Energy Security, Economic Prosperity & Climate Stewardship: A Roadmap for Our Region's Energy Future

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North Dakota Energy Development and Transmission Committee
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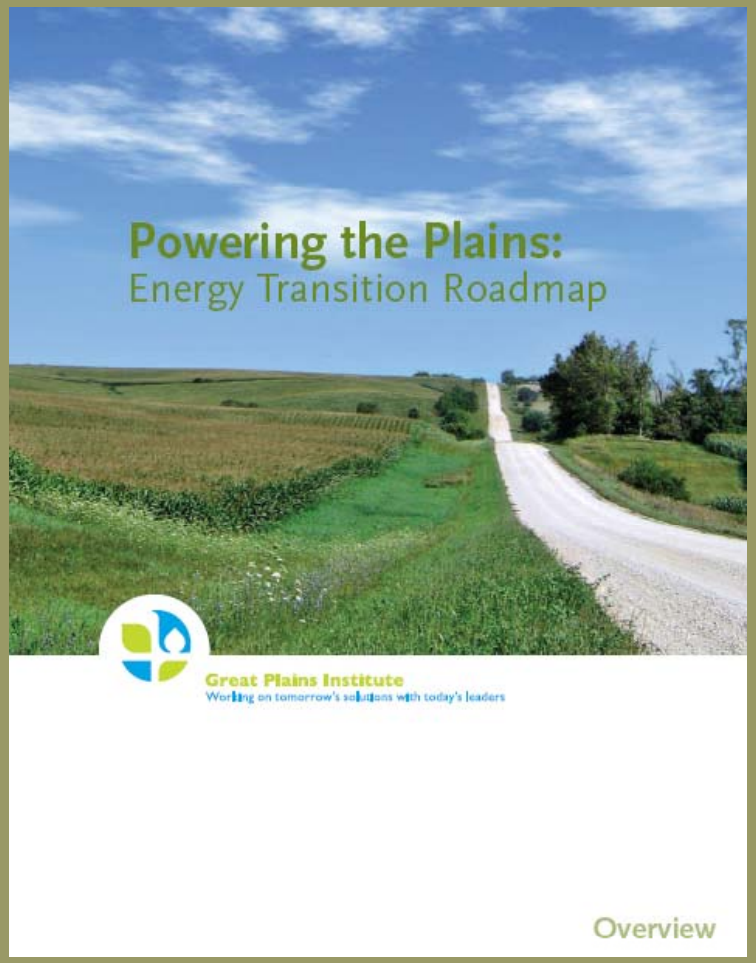
Minot, ND



Presentation Overview

1. Background on Great Plains Institute
2. Global Energy Context
3. Powering the Plains Project and Regional Roadmap Development
4. Results and Significance of Midwestern Governors Energy Security & Climate Stewardship Summit
5. Conclusion

Great Plains Institute

Mission:

To accelerate the transition to a renewable and low-carbon energy system.

Core region we serve, plus other Midwestern and Northern Plains states

We are a small nonprofit based in Minnesota and North Dakota

We bring together diverse interests . . .

- Energy and technology executives
- Agricultural producers
- Elected and government officials
- Environmental advocates
- University researchers and officials

GPI and PTP-led U.S. and Canadian delegation to Europe, 2003

and work with them to. . .

1. Develop & advance win-win energy and climate policies
2. Demonstrate promising technologies
3. Identify research critical to their commercialization
4. Educate key audiences about their benefits

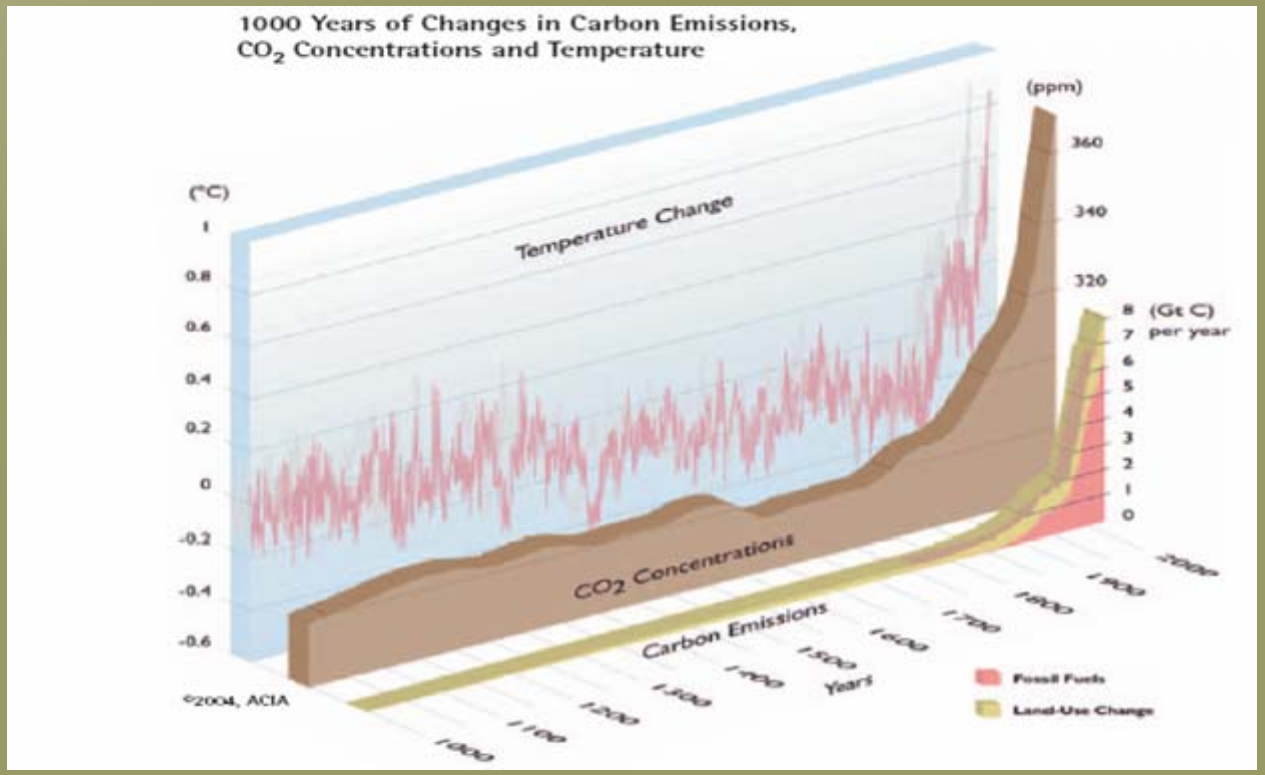
Hydrogen hybrid bus cold-weather tested in Winnipeg

