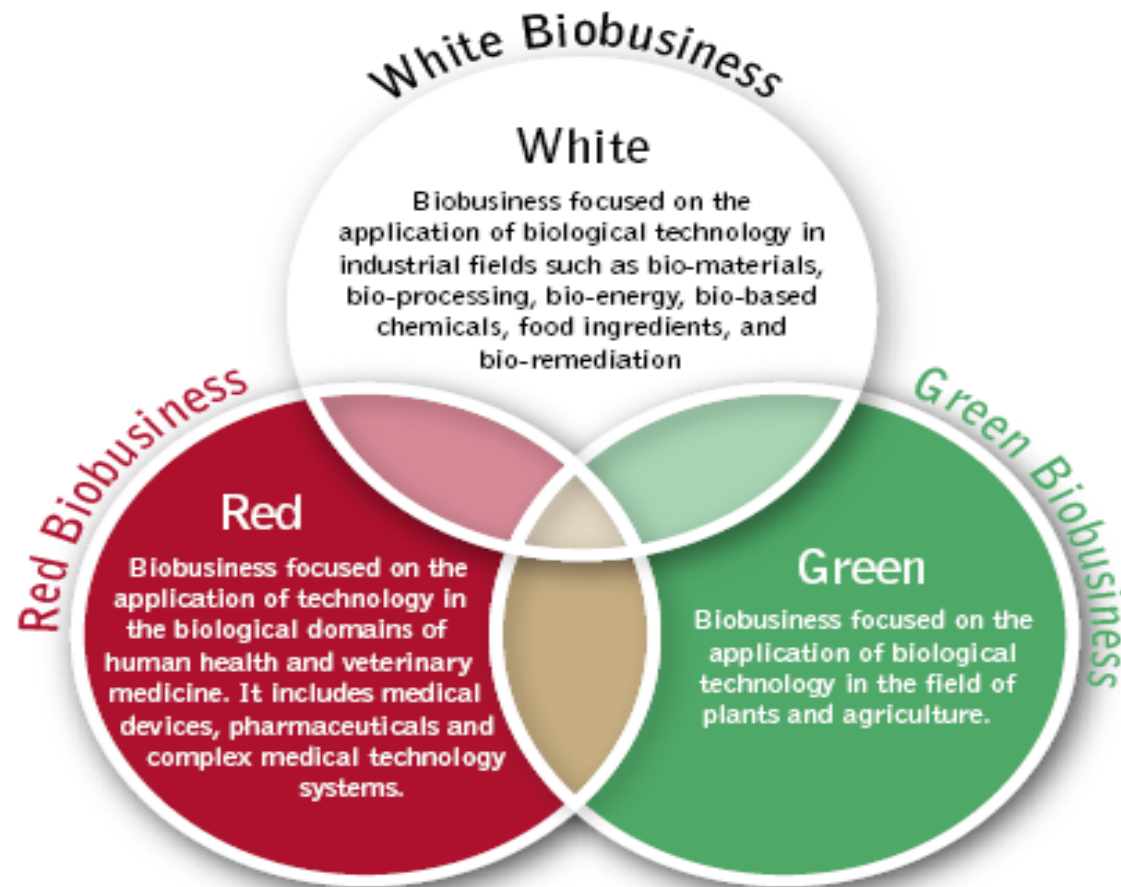
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- **Defining the bio-economy, and sizing up opportunities.**
- **Two concrete examples from an overwhelmingly rural region — Southern Minnesota:**
 - 1. Plant-made pharmaceuticals.**
 - 2. Wind energy**
- **The implications for rural America & public policy.**

Three Paths to the Bio-economy?

Figure 30. Fields of Application of Biobusiness



Source: *Biobusiness: Minnesota's Present Position and Future Prospects*. Report of the Statewide Biobusiness Assessment Project of the BioBusiness Alliance of Minnesota. August 2006

Or, is the power in the nexus?

