



STATE OF MICHIGAN



DEPARTMENT OF LICENSING & REGULATORY AFFAIRS
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JOHN D. QUACKENBUSH, CHAIRMAN

RICK SNYDER
GOVERNOR

MICHIGAN ECONOMIC DEVELOPMENT CORPORATION
MICHIGAN ENERGY OFFICE
STEVE BAKKAL, DIRECTOR

Readying Michigan to Make Good Energy Decisions Michigan Energy Public Forum Statement Card

If you wish to speak today, please complete the following:

Name: Duane Hagen

Affiliation (if any): IMP Customer Coalition for Electric Choice

Phone: 269-668-3336 x 2079

Email: Duane.Hagen@mpiresearch.com
Coalition Company's: MPI Research - Mattawan; Armstrong International - Three Rivers;
White Pigeon Paper - White Pigeon; American Axle & Manufacturing - Three Rivers

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice Question 24
- d. Other Additional Energy Topic

(Please specify): _____

Please prioritize and focus your comments to afford as many as possible, the opportunity to speak. The amount of time allowed for each speaker will be dependent upon the number of people requesting to speak. Please prepare for the time limit for each speaker to be in the 2 - 5 minute range.

Please leave a copy of any written or electronic materials at the welcome center.

You are encouraged to submit written feedback at www.michigan.gov/energy.

IMP Customer Coalition for Electric Choice¹

Comments to Michigan Energy Forum March 18, 2013

Question 24: From an economic standpoint, what is the impact on Michigan of the jobs, infrastructure, supplier base and tax base provided under the current regulatory structure versus what could be expected from an open market system?

I. Inconsistent Regulatory Support of Electric Choice

- The current regulatory structure has resulted in inconsistent support of Electric Choice across utilities in the state.
- Among the intents of Electric Choice laws are:
 - “To improve the opportunities for economic development . . .”
 - “To allow and encourage the Michigan public service commission to foster competition . . .”
[MCL 460.10, Sec.10.]
- However, the businesses in the IMP Customer Coalition have been in effect frozen out of Electric Choice in the I&M area due to regulatory rulings.

II. Financial Harm to IMP Customer Coalition, Instead of Economic Development

- IMP Customer Coalition members in the I&M area are paying \$162,000 per year for Electric Choice implementation charges, but competitively priced power is not available due to I&M’s pricing structure.
- If Coalition members could purchase competitively, annual savings would be about \$2.3 million per year.
- Such savings would contribute to expanding businesses and increasing production in facilities in Michigan, adding to the economic development and the job base in the state.

¹ The IMP Customer Coalition for Electric Choice consists of: American Axle, Armstrong International, MPI Research, and White Pigeon Paper.

III. Policy Implications: Utilities Are Not Harmed by Electric Choice, Yet Are a Barrier to Electric Choice

- Utilities see significant savings in power costs from Electric Choice.
- Utilities may no longer have any “net stranded costs.”
- Utilities already recover implementation costs.
- Electric Choice provides an alternative to expensive new utility power plants.

IV. Conclusion: Current Regulatory Structure Does Not Allow the Capture of Full Economic Benefits of Competition.

- Customer savings – and associated economic development – are there to be had from competitive prices.
- Current 10% Cap means that all businesses do not have equal access to competitive prices – *i.e.*, “winners and losers.”
- Current regulatory structure has not resulted in equal opportunity for competitive electric supply – practical, not theoretical – across all utilities in the state.
- Consequently, opportunities for economic development are being lost under the current structure, but could be captured under an open market system.

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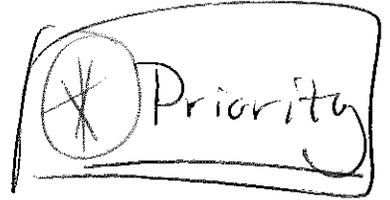
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If you wish to speak today, please complete the following:



Name: Jan O'Connell
Affiliation (if any): Sierra Club Michigan Chapter
Phone: 616-956-6621
Email: jan.oconnell@sierradub.org

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards (Pro-wind)
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

Please prioritize and focus your comments to afford as many as possible, the opportunity to speak. The amount of time allowed for each speaker will be dependent upon the number of people requesting to speak. Please prepare for the time limit for each speaker to be in the 2 – 5 minute range.

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**Michigan Energy Policy Forum
Kalamazoo
Monday, March 18, 2013**

**Statement from Jan O'Connell
Sierra Club Michigan Chapter
Energy Issues Organizer
& Development Director**

Increasing Michigan's use of Energy Efficiency & renewable energy will create jobs, spark investment and launch new businesses in our state. Michigan currently gets nearly 60 percent of its electricity from coal, all of which is imported from other states. Michigan is sending \$1.7 billion a year - - and the jobs it creates to other states and at the present time Michigan is only getting 3.9% of its electricity from renewable sources. Other Midwestern states are blazing far ahead of Michigan in renewable energy with Iowa getting 23% and Illinois has a 25% goal by 2025..and nearly 30 other states have stronger renewable energy & Energy Efficiency goals than Michigan.

I want to give a shout out to the City of Holland that is currently pursuing an Energy Efficiency Pilot Project starting with retrofitting of 90-100 homes which could fall in line like dominoes...turning Holland into a world-class energy efficient city. It is hope that projects like Holland's will be cropping up all over Michigan..and successfully moving our state away from a dependence on dirty Fossil fuels and instead moving towards a Clean Energy Future.

Specifically on wind our state has enough wind and land to really increase Michigan's renewable energy use...Michigan has more than 54,000 MW of high-quality, land-based wind generation potential, according to the National Renewable Energy Laboratory. This would be nearly 12 times more, than would be needed if we did move toward 25% of renewables by 2025, meaning we need to harness only 8 percent of available land-based wind.

The Sierra Club strongly supports the development of wind energy because it creates good-paying jobs, drives economic development, and will help transition Michigan off dirty fossil fuel energy sources to clean energy future. The following items that I am stating here are in regards to the siting criteria for large scale wind turbines.

- Appropriately sited wind can meet this need for local, clean, renewable energy that is smart for the environment and smart for our economy.
- The Sierra Club supports the development of appropriately sited wind farms which avoid or minimize harm to wildlife.
- Wind developers should seek community input and conduct ecological studies in advance of wind farm development.

Michigan could generate 25 percent of its energy from wind alone, on 4,600 acres of land. The MPSC noted that the 3 wind parks in Gratiot, Huron & Sanilac Counties alone, will contribute \$150 million in economic benefits to Michigan.

The Sierra Club also supports distributed wind generation, which has fewer siting concerns and also fits into the existing grid.



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If you wish to speak today, please complete the following:

Name: Dale Shugors

Affiliation (if any): Home Builders Association

Phone: 269-207-5275

Email: dshugors@hba.org

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

Requested time to speak: < 5 minutes 5 minutes

Please leave a copy of any written or electronic materials at the welcome center.

*has 3:30 meeting
& request early
time*



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If you wish to speak today, please complete the following:

Name: Tom Stacy

Affiliation (if any): ASME

Phone: _____

Email: TFSTACY@GMAIL.COM

Priority
(PRESENTATION)

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
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- d. Other Additional Energy Topic

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If you wish to speak today, please complete the following:

Name: Maynard J. Kaufman

Affiliation (if any): _____

Phone: 269 650-1758

Email: Maynard.Kaufman@owid.edu

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): Renewable energy in households

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Statement on Renewable Energy

Maynard Kaufman, March 18, 2013

Many people seem to think that renewable energy from wind and sun does not work in Michigan. My wife and I built a new house in 2001 and did not have it connected to the electrical grid. In the 12 years since then we have enjoyed a normal life in a house powered almost entirely with renewable energy from wind and sun. It is important to recognize that these are complementary sources of energy. When it is cloudy the wind is more likely to blow, and in winter, when the sun is low, it is also more windy. And one advantage of a warming climate is that wind is stronger and more dependable.