Current Initiatives

1. Powering the Plains
2. Upper Midwest Hydrogen Initiative
3. Advanced Coal and CO2 Capture Program
4. North Central Bio-Economy Consortium (12-states)
5. Midwest Renewable Energy Tracking System
6. Midwestern Governors' Energy Summit

Global Context

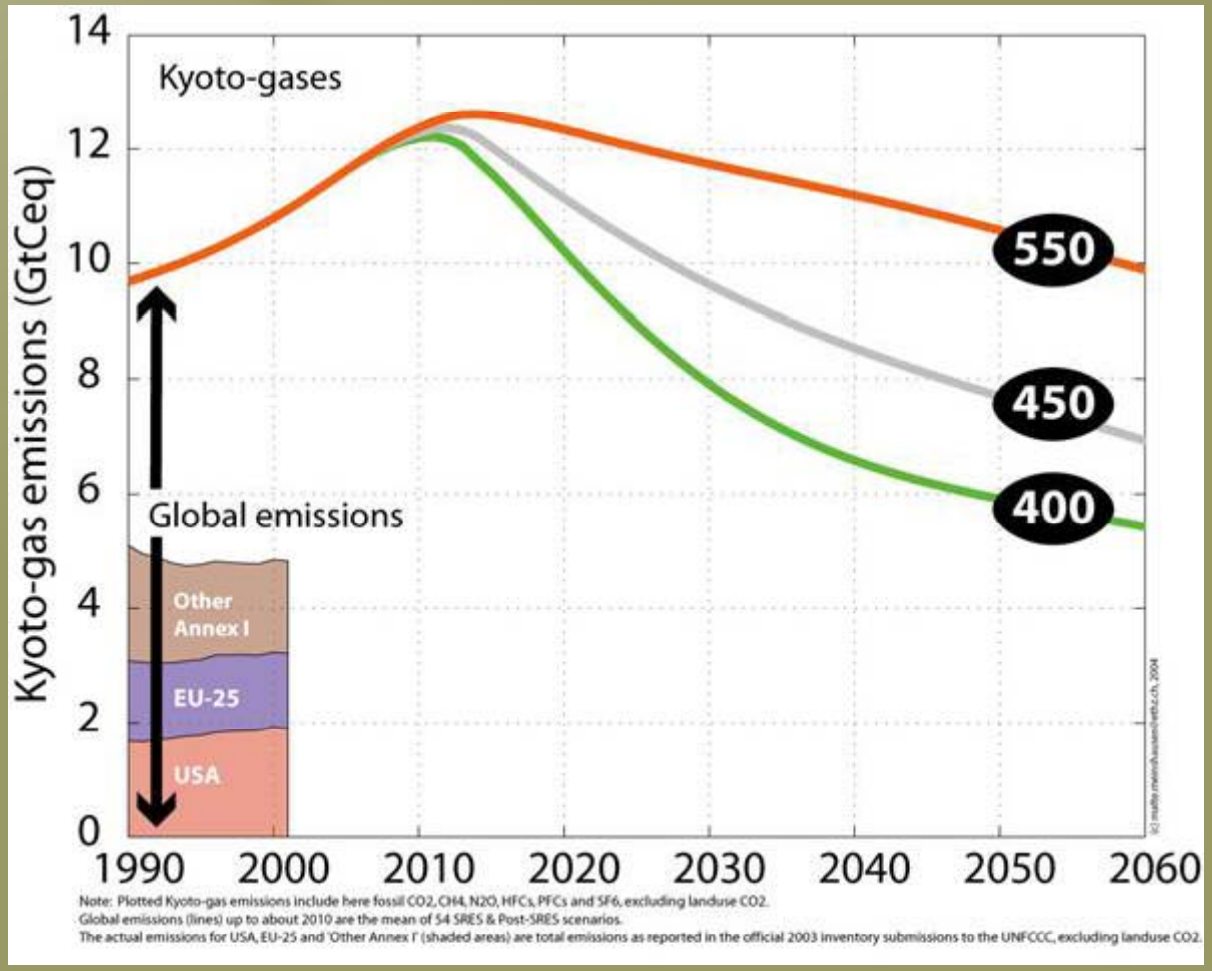
CO2 concentrations and temperature are moving outside historical experience with adaptation. An increase of 2 degrees C/3.6 degrees F is considered a crucial threshold.