Figure 31. Minnesota Biobusiness Technology Enterprises
Percentage of BTEs Active in Each Biobusiness Field

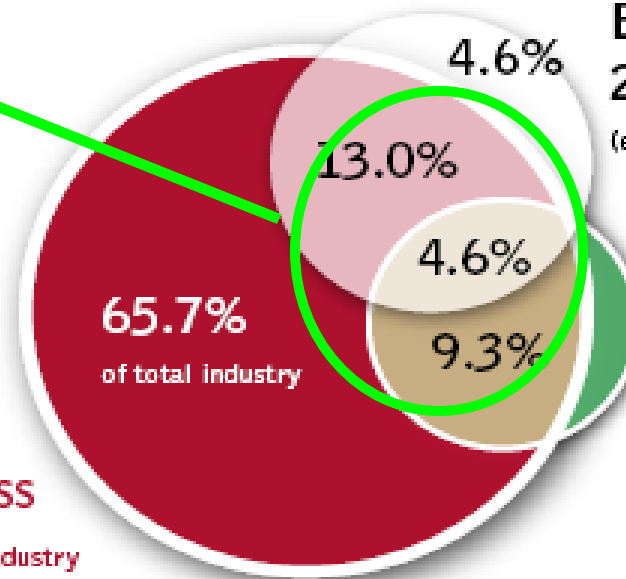
Total BTEs in census = 425

BTEs in survey sample providing biobusiness field data = 108

BTEs in survey sample = 149

Multiple Fields
of Biobusiness
26.9% of industry
(estimated 114 BTEs)

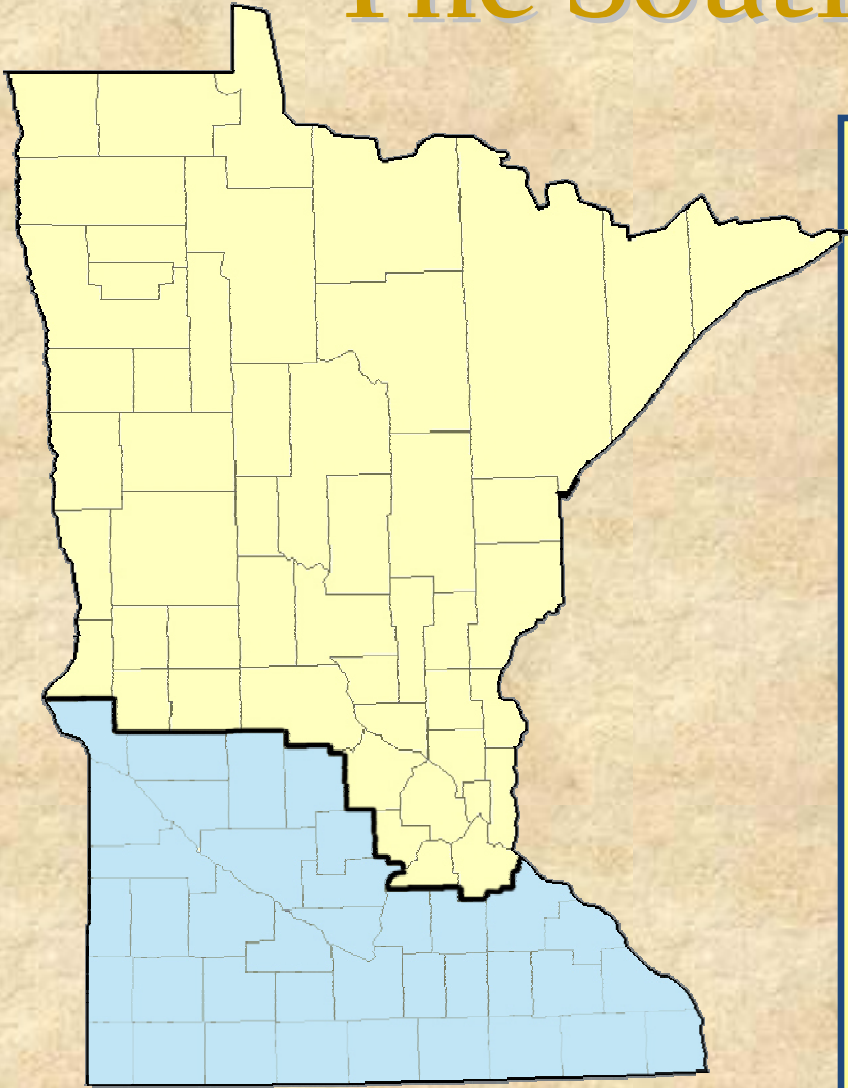
Red
Biobusiness
92.6% of industry
(estimated 393 BTEs)



White
Biobusiness
22.2% of industry
(estimated 94 BTEs)