Because we use as many energy-efficient appliances as possible, the renewable energy system we installed is relatively small. Electricity is provided by a one thousand watt array of photovoltaic panels mounted on a tracker which keeps them facing the sun when it shines. Two wind turbines rated at one thousand watts each provide electricity when the sun does not shine. An inverter changes the direct current from where it is stored in the batteries to alternating current for most household use and lights. All pumps, refrigerators and freezers that go on and off automatically use DC power, and this saves energy since the inverter uses about 15 watts.

The house, which is very well insulated, can be heated with warm water circulating in tubes in the concrete floor, with a wood burning masonry stove which is fired only once a day, or less, and by many south-facing windows. Water for household use is heated by flat plate solar panels mounted on the south wall of the house and by a loop inside of the masonry stove. A propane fueled water heater rarely switches on, but propane is used in the cook stove.

My wife and I chose to invest in renewable energy because burning fossil fuels for energy is warming the climate and because energy from nuclear power is too dangerous. We did not expect to save money, although we may eventually. Our system has delivered dependable power with no outages, and we expect it will continue to do so for another twelve years. The battery bank was replaced after ten years of service, but other repairs have been minor.

Although I do not think that net metering was available when we installed our system, I think it is good to be connected to the grid to share the surplus of renewable energy and to save the cost of a battery bank. Some people, however, complain that the utilities seem reluctant to accept renewable energy and make it a difficult process. We hope the Michigan Public Service Commission continues to facilitate the process of accepting renewable energy from home-owners on the grid.

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Maynard Kaufman

P.O. Box 361, Bangor, MI 49013

Phone 269 650-1758

maynard.kaufman@wmich.edu



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If you wish to speak today, please complete the following:

Name: Anne Marie Hertl (DID NOT SPEAK)

Affiliation (if any): WMGAC

Phone: _____

Email: annemarie@wmgac.org

Topics you wish to address today:

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If you wish to speak today, please complete the following:

Name: Michael Youngblood

Affiliation (if any): Well Home

Phone: _____

Email: michael.youngblood@wellhome.com

Topics you wish to address today:

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If you wish to speak today, please complete the following:

Name: Art Toy

Affiliation (if any): Great Lakes Renewable Energy Association

Phone: 269-267-1804

Email: info@fourlements-energy.com

Topics you wish to address today:

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I would like to thank the Michigan Public Service Commission for hosting this public forum on Michigan's energy future today Monday March 18, 2013 at Western Michigan University.

My name is Art Toy; I am the President of Four Elements Energy, Inc. Our firm designs and installs renewable energy systems. I am here today to present to the commission actual real world data for a solar photovoltaic array located in southwest Michigan not far west of Kalamazoo.

The system in question is at my home in Lawrence, Michigan just north of the I-94 mile marker number 51.

I ask the audience and the commission to turn their attention to the screen which shows by month the amount of electrical power generated at my home from February of 2011 to February of 2013.

As you will note, the system at my home generates power throughout the year from winter to spring to summer to fall and the cycle repeats itself.

In the first full 12 months of operation, the system generated 6923 kilowatt hours of power and in the second year of operation 7639 kilowatt hours of power. The major difference in weather conditions impacting system performance being that the summer of 2011 was cloudy and rainy while the summer of 2012 was hot and dry. The electrical power generated is roughly 2/3 of our family's yearly electrical energy usage.

What I wish to convey to everyone in this presentation is the fact that solar does work year round even in areas which experience significant lake effect snow and over cast conditions, such as we have along much of our state's lakeshore.

What I am doing with this data is to dispel the perception that solar electric power does not work in Michigan and especially so in areas of over cast and heavy snow fall. As this presentation demonstrates, solar electric power generation does indeed work in southwest Michigan and is a viable and valuable energy source for our state, even in the lake effect and over cast areas of the west side.

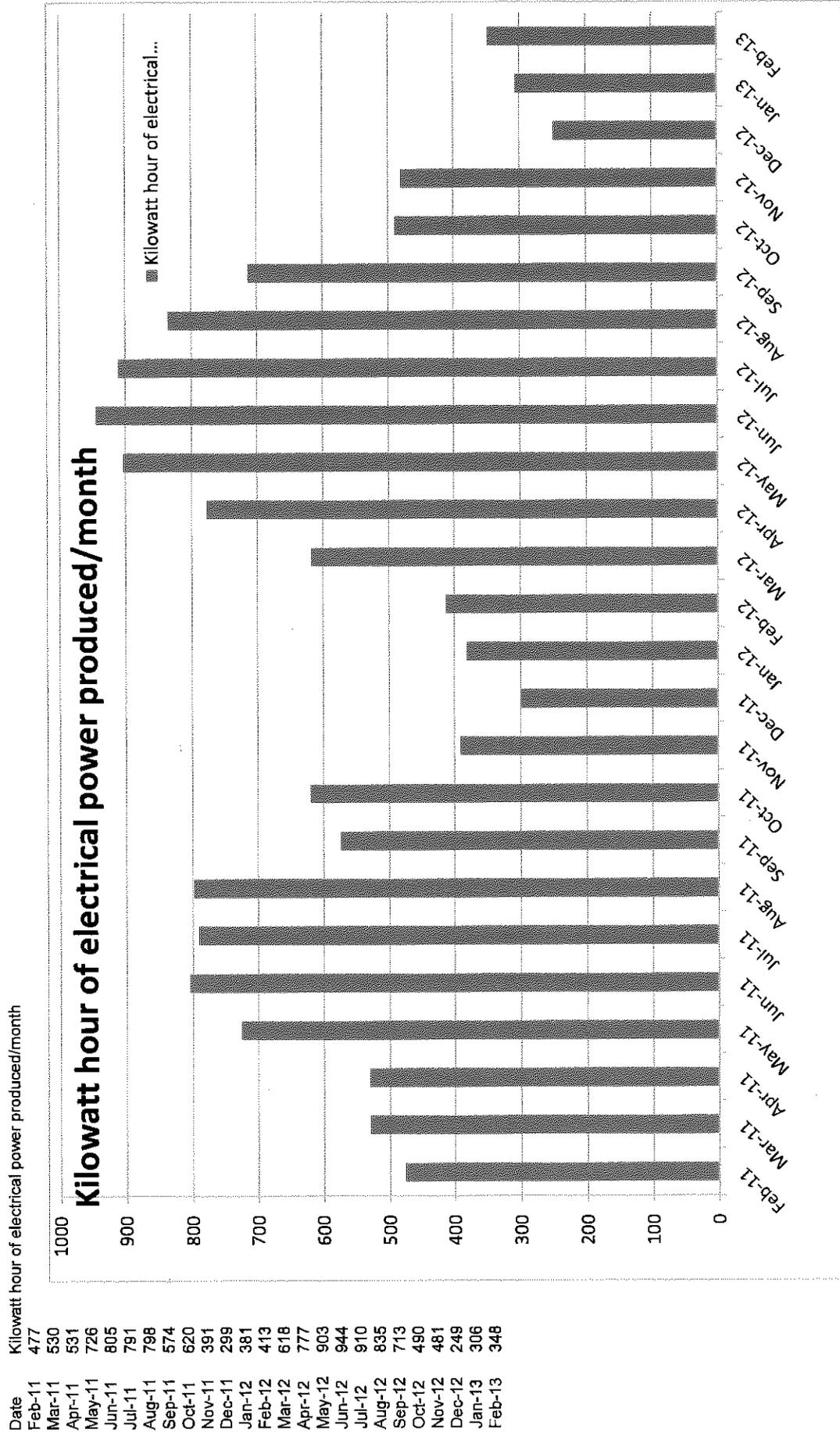
My suggestion for obtaining additional real world solar data similar to what was presented by me is to have Consumers Energy and Detroit Edison post on line the system size and monthly energy production data of all the solar electric Feed-In Tariff systems connected to the grid. This disclosure can be done without releasing the names of system owners, while sharing the general locations of those solar systems.