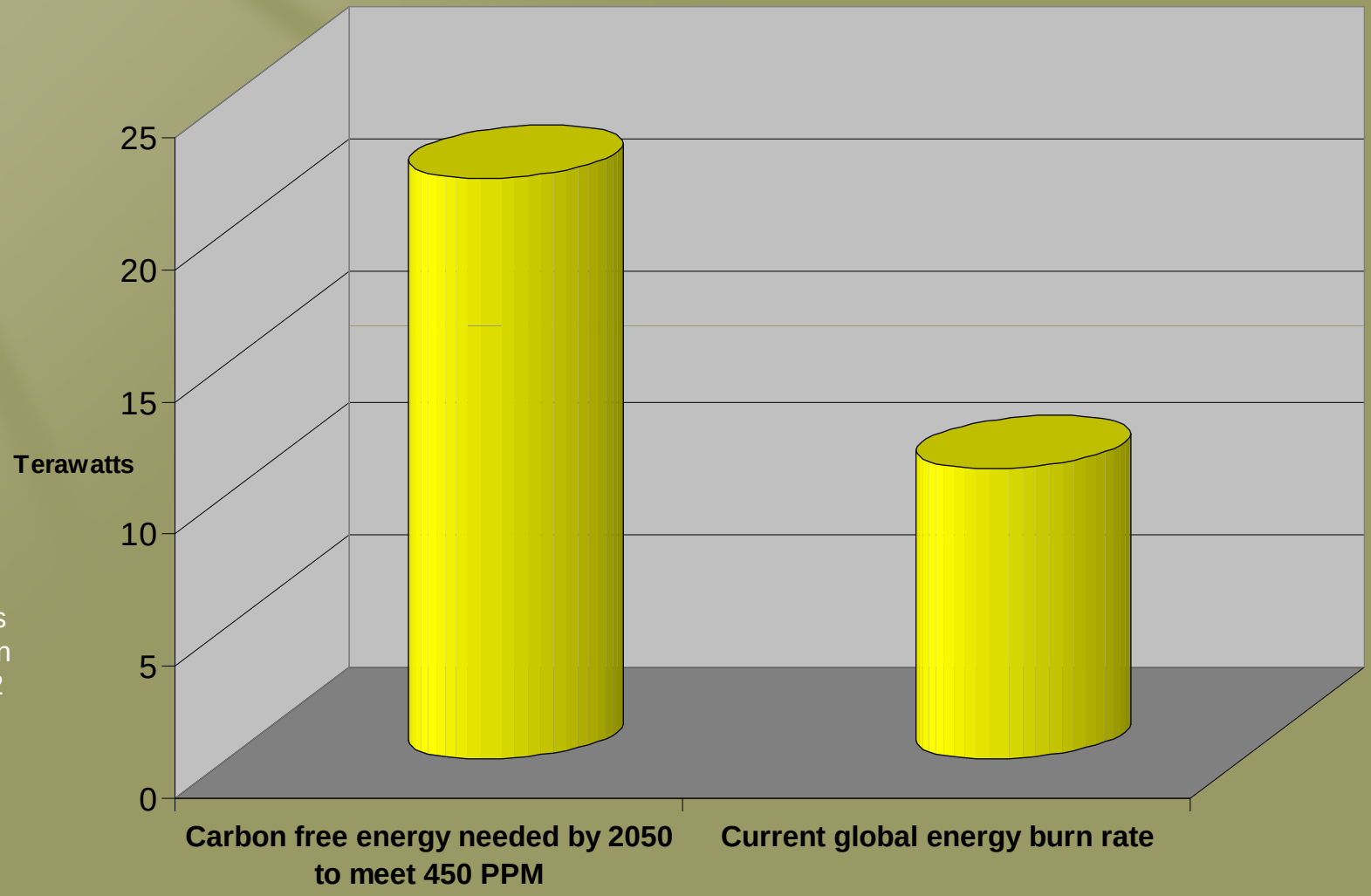
Source: Arctic Climate Impact Assessment

2 degrees C/450 PPM means deep cuts in net emissions very soon

Source: Meinshausen, Swiss Federal Institute of Technology



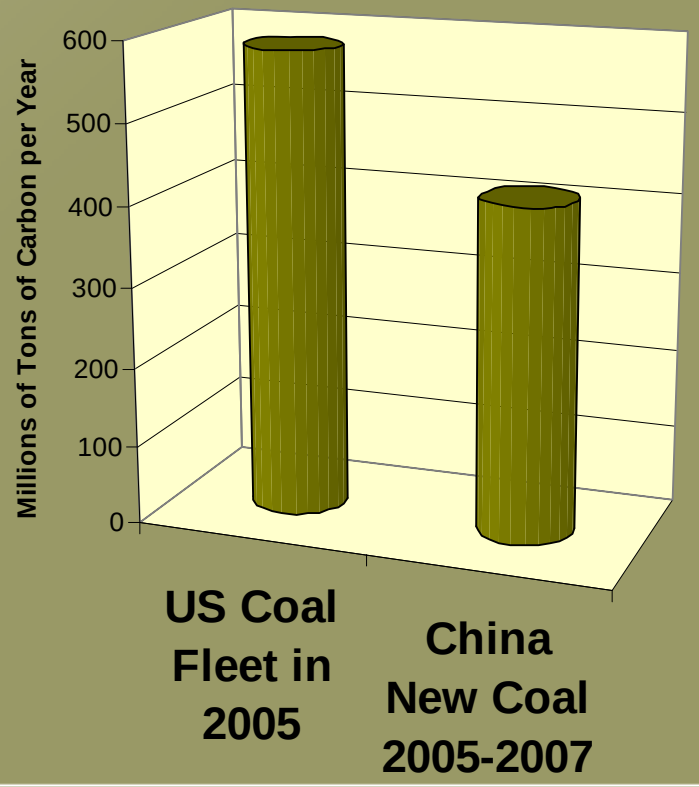
Need twice as much net carbon free energy as *all* energy consumed today



Source: Clean Air Task Force drawn from Hoffert, M., Caldeira, K., et al, "Energy implications of future stabilization of atmospheric CO2 content," *Nature*, Vol. 395, October 1998 at page 881.