2.8%
Green
Biobusiness
16.7% of industry
(estimated 71 BTEs)

The Southern MN Region

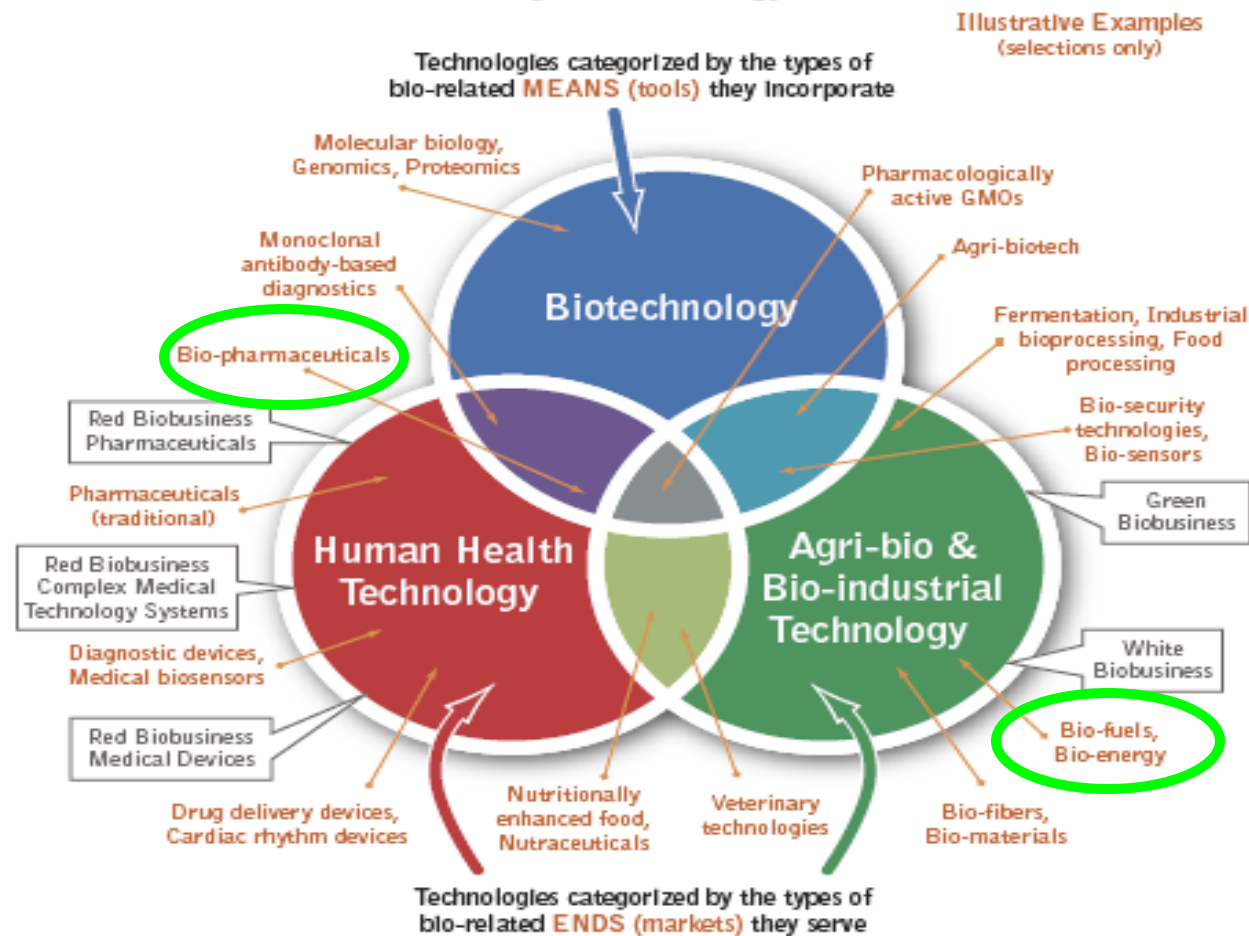


A Region with Many Strengths

- 38 counties
- 988,000 people
- Nearly 2/3 of MN's farm income
- World-class health care
- Strong manufacturing—factories employ 1 in 5 workers in the Region
- Excellent educational institutions

Two examples from Southern MN: “Farmaceuticals” & Wind

Figure 34. Fields of Biobusiness: Biological Technology



Source: *Biobusiness: Minnesota's Present Position and Future Prospects*. Report of the Statewide Biobusiness Assessment Project of the BioBusiness Alliance of Minnesota. August 2006