Finally, as for the perceived issue of storage during low light/low wind or no light/no wind conditions, I would like to remind everyone of the tremendous and unique resource that is right here in Michigan, that being the Ludington Pumped Storage facility. This facility is currently being used to store excess power being generated by our nuclear power plants in Michigan during low load conditions. In other words, we are even now solving our energy storage problems in-state

With that said, I would like to thank the commission and the audience for your attention.

Art Toy
546030 60th Ave.
Lawrence, Michigan 49064
269-674-3216
swmiwindnsolar@yahoo.com

5060 watt solar array at the home of Art Toy and Sharon Crotser-Toy
 54630 60th Ave. Lawrence, Michigan 49064



Ludington Pumped Storage



Image from Consumers Energy Website
Presentation by Art Toy

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If you wish to speak today, please complete the following:

Name: *Benjamin F. Brown, Jr.* _____

Affiliation (if any): *Solar Cooking in Michigan, Black Farmers* _____

Phone: 734-635-6865

Email: *humanhumus@hotmail.com*

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Information for energy policy makers to make good decisions with?

1st. It is cheaper to save fuel than pay for fuel.

Efficiency investment recently made to the Empire State Building demonstrates rate of return far faster than expected saving \$2.4 million dollars in energy costs in its first year.

http://www.esbnyc.com/sustainability_energy_efficiency.asp

Use of readily available high efficiency windows in the Empire State Building 400% more efficient than previous standard windows. Were a part of Johnson Controls improving the efficiency of the building by 38%, saving it \$2.4 million dollars in energy costs in its first year.

2nd Power Companies in multiple instances have under estimated the potential for renewable energy to benefit their bottom line and benefit their customers.

Colorado's Xcel's vice president admitted after a renewable energy amendment to increase the RPS ended up benefiting the company far faster than the projections... "We ended up opposing that amendment. In retrospect, I wish we hadn't," "It was good for the system and it was good for the customer. *Washington Post*, "Renewable Power's Growth in Colorado Presages National Debate." Discovering how profitable wind power was, the state raised the RPS from 10 to 30% by 2020

3rd. If we really care to employ Michigan workers in the energy sector:

Supporting energy efficiency is estimated by several sources to produce 9x the amount of good paying jobs that coal generation would. more than double jobs in solar than a coal plant would and 4times the wind turbine jobs that coal would.

For one billion dollars spent, 870 coal plant jobs are created, Or 1,900 solar jobs created, Or 3,300 wind turbine manufacturing jobs created OR 7,000 jobs in energy efficiency. - Source Clinton Climate Initiative.

Former CIA Director, James Woolsey, who by the way lives in a energy efficient home powered by renewables, says, "**We must undermine oil's monopoly on transportation.**"

We must support pure electric transportation and transport like the chevy volt - because should you choose to support wind and solar energy production, we simply won't be able to consume the amount of electric the state is capable of producing...I am personally in contact with people who drive pure electric vehicles, powering them by home solar and wind generated electricity in Illinois, which has less wind and solar resources than Michigan.

Data or studies available to Michigan policy makers:

"Modern wind plants can be added to a power grid without degrading system performance. In fact, they can contribute to improvements in system performance." - US Department of Energy, Wind 2030.

Dec 4, 2009 Ernest Orlando Lawrence Berkeley National Laboratory Study: No Impact on Property Values From Wind Turbines. *The impact of wind power project on residential property values in the united states:*

Department of Civil and Environmental Engineering, Stanford University. Cristina L. Archer and Mark Z. Jacobson *Supplying Baseload Power and Reducing Transmission Requirements by Interconnecting Wind Farms.*
A predictable reliable 47% of yearly wind power can be used as baseload power

Dan Kammen, Renewable and Appropriate Energy Lab, U.C. Berkeley. Germany went in five years from no wind power to 25% -50% of their power generated from wind energy alone. "Renewable Energy Solution of the Month: Wind - Part 2" 5:15 on YouTube Video. Hugely cost effective.

National Academy of Science: *Environmental Impacts of Wind-Energy Projects* Show that siting wind turbines out of flight paths, birds deaths are reduced many times less than are killed flying into windows [<http://www.youtube.com/watch?v=llIbjC49Fjs>
<http://www.sibleyguides.com/conservation/causes-of-bird-mortality/>]
20-37k (mainly in CA) from wind compared to 900 million deaths from birds hitting windows.



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If you wish to speak today, please complete the following:

Name: DAN ALWAY

Affiliation (if any): SELF, FOUR ELEMENTS ENERGY

Phone: (269) ~~269~~ - 762 0979

Email: DMALWAY@YAHOO.COM

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): RENEWABLE ENERGY / JOB ^{IMPACT}

Please prioritize and focus your comments to afford as many as possible, the opportunity to speak. The amount of time allowed for each speaker will be dependent upon the number of people requesting to speak. Please prepare for the time limit for each speaker to be in the 2 – 5 minute range.

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If you wish to speak today, please complete the following:

Name: Sr. Virgine Jones

Affiliation (if any): Sisters of St Joseph

Phone: 269-344-9124

Email: V Jones @ CSJoseph.org

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): Cost/Benefit analysis

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12:45 pm



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If you wish to speak today, please complete the following:

Name: Martin Stone

Affiliation (if any): ATU - Amalgamated Transit Union

Phone: 269-598-1301

Email: atu1093@hotmail.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

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If you wish to speak today, please complete the following:



Name: Michelle Rison

Affiliation (if any): _____

Phone: 906 322 0007

Email: Risonshine@mac.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): cost safety health

Please prioritize and focus your comments to afford as many as possible, the opportunity to speak. The amount of time allowed for each speaker will be dependent upon the number of people requesting to speak. Please prepare for the time limit for each speaker to be in the 2 – 5 minute range.

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MPSC Energy Policy Forum

03-18-2013

WMU Campus

part 1 of 2

Comments, Michelle Rison.

I partook in the first graduating class of Michigan Tech's Environmental Engineering program some 22 years ago... Environmental illnesses have become recognized since the environmental engineers came to be. Most have heard of chemical sensitivities or sick building syndrome. Today I will speak of electro-hyper sensitivity, or EHS.

My Focus is health, safety and cost.

I am inspired to speak of my personal situation after Cary Shindelcker shared his family's tragic experience w/ the Mason County Wind Farm at the GR forum.

For many of you EHS is a new term. EHS is related to electromagnetic radiation. Electromagnetic radiation is unseen, surrounds us and is known as electro-smog. Most have never considered that electro-smog can be felt, or affect one's body. One seldom considers something electrical when they are tired, feel less than stellar, or when their mind is dis-combobluted. Try noting this potential connection sometime.

Let us speak of Health.

Our bodies are electrical in nature. We have an explosion of electrical- brain related illnesses such as alzheimers, autism, ADD, MS, depression, anxiety & panic attacks. We have mystery illnesses such as fibromyalsia, chronic fatigue syndrome and brittle diabetes. And a rise in cancers including the brain & prostate areas, most near our cell phones. Please see the Bio-Initiative Report of 2012. We are also a country of sleep-deprived individuals.

Who here, w/ a show of hands, falls asleep easily and unaided, stays asleep, and awakens happy, alert, and refreshed each morning? (You have indeed created a sleep sanctuary.)

Have you considered your sleeping environment?