Yet emissions and technology trends are in the *wrong* direction

Entire US Coal Fleet vs. Chinese Coal Plants Built in 2005-07

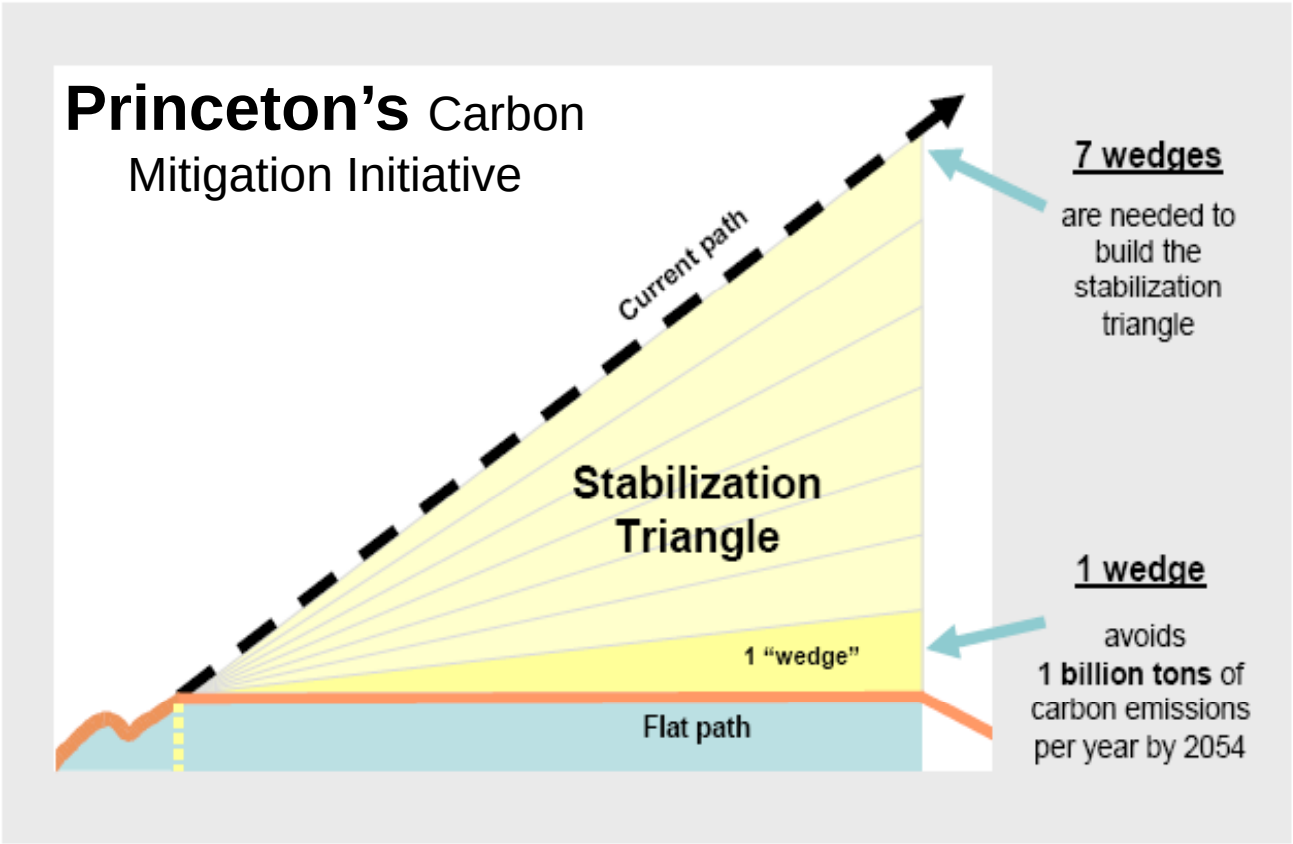


Source: Clean Air Task Force

What Would It Take to Flatten CO_2 Growth by Mid-Century?

CMI
Carbon Mitigation Initiative

To achieve 550 ppm of CO2



Sample Global Wedges: Each Difficult to Achieve

1. Reduce commercial and residential electricity use by 25%
2. Increase wind generation 50-fold
3. Increase solar generation 700-fold
4. Capture CO2 from 800 1,000 MW baseload coal power plants
5. Increased fuel economy (60 mpg) for 2 billion cars

NOTE: These reductions must be achieved alongside population and economic growth.