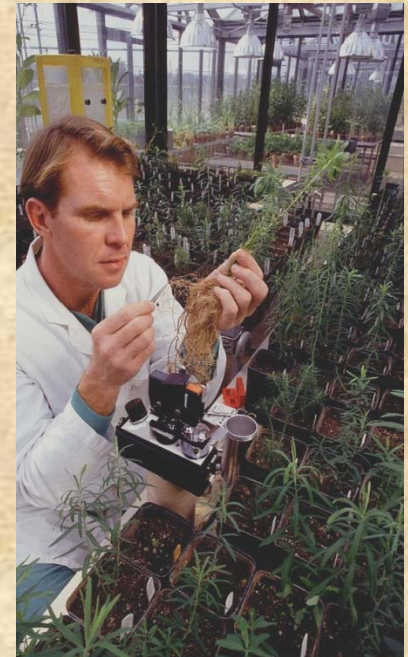
“Farmaceuticals” & A New Bio-Economy: *A Potentially Enormous Value Proposition.*

Proteins are the heart of the pharmaceutical industry.

- But the fermentation process to produce them is *expensive* (\$800,000 to \$1m per kilogram) *and* capacity-constrained.

Many of the same proteins can now be extracted from plants—at huge potential savings and virtually unlimited capacity.

- Cost savings estimated at between 10X and 100X, depending on the protein and the “yield.”



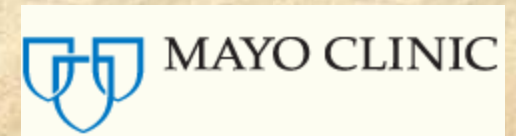
Southern MN has powerful “farma” assets.

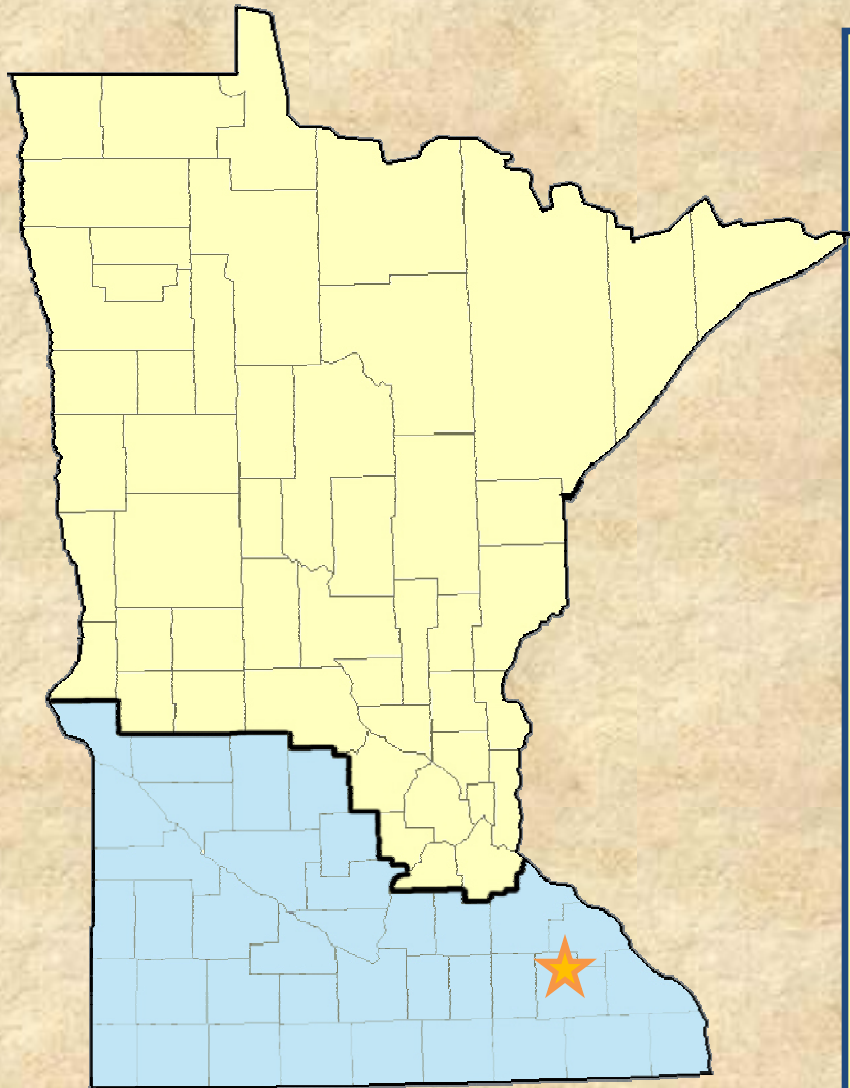
- World-class agricultural prowess.