**Do you recall camping as a kid... away from everything and how well you slept?
Was it the fresh air, or lack of all things electrical?**

**Consider where you sleep now. Are you near your electric meter or service panel?
Do you have water or gas pipes beneath you that could carry electrical anomalies?
How about furnaces or AC units? Cable, tele, wi-fi or Satellite?**

Consider what techno gadgets are on. Baby monitors, DECT phones, cell phones, computers, televisions, CFL lights and even some LEDs. All of these items emit

electro-smog. I challenge you to explore unplugging for the next 4 weeks to see if your sleep patterns change.

Let us speak of Cost.

Techno gadgets are a personal choice. We Opt-In as we purchase them directly, and intentionally. This is not the case w/ utility smart meters. For example, Consumers Energy is allocating \$750M for 1.8M electric smart meters. This equates to a capital expenditure of \$417 per household. Where is this \$750M coming from? How is it being funded? Who ultimately is responsible for this money? On top of this, the MPSC allows for a 10% profit on all capital expenditures, which equates to another \$42 per household or \$75M allocated for sheer smart meter profit. All this to replace meters that still have a useful life. It is not appropriate to force a device w/ unknown and controversial, potential and real affects that cannot be dismantled on any homeowner. Health & fire smart meter related concerns are worldwide. Furthermore, it is outrageous to be charged fees for Opting Out, after already paying in some manner, the \$460 cost of said meter.

Let us go back to Health.

Please consider how precious water is. Does anyone consider that we now place antennas on water towers and ground our electric service panels to the municipal water system – which connects to the water-towers. Thus, we have already coupled frequency and electricity in our water system infrastructure. Are we affecting the molecular structure of the water we drink? My home, and 2 neighbors, have measurable current on our water lines, as well as cable and gas. I am aware of 3 water line failures in my neighborhood that were replaced at homeowner expense. AC converts to DC in the presence of minerals found in water. The converted DC, originating from utility stray current is then what corrodes the pipes.

Retired MI State Professor Hillman, an advocate for dairy farmers affected by stray voltage has measured a radio station from the United Kingdom on his water lines. This was found to seriously affect his health. He resolved this by installing a rubber insulative coupling on his water main to interrupt the conductivity of his water lines.

Let us speak of all smart meters.

We are now in the process of adding additional Radio Frequencies, to our entire utility infrastructure w/ electric, gas and water smart meters. We are creating an entire infrastructure of radio frequency, a giant antenna, an inductive circuit, that we cannot extricate from. Furthermore, our future is set to include RF chipped appliances, creating another continuous stream of in-home electro-smog.

Let us speak of Health & Safety.

Two unintended benefits of electric smart meters come to mind. The first benefit of electric smart meters is the possibility of determining the true extent of transmission line loss by actually comparing how many electrons are

Hold
time

Hold
time

Hold
time

moved from the generating station as compared to how many electrons are used in a given period of time. With this knowledge, transmission line losses will be revealed. The questionable line loss range of 7 to 70% and the subsequent issue of the undersized neutral can finally be put to rest as well as truly targeting grid-wide energy efficiencies.

A second benefit of a \$460 smart meter will be locating electrical anomalies. This will be noted with discrepancies in billing, or by resulting house fires. An aside, some smart meter fires have not been insured since smart meters are not UL listed. Back to locating anomalies,

... Anomalies exist as stray voltage, current, frequencies, electro static charges, sparking, and impulses and are present on electric, gas, water, cable and tele utilities. These are real grid issues that are not being addressed. Smart meters will only compound this. These issues are present at my home, and in my neighborhood. The electric company considers this normal. What the utility deems as normal has kept me from living in my home for the better part of 3 years.

I can sense these anomalies and feel them thru out my body
Which leads to my personal Health circumstances.
I actually had the power removed from my property and lived w/out electricity for some 6 months. Electricity is precious. Refrigeration, a god-send.

I became electro-sensitive because of electrical anomalies present at my home. I had been unable to sleep for more than a few hours a night for months on end. My body sizzles and shakes when in a sensitized state. I can sense impulses that put me in a continual state of terror at a cellular level. My mind is affected. EHS is absolutely intolerable.

I have been hospitalized some 10 weeks of the past 6 months. The bill to my insurance company for the first hospital stay was \$64K. I have yet to receive the second. What a burden to our health care system. I stopped counting at 18, back in November, how many times I have moved since June. I stopped counting at \$100K what this has cost me out of pocket to try and evaluate, fix, shield, heal and pay to live elsewhere. I recently found 2 therapies that have helped. I have had my metal Hg fillings removed and now have my memory erased every other week w/ electro-convulsive shock therapy so I can continue to walk this planet. There are many like me. (A wonderful resource for those experiencing homelessness from environmental illness is the non-profit www.Reshelter.org.)

My question to this forum is it truly cost effective to exchange our health for real or perceived energy savings? Before we move any further we need to consider the health affects of what already exists, and any new technologies we plan to add.

Unplug. Sleep Sweet. Namaste

i'm not for's Nick externalities



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If you wish to speak today, please complete the following:

Name: Brett Little
Affiliation (if any): Alliance for Environmental Sustainability
Phone: 888-533-3274
Email: brett.little@alliancees.org

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

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If you wish to speak today, please complete the following:

Name: Samuel T. Field

Affiliation (if any): Helios Solar LLC

Phone: 269-343-5581

Email: samfield@helios-power.com

Topics you wish to address today:



- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): Property Taxes

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If you wish to speak today, please complete the following:

Name: Chad Jones

Affiliation (if any): Parker - Arntz Plumbing & Heating

Phone: 616-890-3540

Email: cjones@parkerarntz.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

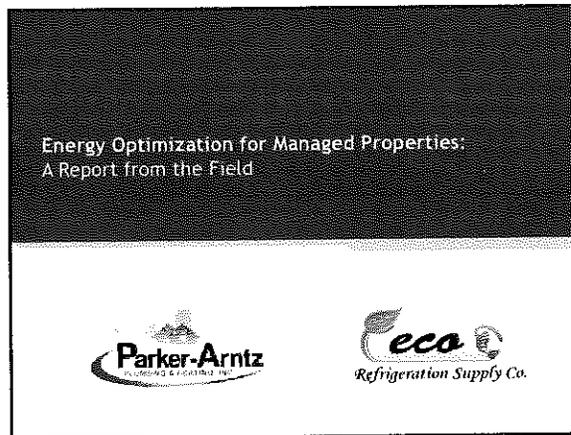
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Have a powerpoint.

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Good afternoon, I'm Chad Jones, Vice President of Parker-Arntz Plumbing & Heating, a full service mechanical contractor--and its recently formed subsidiary Eco-Refrigeration Supply, which is an energy conservation services initiative--all based in Greenville, MI. Let me first thank Director Bakkal and Chairman Quakenbush for this opportunity to share our insights today—we contractors on the front line of energy conservation measures appreciate being heard. I want to tell you about a few issues that currently prevent us from even greater progress, and also point out what appears to be working very well. Let me begin with the treatment of different energy classes and use of incentives to promote energy savings in both new and existing commercial and residential projects, and especially market rate and/or income-qualified multi-family properties.

Classifications & Incentives

Boiler Type	Incentive	Unit
HVAC Boiler 86% to 89.5% AFUE or Combustion Efficiency - Level 1	\$ 1.00	MBH
HVAC Boiler at Least 90% AFUE or Combustion Efficiency - Level 2	\$ 2.00	MBH
Process Boiler at Least 82% AFUE or Combustion Efficiency (hot water or steam)	\$ 2.00	MBH
Furnace/Unit Heater Type	Incentive	Unit
High-Efficiency Furnace or Unit Heater at least 90% (up to 200 MBH)	\$ 350.00	LR
High-Efficiency Furnace or Unit Heater at least 90% (greater than 200 MBH)	\$ 1.75	MBH
Infrared Heater Type	Incentive	Unit
Infrared Heaters (Consumers Energy electric and natural gas customers*)	\$ 8.00	MBH
Infrared Heaters (Consumers Energy natural gas only customers*)	\$ 5.00	MBH
Specialty/Other Fan Type (See Administration Manual)	Incentive	Unit
Dehumidification Fans (also greater than 15 degrees)	\$ 0.04	Square Foot

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Regarding the treatment of utility classes: Some of our clients hold properties operating in multiple utility service regions and some clients who operate similar HVAC systems installed in different buildings find them inconsistently incentivized.