Regional Response: Powering the Plains

- Public-private partnership launched in 2001 to:
  - Reduce regional CO2 and other greenhouse gas emissions while adding economic value to our energy and agricultural economy
  - Help the region capitalize on its energy advantages.
- Industry executives, agricultural producers, environmental advocates and government officials from Dakotas, Iowa, Minnesota, Wisconsin and Manitoba
- Sponsored by charitable foundations and participating companies and organizations

Early PTP initiative: 2003 delegation to Europe

- Public and private leaders from the Upper Midwest visited Denmark, Germany, the Netherlands and Iceland
- Saw how energy and technology development, CO2 emissions reductions, and sustained job creation and economic growth can go hand in hand
- Delegation participants shared their experience with MB, MN, ND & SD legislators at the 2004 Legislators Forum annual meeting

LF Delegates Adopted Energy Transition Resolution

- Legislators called for a transition in our region's energy economy that "relies on clean energy production and carbon sequestration"

Legislators Identified Region's Strategic Energy Strengths

- Renewable wind, biofuels, biomass, and hydropower
- Hydrogen from renewables and coal
- Experience with coal gasification & geologic storage of CO_2
- Sequestration of carbon in soils, wetlands, and woodlands
- Marketing renewable energy and carbon credits

And legislators asked PTP to. . .

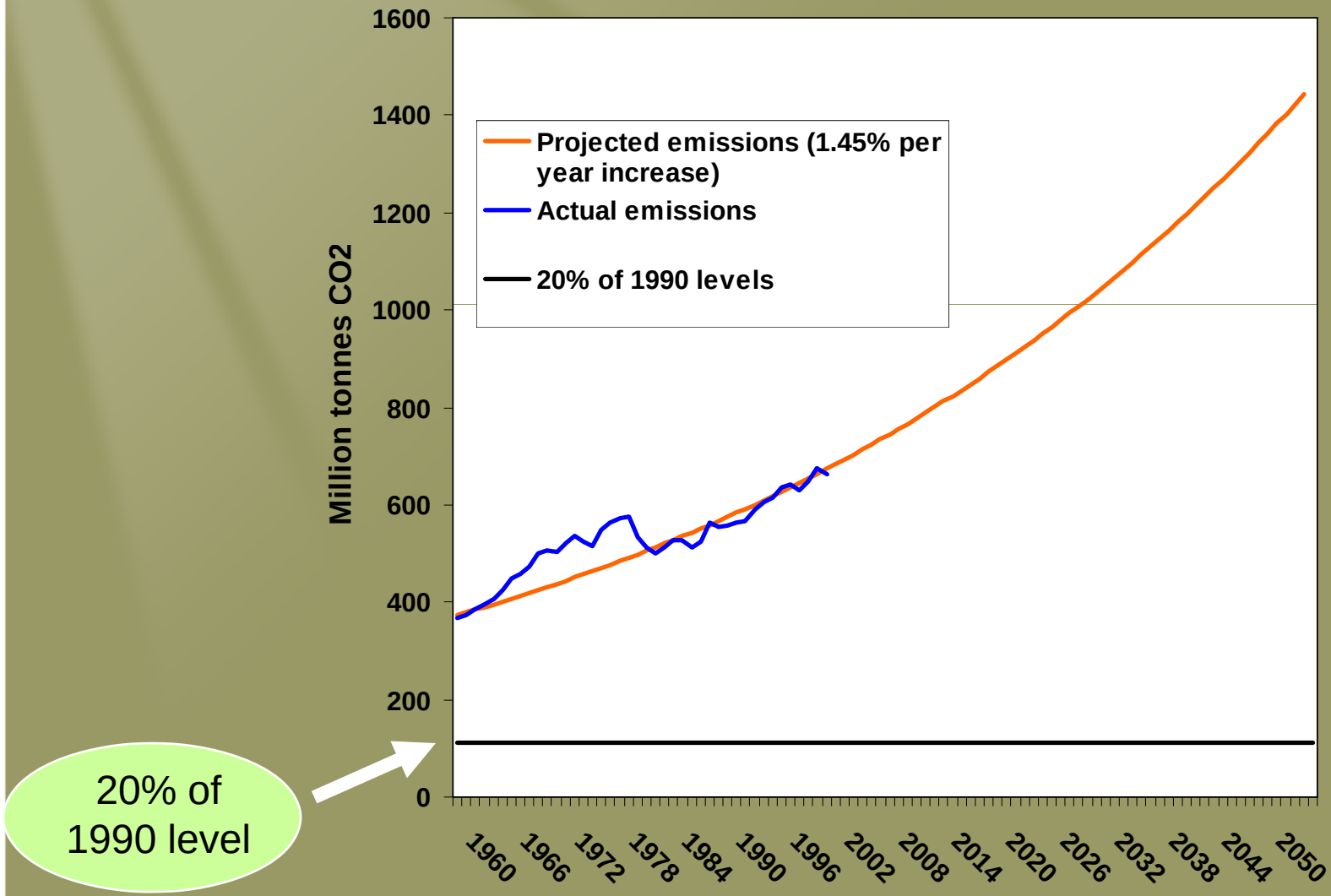
1. "Prepare preliminary scenarios, goals and measurable targets outlining a potential regional energy transition;

2. Identify legislative measures and institutional arrangements needed to implement such a transition roadmap inter-jurisdictionally over time."