How can these combine in

- ~~World-class medical research & practice.~~
*How can these combine in
a new bio-economy for
the Region?*

- World-class life science research.

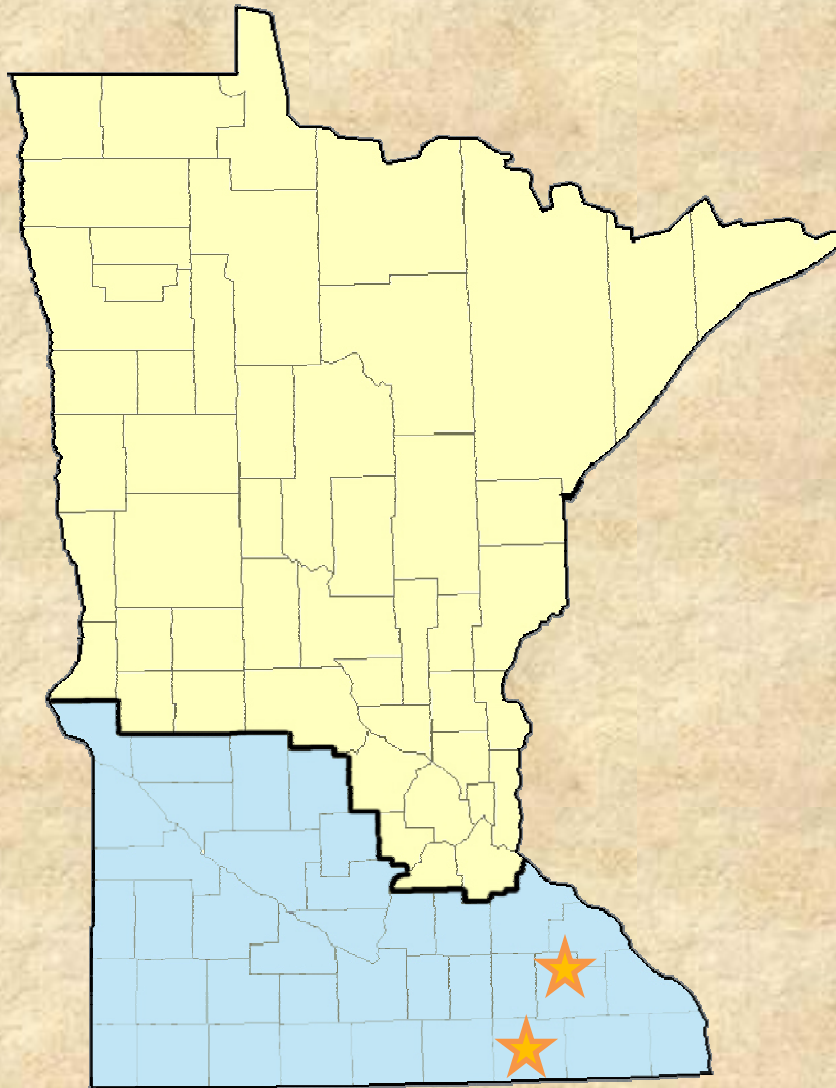




Mayo Clinic

Rochester, MN

- Research scope is vast—major expertise in cancer research, genomics.
- A National Cancer Institute-designated center
- Research and education budget in excess of \$700 million.
- 3,043 dedicated research staff. Another 3,000 split between research and practice.



Hormel Institute

Austin, MN

- A research unit of the University of Minnesota.
- A collaborative partner with Mayo Clinic as well as IBM.
- Well-known discoveries in the cancer/dietary connection.
- Recent \$23 million facilities expansion.

New partnerships will be necessary to connect these assets creatively within the Region.