Situations like these lead to multiple challenges , for both property management and contractors like Parker Arntz, as we work together to improve energy efficiency.

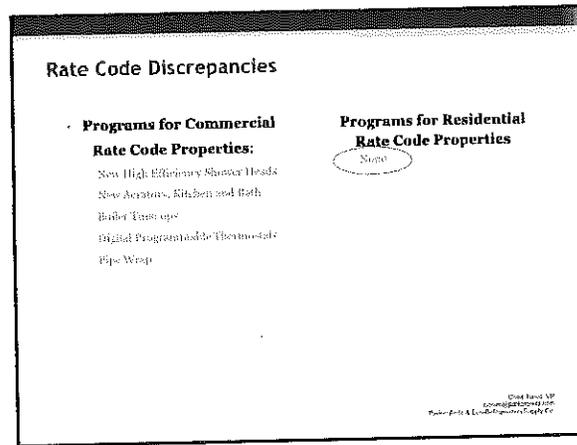
Different Utilities—Different Incentives—Same Measures		
\$1.36	\$0.25	\$0.21
		
*Note: Based on payment to contractor per MBH		
<small>©2010 DTE Energy, Consumers Energy, Efficiency United</small>		

The first challenge is that incentive levels, incentive processing and contractor compensation are different for the same measures across various programs.

Consider, as an example, a boiler tune-up in a typical 5 unit multifamily property with a 110 MBH (1000 Btu per hour) boiler:

DTE offers \$1.36 per MBH for a tune up
 Consumers Energy--\$.25 cents
 and Efficiency United? .21 cents.

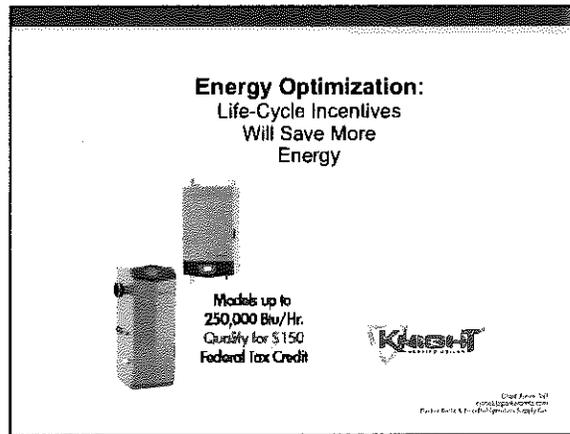
Not only are there differences between utility companies, there are differences between various programs within a single company. We believe that unified incentives within the utility incentive programming will benefit everyone!



Another situation arises when a property owner has similar systems installed in buildings with a different rate code. Again, the incentives, incentive processing and contractor compensation can vary significantly. Take for example two 24 unit properties, managed by the same company, located only two miles apart, and utilizing virtually identical boiler/domestic water heater systems. One unit has A commercial rate code, which qualifies for all of the DTE/ MICHCON programs. The other property, which has a residential rate code qualifies for none of the programs just mentioned---not one. Such differences often confuse and frustrate property owners. They see the system as being not very efficient. In some cases, the differences are enough to prevent needed upgrades from being installed, thereby wasting an opportunity for not only greater energy conservation, but also the qualitative improvement of the structure and its occupied spaces.

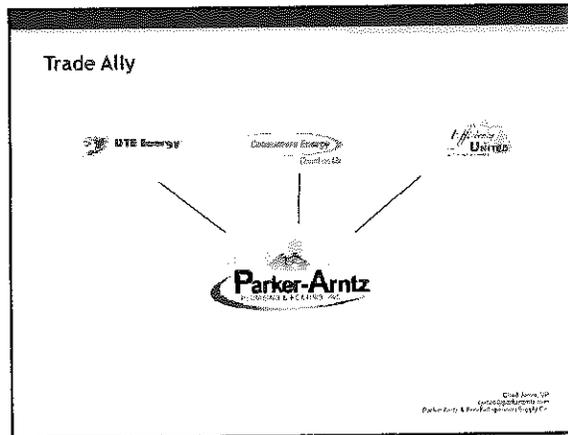
As an organization on the front lines of these two initiatives, Parker-Arntz encourages the MPSC and policy makers to create an incentive structure with a framework of standards that allow for navigating across utilities and across programs.

Additionally, we suggest creating a mechanism that allows for variances in billing class to be considered when that billing class provides disincentive or inhibits the installation of prescriptive measures.



We think energy optimization incentives go directly to the triple bottom-line of Michigan's sustainable future, and encourage the MPSC as well as other policy makers to ensure these incentives continue their significant impact.

We would also like to propose creating incentive mechanisms for even deeper energy saving measures; that is, ones that factor in the life-cycle savings rather than only first-year savings of those measures. Doing so will increase customer uptake and better align incentive programs with generally accepted financing principals.



My direct responsibilities at Parker-Arntz have been to oversee the expansion of our services into energy conservation measures, establishing energy analysis and ASHRAE auditing standards for Energy Conservation Measures implementation. In 2012, we became a trade ally of DTE, Consumers Energy and Efficiency United, helping them to reach their energy-saving goals, using good engineering practices, and quality workmanship.

These alliances have resulted in:

251 boiler tune-ups
and 5032 furnace tune-ups.

We installed 1909 programmable thermostats,

2257 high-efficiency showerheads,

5005 faucet aerators,

4872 CFLs,

15 boiler reset controls,

and 10,144 pieces—equaling over 5 miles—of pipe-wrap insulation!

Prescriptive Measures Installed: 2012

251 boiler tune-ups
5032 furnace tune-ups
1909 programmable thermostats
2257 high-efficiency showerheads
5005 faucet aerators
4872 CFL light bulbs
15 boiler reset controls
10,144 pieces of pipe-wrap insulation

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The one-year revenue from the direct installs and energy efficiency retrofits through these three utility programs was \$449,000. Certainly, without these utility programs and their incentives, Parker-Arntz would not have been able to secure this valuable opportunity for new business. And for that, we are very grateful. We believe this growth is the result of a phenomenon we call 'Givers Gain'.

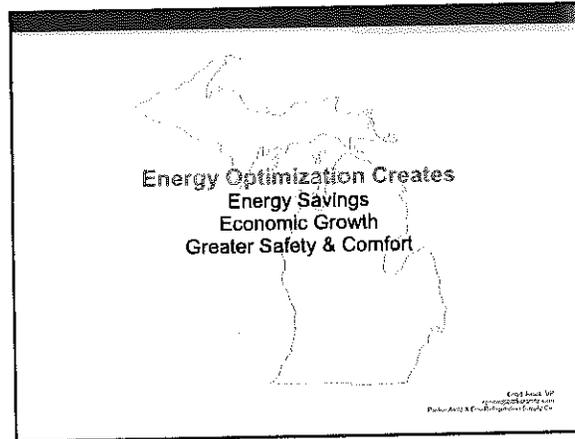
As the 'Giver', Parker-Arntz worked diligently with all three utility programs to help them reach their savings goals.

We invested in the necessary training and outfitting of our crews.

We 'gave' as some individual installations were done at a loss, but more frequently as a break-even proposition.

We also 'gave' as we spent a good deal of time educating property owners and managers on the other utility based incentives available through their utility providers.