Lesson from Europe: Develop 50-Year Regional Energy Roadmap

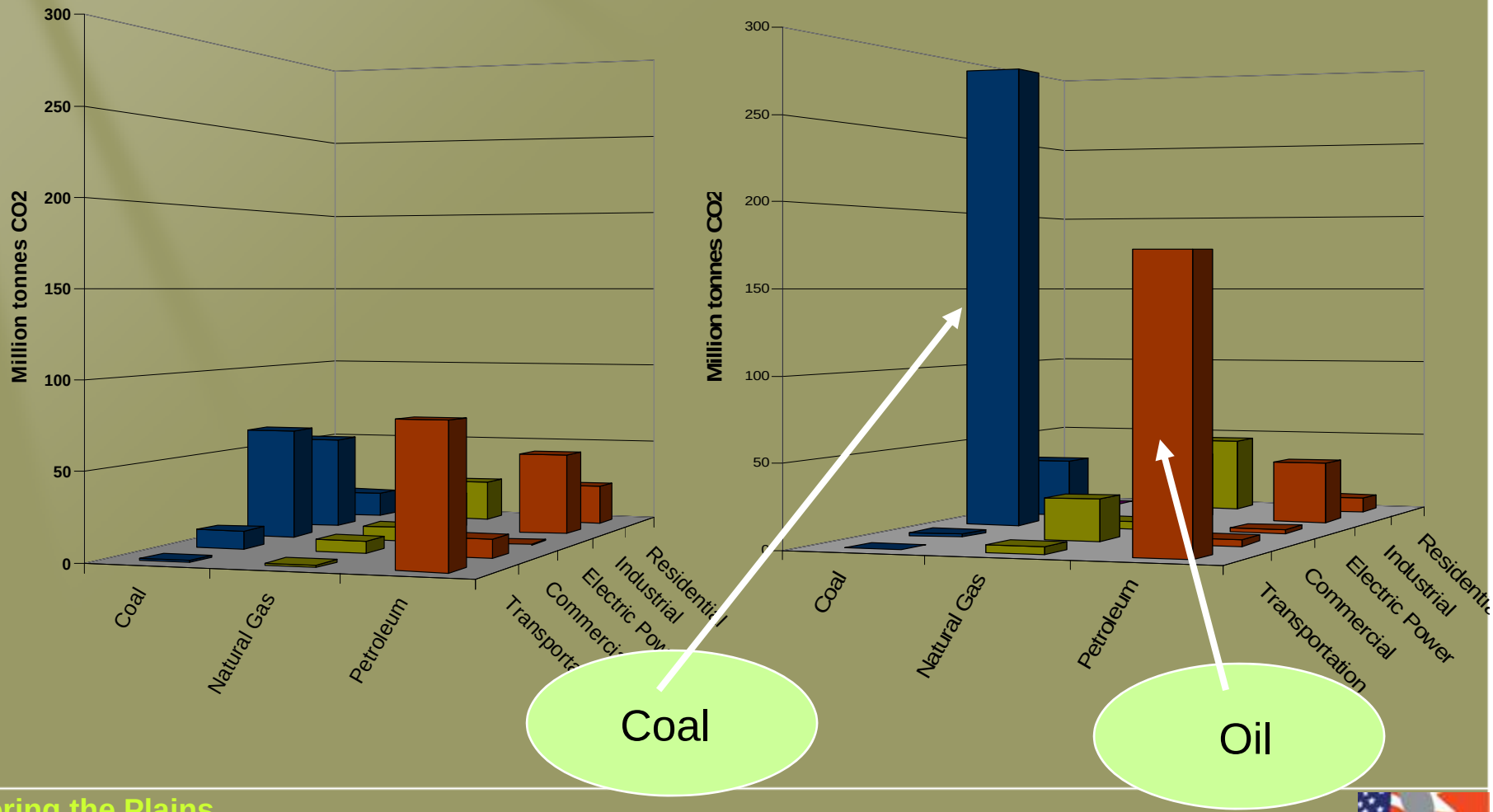
1. Powering the Plains tasked by bi-partisan regional Legislators Forum to develop roadmap (MB, MN, ND & SD legislators)
2. Great Plains Institute partnered with U of MN research team
3. Developed interactive, real-time computer model to analyze how region might meet energy demand AND reduce CO_2 emissions 80% from 1990 levels by 2055
4. No sacred cows: all energy types & energy efficiency considered
5. PTP participants using scenario analysis as basis for roadmap

PTP Emissions Inventory: Regional Path We're On



20% of 1990 level

Change in CO_2 Emissions, 1960-2005



PTP CO2 Scenario Modeling: High Efficiency Least Cost Option!

Scenarios	Cost of Power (US$/MWh)	Total (US$ billions)	80% CO2 Reduction
BAU	$42	$771	No
Efficiency*	$51	$743	Yes
Renewables	$49	$775	Yes
IGCC w/CCS	$51	$779	Yes