Partners to convene

- Mayo, Hormel, & Univ. of MN
- Farm groups
- Commodity groups
- State regulatory groups
- Rural development groups
- Entrepreneurial support groups
- Regionally based venture capital groups.
- Consumer organizations
- Environmental organizations

Issues to address

- Which pipeline proteins could be grown in plants?
- Which crops in Southern MN?
- What are the production protocols?
- What is the business ownership structure to maximize the win for everyone?

How would the Region benefit?



- **Farm income: several hundred \$ an acre to growers.**
- **New processing facilities → high- pay jobs and wealth creation.**
- **New “farma” start-ups.**
- **Additional research \$ in MN.**

First to build the 21st century pharmaceutical industry to scale?

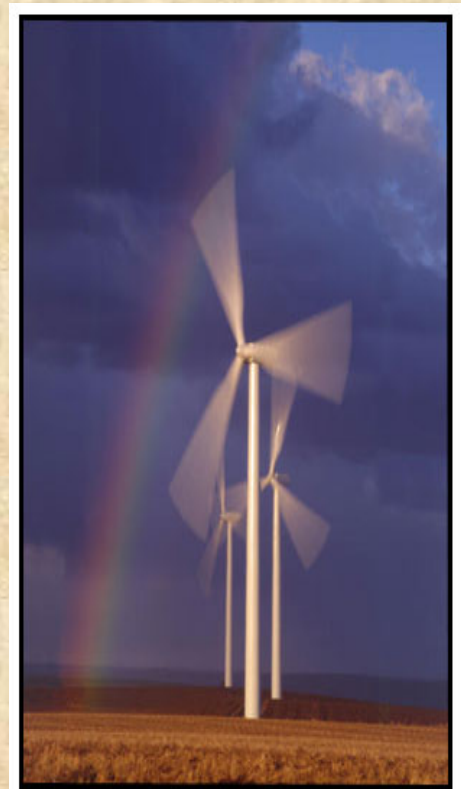
Wind Energy:

Could supply 20% of U.S. electricity needs.

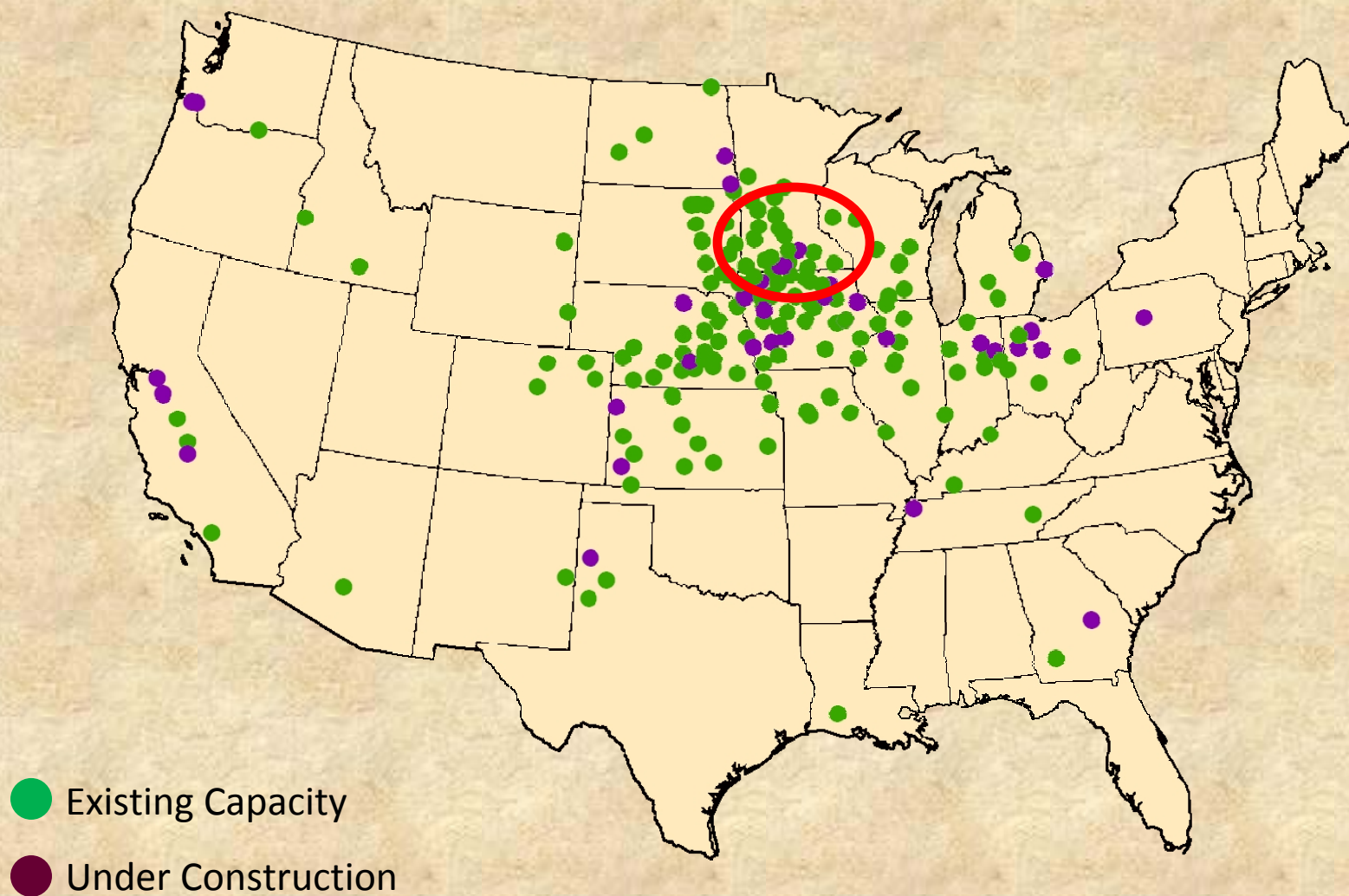
The Region bet early and big on corn ethanol.