But, because we assess the HVAC equipment of each building we go into, we are able to identify health, safety and efficiency issues of dangerous, out-dated and inefficient HVAC systems. By getting this access and following this process, we identified and replaced a total of 77 furnaces, and 6 boilers. Some of those furnaces were operating with cracks in their air exchangers, a very dangerous situation for that buildings occupants. We also conducted other efficiency upgrades resulting in even more energy savings for our clients.



So, the 'Gain' for Parker-Arntz was \$670,000 of additional opportunity and an expansion of our workforce by additional 9 employees.

As I mentioned before, we place a high value on the incentives provided through the Energy Optimization utility policies.

Because of them,

Our business has grown

Our customers have saved money and energy

And, I dare say, lives may have been saved.

Thank you again for this opportunity to speak to you all today.



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MICHIGAN ENERGY OFFICE
STEVE BAKKAL, DIRECTOR

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If you wish to speak today, please complete the following:

Name: LARRY KAUFMAN

Affiliation (if any): MGFA - EXECUTIVE DIRECTOR

Phone: 248-396-8231

Email: ENERGYC2AR@SBCGLOBAL.NET

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): GEO THERMAL

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MPSC Discussion

Larry Kaufman-executive director Michigan Geothermal Energy Association
248-396-8231 energyczar@sbcglobal.net

My name is Larry Kaufman. I am the executive director of the Michigan Geothermal Energy Association. This association promotes the use of geothermal heat pumps which lower the customer's utility bills and create jobs in the State of Michigan.

For full transparency, during the past 17 years I have been the energy expert for DTE Energy. I retired from DTE in November 2012. Therefore, my comments are completely independent from DTE. They can speak for themselves.

I am also the Vice President of the Michigan Interfaith Power and Light. While Michigan IPL supports my position, I am not speaking for them either. They will also have their own speaker.

I am here to speak about geothermal. I installed geothermal into my own home in 1998. I have a 2600 square foot home with a 1,200 square foot basement. I keep my house at 71 degrees in the winter and 73 degrees in the summer. During the past 14 years, my heating and cooling bills have averaged about \$60 a month. It is my opinion that you cannot have a serious conversation about energy optimization without including geothermal. I have 60 CFL's in my house. They pay for me to take my wife out to dinner. My geothermal pays for my vacation. I am not here to talk about energy optimization.

I am here to talk about geothermal as a renewable energy source. Why is my geothermal 5 times as efficient as a propane or oil furnace and twice as efficient as an air conditioner? Because it uses the heat in the ground which keeps the temperature at 50-55 degrees year round when you get 5 feet below surface. What provides the heat that is in the ground? The sun.

I installed 2.4 KW of solar panels about 2 /12 years ago. The sun shines on the panels and the panels covert them to electricity. This electricity is used in my house. The excess is purchased by DTE Energy, and I receive a renewable energy credit of .11 cents per kWh for each kWh I produce.

Geothermal is really the same. Let's look at summer as it is apples to apples with electricity when compared to an air conditioner. The sun heats the ground which allows the geothermal system to cool the house using half as much electricity as an air conditioner. Saving 50% of electricity is better than producing 50% as there is reduction efficiencies in production and transmission.

Rob Dersksen from Michigan Energy Services calculated that a 4 ton geothermal system (I have a 4 ton system) rejects 8,021 kWh (27,375,700 btu's) to the earth during the summer. My

2.4 kW solar panels produce about 1,700 kWh per year of which 1,400 are during the summer. Therefore a geothermal system is producing about 5 times the kWh as my solar panel. Both systems cost me approximately \$20,000 to install. Even cutting the geothermal kWh by 50% to compare against air conditioning still is more efficient than a solar panel. Therefore, I contend that geothermal should be considered a renewable source and the public utilities should pay a renewable energy credit to the geothermal owner. This is currently being done in Wisconsin and Maryland.

There are two major questions. One- what is the carbon footprint of geothermal vs. other heating system. Two- how does increasing geothermal sales effect the utility.

For the first question DTE Energy did a complete engineering study about 7 years ago. They concluded that geothermal is the same or better in terms of carbon footprint as other forms of heating. This was when we did not have any wind energy. In 2015 we will have 10% wind energy which will make the geothermal carbon footprint even less.

In terms of utilities, geothermal helps utilities lower their rates and be more efficient. Any manufacturer will tell you that they want a plant to run every day making the exact same amount of product. The worst thing is highs and lows of production. A utility has excess capacity in the winter and has shortfalls of energy in the summer during hot days. This forces utilities to purchase summer energy- sometimes at very high prices.

Geothermal reduces energy in the summer as it is twice as efficient as an air conditioner. Geothermal increases energy usage in the winter as it adds revenue that was going to propane or oil furnaces. Michigan has more propane furnaces than any other state in the country. The high cost of propane and oil is a barrier in improving the Michigan Economy. Geothermal balances the load between summer and winter which increases utility efficiency and reduces rates.



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If you wish to speak today, please complete the following:

 County
Commissioner

Name: John Taylor

Affiliation (if any): Citizen

Phone: 815-245-7160

Email: taylorjt91@yahoo.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

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If you wish to speak today, please complete the following:

Name: MATT ROSENDAUL

Affiliation (if any): GREAT LAKES HOME PERFORMANCE LLC

Phone: 517-712-7665

Email: MATT@GREATLAKESHOMEPERFORMANCE.COM

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

Please prioritize and focus your comments to afford as many as possible, the opportunity to speak. The amount of time allowed for each speaker will be dependent upon the number of people requesting to speak. Please prepare for the time limit for each speaker to be in the 2 – 5 minute range.

Please leave a copy of any written or electronic materials at the welcome center.

You are encouraged to submit written feedback at www.michigan.gov/energy.

Sustainable Energy Optimization Programs through Market Creation

Speaker: Matt Rosendaul, Great Lakes Home Performance, LLC
517-712-7665 / matt@greatlakeshomeperformance.com

Targeting fewer homes with deeper and more durable energy saving measures by fostering home performance businesses and creating market demand for their services.

As a result of PA295 and other stimulus programs, there are now dozens of new Michigan based companies employing hundreds of certified home performance professionals. In order to assure continued growth of this new market, support and assistance is still needed because this new market is still in its infancy. The end goal of any new legislation should be the continued operation of these businesses in the absence of incentives, programs, or additional legislation.

The next version of this legislation should support the creation of this new market in the following ways:

- Fund the recruiting, training, and equipping of energy efficiency companies and professionals
- Offer incentives for contractors who perform high quality work
- Continued customer incentives for installed energy improvements, but with additional rebates for the contractors as an incentive to sell improvements
- Emphasis on rebates directed to the contractor directly (in most of the current programs, contractors can offer customers "instant" rebates by having the homeowner assign the rebate to the contractor but very few contractors participate)
- Creation of a system wherein customers can pay for a portion of their improvements with the savings they generate
- Increased use of the Home Energy Rating System (HERS) in real estate transactions (i.e. within mortgage calculations* and inclusion on MLS property profiles (which is already being done in Traverse City))

***NOTE:** The SAVE Act is proposed legislation to improve the accuracy of mortgage underwriting used by federal mortgage agencies by ensuring that energy costs are included in the underwriting process. The bill, S. 1737 [112th Congress], was introduced on Oct. 19, 2011, by Senators Bennet (D-Colo.) and Isakson (R-Ga.) and referred to the Committee on Banking, Housing, and Urban Affairs. **ACEEE found that SAVE would generate 83,000 jobs and \$1.1 billion in consumer energy bill savings in 2020 nationwide.**

Market creation and transformation measures such as these are not only more sustainable, but also offer more substantial and durable measures. The current programs place too much stock in small, temporary measures which are entirely dependent on homeowners keeping them in place. CFL light bulbs will be bought by homeowners anyway; low flow shower heads and faucet aerators last only until the homeowner changes fixtures, and most programmable thermostats are set to maintain the same temperature 24/7. The current energy optimization program however assumes large savings from these measures. Durable measures such as insulation, air sealing, and duct sealing, outlast the legislation and the occupancy of the house and will function regardless of homeowner lifestyle.