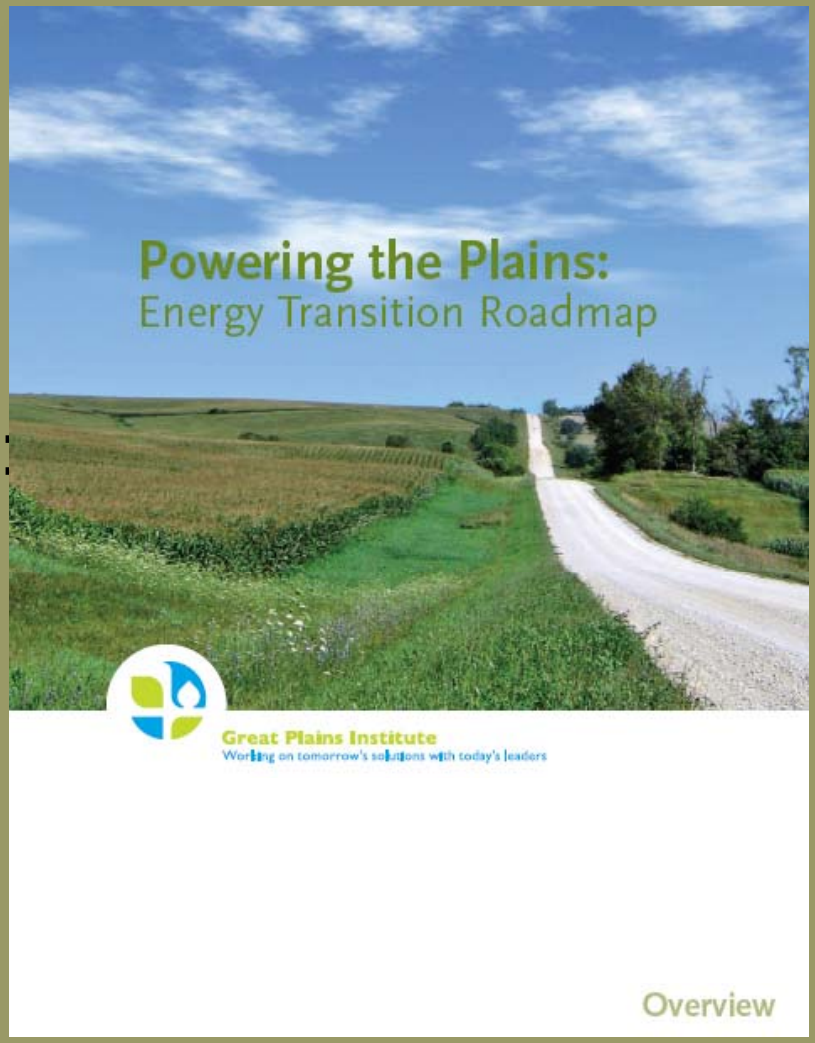
BAU = Business as usual

*High efficiency scenario reduces projected demand 40 percent over BAU.
High renewables & IGCC/CCS scenarios reduce demand 25 percent over BAU.

Roadmap based on scenario modeling released June 2007

1. Executive Summary
2. Overview
3. Measurable Milestones
4. All on-line at: www.poweringtheplains.org:
   - Efficiency
   - Coal with CCS*
   - Wind
   - Biomass
   - Hydropower
   - Nuclear Power
   - Hydrogen & Fuel Cells

*CCS = CO2 capture & sequestration



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Main Roadmap Conclusions

1. It is possible to meet electricity needs AND reduce CO_2 emissions 80% between now and 2055 without significant additional cost over business as usual.
2. Doing so will require <u>significant efficiency</u> and low- and zero-carbon energy development over the next half century.

Slide 23

MSOffice7 Rolf and I discussed having perhaps two slides with "pearls of wisdom", one for each sector, or something along those lines. The conclusions needs somewhat more detail than this.
, 5/19/2006

PTP Roadmap foundation for bipartisan Midwestern Governors Summit

MIDWESTERN ENERGY SECURITY & CLIMATE STEWARDSHIP SUMMIT

MGA
Midwestern Governors Association

- Co-chaired by WI Gov. Doyle and MN Gov. Pawlenty
- 12-state Midwest footprint + Manitoba
- November 14-15, 2007
- Funded by the Joyce Foundation and staffed by MGA and Great Plains Institute

Elements of Summit Platform that the Governors & Premier Signed

- Tier I: Preamble and Guiding Principles
- Tier II: Measurable Goals, Objectives & Policy Options for:
  - Efficiency, renewable electricity, advanced coal with CO2 capture, and bioeconomy and transportation
- Tier III: Cooperative Regional Initiatives
- Tier IV: Greenhouse Gas Accord

Ambitious Platform Goals: Energy Efficiency

- Goal: Meet at least 2% of regional annual retail sales of natural gas & electricity via efficiency by 2015 and each year thereafter.
- C02 Savings = eliminate growth in C02 from electricity & gas after 2015 and potentially much more
- *Most aggressive commitments in North America*

Renewable Electricity

- Goal: By 2030, 30% of the region's energy comes from renewable sources
- This would be equal to 83,000 1.5 MW commercial wind turbines (or enough to supply 31 million ave. Am. Homes)
- C02 Savings: roughly 15% reduction in total emissions
- *Most aggressive commitments in North America.*

Advanced Coal w/CCS

- Goal: Demonstrate IGCC with both eastern & western coals by 2015 (MGA states have 25% of U.S. recoverable reserves)
- By 2020 all new coal plants have CCS
- By 2050, entire coal fleet is transitioned to CCS
- CO2 savings = Roughly 25% reduction by 2050
- *Commitments rival those of the European Union*