- The food-fuel issue puts this at risk ...
- As do potential changes in subsidies, tariffs, and carbon regulation.

The Region may be well-positioned for cellulosic, whenever that technology comes on line.



Ethanol Production Facilities



Source: Renewable Fuels Association

Wind Energy:

Could supply 20% of U.S. electricity needs.

A more immediate option is wind—not normally considered a “bio-fuel” but in this case, the land is almost entirely owned by farmers.

- Thus, an energy investment that pays a unique dividend to the existing “bio-economy.”
- Also, the future may bring anhydrous production.



But reaping the wind will take a LOT of coordination to pull off.

SW MN has some of the best wind potential in the nation.

- **The Region has the potential to add several hundred thousand MW of generating capacity.**

It is relatively easy to transmit the power to MSP, which has a high proportion of “green” consumers.

With additional lines, could consider supplying as far away as Chicago.



Wind Energy:

A Huge Win for the Region

New companies are locating in the Region to build the turbines:

- **Dutch company (600 employees) making turbine blades in the Region, and a Finnish company is moving there to build turbines.**

A flourishing maintenance industry is emerging.



New Transmission Lines Critical

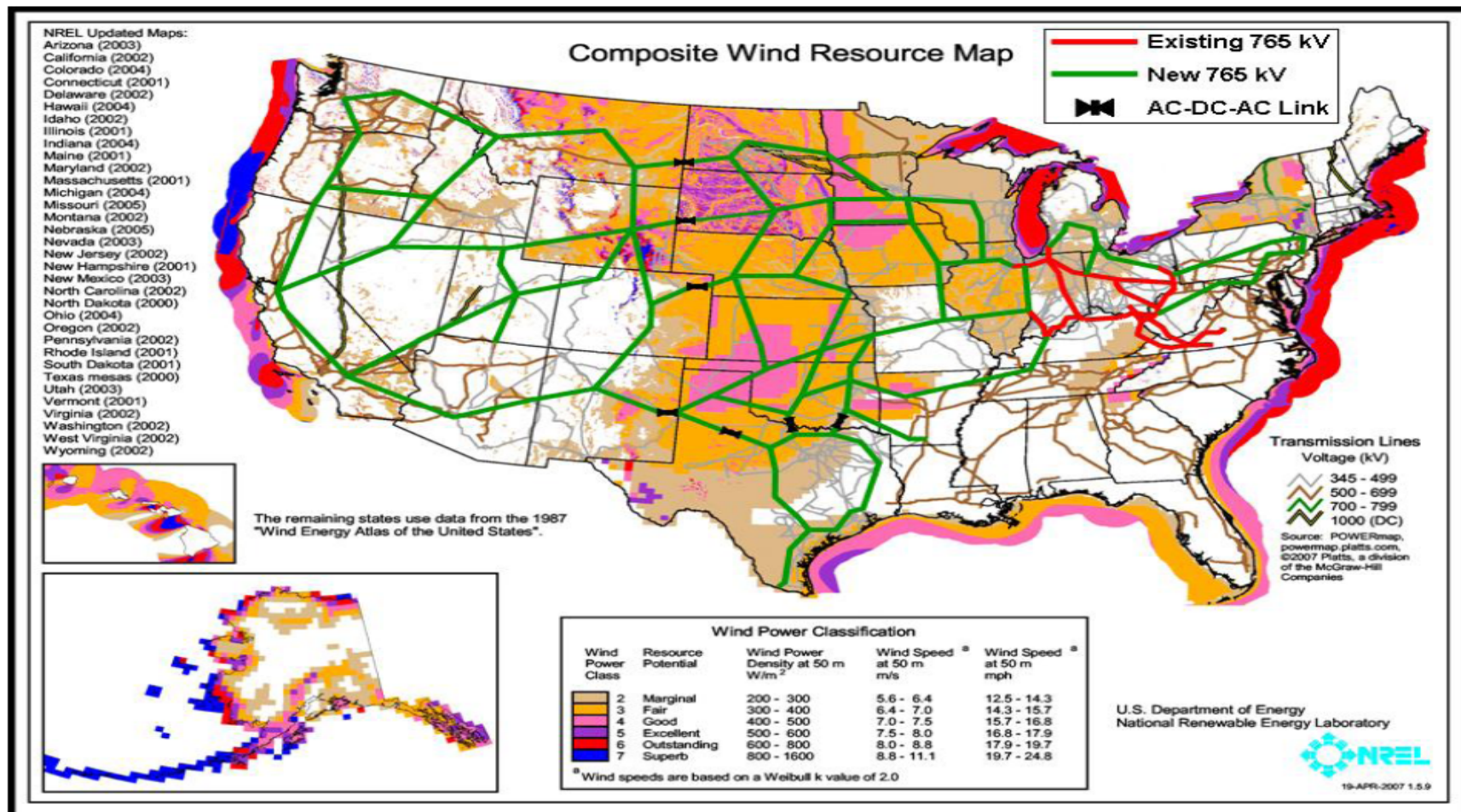


Exhibit 1: Conceptual 765 kV backbone system for wind resource integration (edited by AEP).

Source: AEP and NREL.

Wind Energy:

How would the Region win?

- **Farm income: direct payments to farmers.**
- **Attract “green energy” manufacturers.**
- **Build long-term “compact” with Twin Cities.**
- **Reduce natural gas prices (~ \$1).**
- **Reduce water use (1.6 trillion gallons saved by 2030 in the Midwest. Agriculture can benefit from this.**
- **Potential for anhydrous ammonia production?**