The outcome of the new legislation needs to be a free market system where customers demand energy improvements and can find plenty of qualified contractors. The incentives for the homeowner are the energy savings, increased comfort, health, safety, and durability of their homes. The outcome for the State of Michigan is not only the energy reduction and environmental stewardship, but the creation of businesses, jobs, and a well trained workforce.



STATE OF MICHIGAN



DEPARTMENT OF LICENSING & REGULATORY AFFAIRS
MICHIGAN PUBLIC SERVICE COMMISSION
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GOVERNOR

MICHIGAN ECONOMIC DEVELOPMENT CORPORATION
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STEVE BAKKAL, DIRECTOR

Readying Michigan to Make Good Energy Decisions Michigan Energy Public Forum Statement Card

If you wish to speak today, please complete the following:

Name: Wendy Denning

Affiliation (if any): _____

Phone: 1-269-720-9387

Email: wendysue.denning@gmail.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

Please prioritize and focus your comments to afford as many as possible, the opportunity to speak. The amount of time allowed for each speaker will be dependent upon the number of people requesting to speak. Please prepare for the time limit for each speaker to be in the 2 – 5 minute range.

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Submitted by: Wendy Denning, 12841 M-89, Plainwell, MI 49080

wendysuedenning@gmail.com

Thank you for the opportunity to address you today. I am here to lend my support to wind generation. Our great state has four major universities boasting their engineering departments, I feel we should use them as a resource to take the lead in wind generation technology.

Govenor Snyder you made a presentation at the Kellogg Biological Station in November, 2012, on energy and resources in Michigan. At that presentation you said the next world-wide commodity is going to be water. You said you could not impress upon us how valuable water is going to be in the future. Lucky for us Michiganders' water is Pure Michigan's greatest natural resource. I concur with you about the importance of fresh water, we need to protect it. As a result I am here to speak out against drilling for gas in Michigan.

I understand I have three to five minutes. That is not enough time to even scratch the surface of the dangers of slick water horizontal hydraulic fracturing. I will do my best to defend my objection.

A year ago if asked if I thought drilling for natural gas was a good idea, I'd have said "Heck yes." Then last summer I learned about the sale of the mineral rights in the Barry Co State Game Area, which is in my back yard. I decided I needed to do a little homework. I began my research on the Michigan DEQ and DNR websites. The web sites assured me there have not been any incidents or accidents as a result of gas drilling in Michigan, and that it has been going on for over fifty years.

I expanded my research to other states, and discovered there have been many very serious incidences of public harm in areas near well sites. I learned that the information on the DNR and DEQ's web sites are extremely elementary and incomplete. Drilling has been going on without incident in Michigan for over fifty years. However, slick water horizontal hydraulic fracturing, or fracking, is only about ten years old, and there are, I believe, only 14 slick water horizontal hydraulic fracturing wells in Michigan. So the DNR and DEQ websites are very misleading. I was shocked and disappointed. The DEQ and DNR are the very safety organizations I count on for accurate information regarding the environment. It is my expectation that the DEQ and the DNR, as well as my elected representatives, will learn all that is humanly possible about an issue effecting public health. Especially when its an issue whereby my elected officials will be making decisions that will effect my quality of life.

I recognize Michigan's economy stands to gain enormously from fracking. It'd be one thing if America needing Michigan's gas. But it doesn't. Here's an article in Harper's explaining that N. Dakota alone has enough oil to render the US independent of foreign oil. It also states there is a glut of gas and oil in America right now. It is not imperative to America that Michigan's natural gas be mined. It IS imperative to Michigan that our water be protected. Water is the commodity Michigan needs to protect, not waste.

I just read an article in the Kalamazoo Gazette about a well in Kalkaska, drilled by Encana Corp, where they used over 21 million gallons of fresh pure Michigan Water. 21 million gallons. That's ludicrous! And as you know, the water used in fracking is contaminated with up to 650 chemicals, many of which are human carcinogens. What is the state going to do with 21 million gallons of poisonous water, per frack? Multiply that by the thousands of wells the gas companies hope to drill in Michigan. Where is the water coming from, and where is it going to go once its poisoned?

This, at a time that the water levels in Lake Michigan and the inland lakes are at an all time low. This is not good public policy.

In the same article the Chairman of the Michigan House Committee on Energy and Technology stated that "after peer reviews of over 200 documents, the EPA failed to find one case of underground drinking water contamination from the (fracking) process". That's a very disturbing statement, because other states indeed have incidences of drinking water contamination from fracking. I am submitting to you an in-depth study by scientists from Cornell University, which states, in the summary:

"Without complete studies, given the many apparent adverse impacts on human and animal health, a ban on shale gas drilling is essential for the protection of public health."

I have many other reasons for supporting a ban on slick water horizontal hydraulic fracturing in Michigan, and will list them until my time runs out.

The gas and oil companies are exempt from the Federal EPA laws: Clean water act, safe drinking water act, and the Superfund act. That gives them carte blanche to rape our land, poison our water, and leave without any responsibility for cleaning up their mess.

In the future Michigan's pure water will be more valuable than natural gas is now. Water is necessary for life, natural gas is not. You can't drink natural gas.

Fracking will destroy the beauty of our rural areas. It will turn them into industrial waste lands. It will destroy the quality of life of the area residents with the onslaught of temporary workers setting up shanty towns. They'll make a mess then leave us local tax payers to clean it up.

The slimy way in which the gas company leasing agents try to convince people, many aging farmers, to sign their super secret leases. How they don't disclose that if your barn is in the path of their access roads, they'll tear it down. Or how you cannot discuss your lease with your neighbors.

I believe in the long run, the dangers of fracking in Michigan outweigh the risk. I support a ban on Michigan slick water horizontal hydraulic fracturing.

Scientific Solutions

**IMPACTS OF GAS DRILLING ON HUMAN
AND ANIMAL HEALTH**

**MICHELLE BAMBERGER
ROBERT E. OSWALD**

ABSTRACT

Environmental concerns surrounding drilling for gas are intense due to expansion of shale gas drilling operations. Controversy surrounding the impact of drilling on air and water quality has pitted industry and leaseholders against individuals and groups concerned with environmental protection and public health. Because animals often are exposed continually to air, soil, and groundwater and have more frequent reproductive cycles, animals can be used as sentinels to monitor impacts to human health. This study involved interviews with animal owners who live near gas drilling operations. The findings illustrate which aspects of the drilling process may lead to health problems and suggest modifications that would lessen but not eliminate impacts. Complete evidence regarding health impacts of gas drilling cannot be obtained due to incomplete testing and disclosure of chemicals, and nondisclosure agreements. Without rigorous scientific studies, the gas drilling boom sweeping the world will remain an uncontrolled health experiment on an enormous scale.

Keywords: hydraulic fracturing, shale gas drilling, veterinary medicine, environmental toxicology

At what point does preliminary evidence of harm become definitive evidence of harm? When someone says, "We were not aware of the dangers of these chemicals back then," whom do they mean by *we*?

—Sandra Steingraber, *Living Downstream* (Da Capo Press, 2010)

by the tobacco companies had a devastating and long-lasting effect on public health from which we have still not recovered [7], and we believe that a similar approach to the impacts of gas drilling may have equally negative consequences.

