Reducing greenhouse gas emissions in the Midwest:
Lessons for Michigan from Minnesota

Laura Schmitt Olabisi (schmi420@msu.edu)

Community, Agriculture, Recreation, and Resource Studies (CARRS) and Environmental Science and Policy Program, Michigan State University

Minnesota Study

Stabilizing atmospheric concentrations of CO_2 will require a reduction of global greenhouse gas (GHG) emissions by as much as 80% (1). While national climate policy is crucial, many of these reduction strategies must be implemented at the state or regional level. Minnesota has adopted a strategic goal of reducing the state's GHG emissions 80% below 2005 levels by 2050. Meeting this target will require a fundamental shift in current energy generation and use. Because Michigan has a climate and energy profile similar to Minnesota's, similar strategies will likely be considered for GHG reduction in both states

Modeling the Possibilities

We created scenarios describing potential strategies (and combinations of strategies) to achieve the 80% GHG reduction goal in Minnesota. Historical trends in population growth and energy consumption were used to model a 'business as usual' emissions trajectory.

Scenarios we considered:
☼ Efficiency of all coal-powered plants increased to 60%
☼ All coal electricity replaced with natural gas, wind, or biomass
☼ Carbon capture and sequestration (CCS) at all coal plants (or biomass plants)
☼ Electricity conservation in residential and commercial buildings
☼ All motor vehicles fueled with ethanol (corn-based or cellulosic)
☼ Vehicle miles drive cut in half
☼ Fleet vehicle fuel efficiency increased to 55 mpg
☼ Fleet transition to plug-in hybrid vehicles
☼ Reforestation of 6% of Minnesota's land area

Extremely Difficult to Meet the Goals

With no strategies adopted, GHG emissions in Minnesota would rise to approximately 230 million metric tons of CO_2 equivalent by 2050. This represents an increase of 37% over 2005 emissions levels.

"Conservation" Portfolio of Strategies
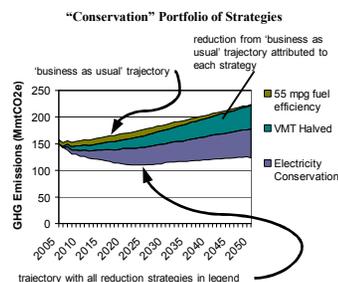
Energy conservation alone does not reach the 80% reduction goal. Combining all conservation strategies would result in an 18% reduction below 2005 levels by 2050.

**"Conservation and Renewables" Portfolio of Strategies**
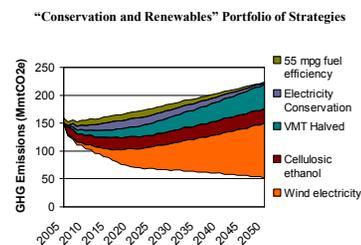
Adding renewable fuels to conservation strategies results in a GHG emissions reduction of 65% below 2005 levels by 2050—still shy of the 80% reduction goal.

Only one modeled strategy achieved 80% GHG reduction by 2050–combining biomass burning for electricity generation with CCS, thereby removing GHGs from the atmosphere.

What about Michigan?

Michigan's greenhouse gas emissions are rising at a much slower rate than Minnesota's, due to the state's economic situation. As in Minnesota, Michigan's electric generation and transportation are the largest and fastest growing emissions sectors. Targeting these sectors for GHG reduction will therefore have the most impact on the state emissions profile.
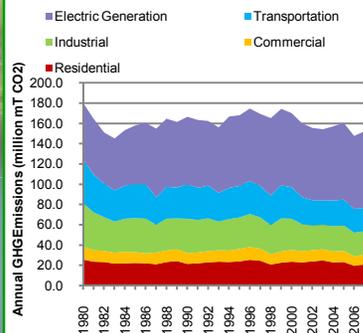
Michigan trails Minnesota in renewable energy development for electricity generation, so achieving an 80% GHG reduction goal would necessitate more rapid future growth in renewable energy in Michigan compared with Minnesota.
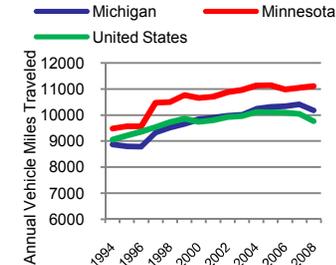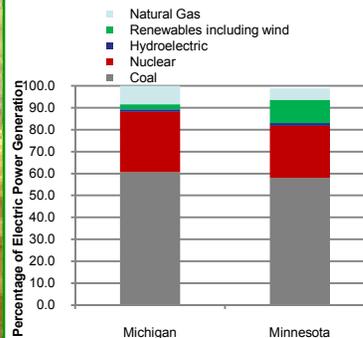
Michiganders are driving more every year, and Midwesterners drive more than Americans in general. Strategies to improve vehicle fleet fuel efficiency will therefore be more effective if coupled with strategies that reduce vehicle miles driven.

Conclusions

❖ Meeting an 80% GHG reduction goal by 2050 will require radical transformations in the way we produce and consume energy in the Midwest.

❖Michigan's economic recovery could make GHG emissions reduction more challenging.

❖ Reducing emissions from electricity generation and transportation could have the greatest overall impact, as these are the largest and fastest-growing emissions sectors in both states.

Literature Cited

N. Rive, A. Torvanger, T. Berntsen, S. Kallbekken, *Climatic Change* **82**, 373 (2007).
Data sources: Energy Information Administration, Federal Highway Administration

Acknowledgements