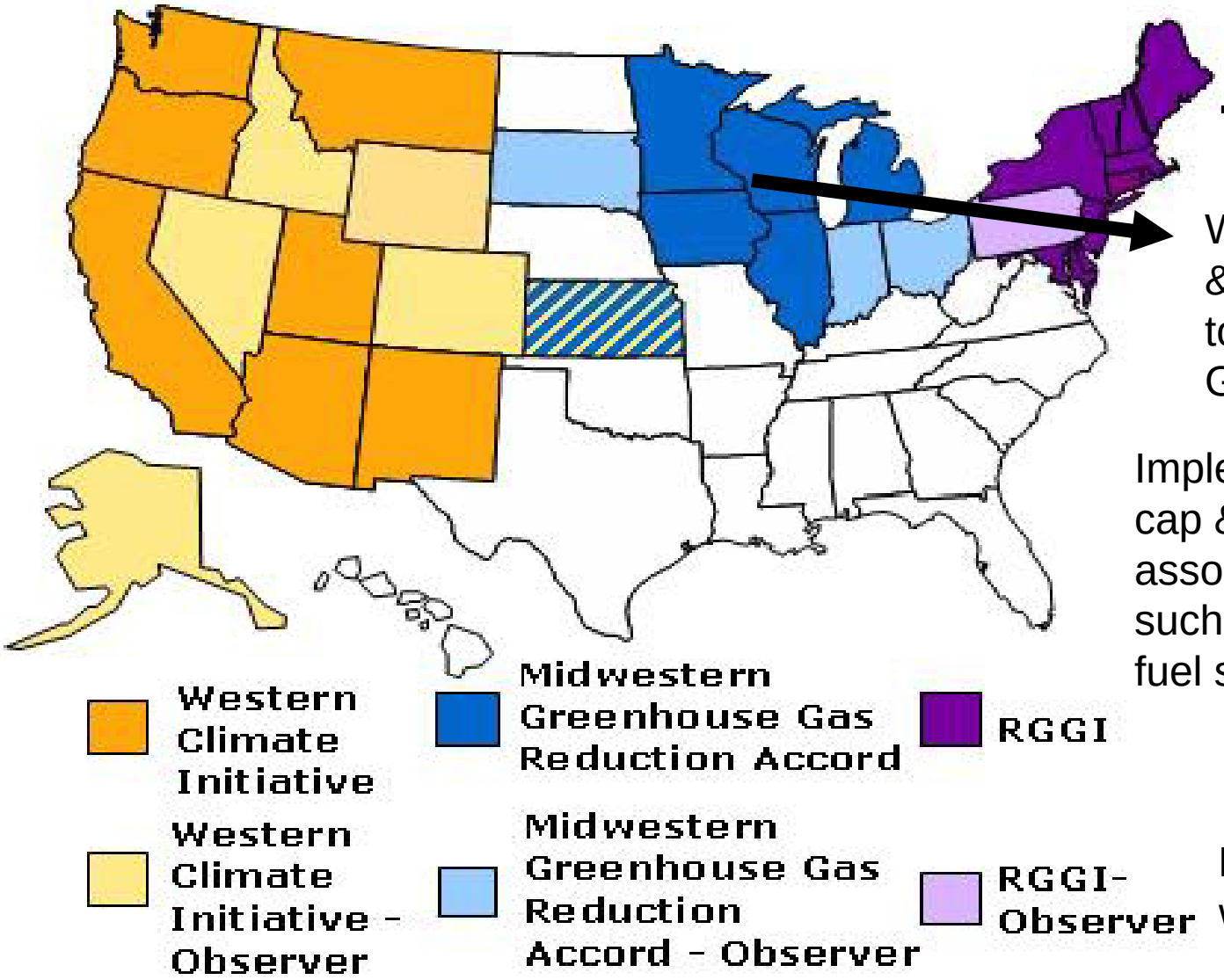
Bioeconomy & Transportation

- Goals: Increase availability of low-carbon fuels 10-fold
- Reduce fossil fuel inputs to biofuels by half
- By 2025 meet half of the region's transportation demand with biofuels and other low-carbon fuels
- C02 Savings = roughly 10% by 2025
- *Midwest will achieve highest biofuels market penetration anywhere.*

Tier 3:
Six Regional Agreements

1. CO2 Mgmt. Infrastructure Partnership
2. Low-Carbon Energy Transmission Infrastructure
3. Transmission Adequacy Initiative
4. BioProduct Procurement Program
5. Advanced BioEnergy Permitting Collaborative
6. Renewable Fuels Corridors and Common Signage

States Covered by GHG Accords = 50% of pop. + > 50% of GDP



Tier 4:

Will establish targets & timeframes for 60 to 80% reduction in GHGs by 2050

Implement an emissions cap & trade system and associated mechanisms such as a low-carbon fuel standard

Map Source: www.pewclimate.org

Next Steps

1. MN and WI governors to continue chairing 2-year implementation process
2. GPI working with MGA and governors staff to organize 4 advisory groups:
   a) Efficiency
   b) Renewable Elec. + Coal w/CCS
   c) Bio-Economy & Transportation
   d) Greenhouse Gas Reduction

MIDWESTERN ENERGY SECURITY & CLIMATE STEWARDSHIP SUMMIT

MGA
Midwestern Governors Association

Conclusions: Implications for North Dakota

- Our long-term role as energy exporter hinges on our ability to embrace the future low and zero-carbon energy market.
- We can become a premier supplier of low-carbon energy and provider of CO2 management services to the Midwest and beyond.
- However, not without much more aggressive state support for deployment and commercialization of advanced energy technologies.

Potential Next Steps

- The North Dakota Legislative Assembly could signal its commitment by:
  - Endorsing the regional Midwestern Governors goals for energy efficiency, bioenergy, renewable electricity and advanced coal with CO2 capture and storage; and
  - Crafting a state policy framework sufficient to accomplish these goals over time.

Potential Next Steps

- Policy framework of state incentives and investments should be targeted to maximize North Dakota's comparative advantages in low-carbon energy, namely:
  - Wind energy and cellulosic biomass;
  - CO2 capture, transport and storage from lignite and ethanol plants (including use of CO2 for enhanced oil recovery); and
  - Necessary transmission, pipeline and associated infrastructure for the above.

Thank You

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