New partnerships will be necessary to harness the wind within the Region.

Partners to convene

- Farm groups
- Utilities
- Local zoning authorities
- State regulatory groups
- MISO (5 Govs in sync!)
- Regionally based venture capital groups.
- Consumer organizations
- Environmental organizations

Issues to address

- How to standardize & coordinate local siting?
- What new transmission lines and where—and how to ensure local access to the grid?
- Who pays for the lines?
- How to ensure reliable supplies with uncertain winds?
- How to coordinate investment across the “bigger” region?

Some Conclusions



- **Bio-economy opportunities have huge potential for rural development.**
- **Most of these build on the “convergence” of life science — human, plant, and animal.**
- **Technology is necessary in driving these new opportunities.**
- **However, nearly all of them also have regional footprints *AND* bring together new partners in new business models.**
- **Thus, regional partnerships are the “sufficient” for development.**

Some Needs for Policy



- **Most rural regions still operate under Friday-Night-Football rules:**
The next county over is the competition.
- **Moreover, commodity traditions die hard, and new business models will demand significant innovation.**
- **“Conveners” (King Arthurs) are in short supply.**
- **All that said, the appetite for stronger rural growth is high (and driven by concerns about retaining next generations).**

Some Policy Directions



- Incentives for regional, rural partnership to form (ample examples from around the world).
- Diagnostics that help regions identify competitive advantages.
- New “transmissions” between innovation “engines” and rural regions.
- New regional equity capital mechanisms.
- New business models that create *win-win-win* in bio-economy opportunities — pharmaceuticals is a prime example.