

## 100% Clean Energy Standard HF XXX

I am writing to add my support to the proposed 100% Clean Energy Standard. Recent advances in technology show that this is possible. Recent trends in climate and weather extremes (in Minnesota as well as around the world) show that this is necessary and urgent.

Minnesota is already benefiting from the progress so far in transitioning from fossil fuels to clean energy. Besides the obvious environmental benefits, this has led to growth of living wage jobs (manufacture, installation, and operation of wind and solar energy systems). Clean energy is a Minnesota success story. Over 61,800 Minnesotans already work in clean energy. Minnesota's clean energy industry is growing 2.5x faster than the rest of our economy, and it employs Minnesotans in every county of the state.

Minnesota has an abundance of sun and wind. These resources have barely been tapped to date, yet already provide approximately 24% of Minnesota's electrical needs. There is ample supply to cost-effectively provide 100%, with the potential to even bring revenue to the state by exporting excess clean electricity. This is in dramatic contrast to fossil fuels which are virtually all imported into Minnesota, negatively affecting both our environment and our balance of trade.

One of the frequent objections to reliance on clean energy sources is the concern for a consistent and reliable supply of electricity. As we well know, the sun only shines during the day; and even then, can be obstructed by clouds and precipitation. Wind, while available 24 hours a day, can also be highly variable in intensity. While technologies to generate clean electricity have made great strides in cost and performance over the past 2 decades, energy storage technologies (e.g. utility scale battery systems), are still cost largely cost prohibitive at present. As a Ph.D. Physical Chemist, with experience in electrochemistry, I have been actively monitoring the development of new electrical storage technologies. I can happily report that there has been a dramatic increase in R&D in just the past few years. I expect a new generation of batteries to be available in the next decade, ones with greatly improved storage capacity and dramatically reduced cost. In addition, there are a number of recent technologies being piloted to generate hydrogen (by electrolysis of water using surplus electricity), which can then be cleanly burned to generate electricity in times of need.

One other remedy to irregular electrical supply (from solar and wind), is already in place. Several Minnesota utilities participate in the "MISO Market" (MISO stands for Midcontinent Independent System Operators). This is effectively a multistate electrical grid which allows trading/sale of electricity from those areas with a surplus to areas needing more. Through this expanded network, local fluctuations in generation of clean electricity can be mitigated to a great extent.

In closing, Minnesotans want clean, renewable energy. It's popular across the state. We can act now to protect our state by passing the 100% clean energy bill. It's time for Minnesota to lead on clean energy.

Sincerely,

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