Although reports of petroleum hydrocarbon exposure in humans [8-14], primates [15], and several other species, including ruminants [16-26], horses [27], wildlife [28], and a dog [29], have been cited in the literature, there are few reports on exposure of animals to gas operations, and to our knowledge, no case reports on exposure of humans to hydrocarbon gas operations [30]. Adler et al. [31] observed aspiration pneumonia in sheep following exposure to gas condensate. In another study, Waldner et al. [32] found no association between the productivity of cattle and exposure to a sour gas pipeline leak; while in a longer-term study [33] in cattle, the same group reported associations between sour-gas flaring and increased risk of stillbirth across three of the four years studied, as well as increased risk of calf mortality in one of the years studied. In a study of habitat selection, Sawyer et al. [34] found that mule deer tended to move away from areas of gas development, and in a recent report [35] from the same author, the deer population dropped by 45 percent in one year, and the survival rate decreased.

Just as epidemiologic studies linked smoking to human health impacts, such studies could be used to assess the health impacts of gas drilling operations on human beings. Studies in laboratory animals have also been a powerful tool for linking components of tobacco smoke to cancer, not only because controlled studies can be done but also because breeding cycles are short and the age at which cancer develops is within a range accessible to laboratory studies. Though such controlled animal studies of the effects of gas drilling are not feasible, animals can nevertheless serve as sentinels for human health impacts. Animals, particularly livestock, remain in a confined area and, in some cases, are continually exposed to an environmental threat. Further, effects on reproduction can be more readily assessed in a herd of cattle than in a human population, simply due to the higher rates of reproduction.

For the past year, we have been documenting cases of animal and owner health problems with potential links to gas drilling. Many cases are currently in litigation. To protect individuals' privacy and due to ongoing legal action, the discussion will not include personal identifying information. We summarize the results of our investigation, provide several case studies, and conclude with recommendations for minimizing or preventing similar problems in the future. This study is not an epidemiologic analysis of the health effects of gas drilling, which could proceed to some extent without knowledge of the details of the complex mixtures of toxicants involved. It is also not a study of the health impacts of specific chemical exposures related to gas drilling, since the necessary information cannot be obtained due to the lack of testing, lack of full disclosure of the International Union of Pure and Applied Chemistry (IUPAC) names and Chemical Abstracts Service (CAS) numbers of the chemicals used, and the

associated with faulty well casings and failure of blowout preventers; in our study, wastewater dumping and leakage, failure of a blowout preventer, and affected well water involving conventional gas wells were associated with both animal and human health problems.

By the standards of a controlled experiment, this is an imperfect study, as one variable could not be changed while holding all others constant. It also is not a systematic study that will provide the percentage of farms with problems associated with gas drilling, but the design is such that the study can illustrate what can happen in areas experiencing extensive gas drilling. It is also possible to observe temporal correlations between events such as well flaring and air quality, or hydraulic fracturing and water quality leading to toxicity. In two cases, spatial differences (cows in a single herd, with some allowed access to a creek or pond and others not allowed access) could be used to compare outcomes.

Table 1 summarizes the types of wells involved and the sources of exposure, and Table 2 describes the details of each individual case. In some cases, exposure was due to accidents or negligence, but at other times, it was a consequence of normal operations. Direct exposure to hydraulic fracturing fluid occurred in two cases: in one, a worker shut down a chemical blender during the fracturing

Table 1. Number of Cases, by Type of Gas Well and Source of Exposure^a

Type of gas well	
Shallow vertical wells	4
Deep vertical wells	3
Horizontal high-volume hydraulically fractured wells	18
Source of exposure	
Hydraulic fracturing fluid spill from holding tank	2
Drilling fluids overran well pad during blow out	1
Storm water run-off from well pad to property	3
Wastewater impoundment leak	1
Wastewater impoundment allegedly compromised	1
Wastewater spread on road	2
Wastewater dumped on property	1
Wastewater dumped into creek	3
Wastewater impoundment not contained	3
Well/spring water	17
Pond/creek water	8
Pipeline leak	1
Compressor station malfunction	2
Flaring of well	3

^aTotal number of cases is 24; one case has two types of wells.

Table 2. (Cont'd.)

Case	Type of gas well ^a	Source	Animal	Health Impact
10	HHV	Well/spring water Wastewater impoundment not contained	Ovine Canine Human	Reproduction Sudden death Gastrointestinal, neurological, upper respiratory, burning of eyes, dermatological, vascular, sensory, headache
11	HHV	Wastewater impoundment leak	Bovine	Reproduction
12	HHV	Storm water runoff from well pad	Canine Human	Neurological Gastrointestinal, headache, dermatological
13	HHV	Well/spring water Pond/creek water Pipeline leak	Equine Canine Amphibian Human	Neurological, gastrointestinal, musculoskeletal, upper respiratory Urological, gastrointestinal, musculoskeletal, neurological Sudden death Upper respiratory, burning of eyes, bone marrow
14	HHV	Well/spring water Wastewater spread on road Wastewater impoundment not contained	Canine Human	Reproduction Neurological
15	HHV	Well/spring water	Canine Feline Human	Gastrointestinal, dermatological Dermatological Gastrointestinal, upper respiratory, burning of eyes, vascular, headache

Table 2. (Cont'd.)

Case	Type of gas well ^a	Source	Animal	Health Impact
23	HHV	Well/spring water Wastewater spread on road	Equine Canine Human	Neurological Reproduction, gastrointestinal Reproduction, upper respiratory, burning of eyes, vascular, sensory, headache
24	HHV	Hydraulic fracturing fluid spill from tank	Bovine	Gastrointestinal, neurological, respiratory, sudden death

^aSV = shallow vertical well, DV = deep vertical well, HHV = horizontal high-volume hydraulically fractured well.

process, allowing the release of fracturing fluids into an adjacent cow pasture, killing 17 cows in one hour; the other was a result of a defective valve on a fracturing fluid tank, which caused hundreds of barrels of hydraulic fracturing fluid to leak into a pasture where goats were exposed and suffered from reproductive problems over the following two years. Exposure to drilling chemicals occurred during a blowout when liquids ran into a pasture and pond where bred cows were grazing; most of the cows later produced stillborn calves with congenital defects. Exposure to wastewater occurred through leakage or improper fencing of impoundments, alleged compromise of a liner in an impoundment to drain fluid, direct application of the wastewater to roads, and dumping of the wastewater on creeks and land. The most common exposure by far was to affected water wells and/or springs; the next most common exposure was to affected ponds or creeks. Finally, exposures also were associated with compressor station malfunction, pipeline leaks, and well flaring. In addition to humans, the animals affected were: cows, horses, goats, llamas, chickens, dogs, cats, and koi. Other than photographing and recording the presence of dead and dying wildlife (deer, songbirds, fish, salamanders, and frogs) in the vicinity of affected pastures, creeks and ponds, the effect on wildlife has not been well documented.

Because production animals were exposed to the environment for longer periods and in greater numbers than companion animals, and because most of the farms we documented raised beef cattle, cows were represented to a greater extent than other animals. Exposures through well water, ponds, springs, dumping of

spring, creek or pond. Reproductive problems (irregular cycles, failure to breed, abortions, and stillbirths) and neurological problems (seizures, incoordination, ataxia) were the most commonly reported. Other commonly reported symptoms included those of gastrointestinal (vomiting, diarrhea) and dermatological (hair and feather loss, rashes) origin.

In the majority of cases, owners of animals were exposed upon using their well or spring water for drinking, cooking, showering and bathing. Upper respiratory symptoms (including burning of the nose and throat) and burning of the eyes were the most commonly reported. Headaches and symptoms associated with the gastrointestinal (vomiting, diarrhea), dermatological (rashes), and vascular (nosebleeds) systems were commonly reported.

CASES ILLUSTRATING THE EFFECTS OF GAS DRILLING ON PRODUCTION AND COMPANION ANIMALS AND THEIR OWNERS

Case 1

Two homes (A and B) are located within two miles of approximately 25 shale gas wells. The closest pad, drilling muds pit, and wastewater impoundment are within one mile of both homes; the impoundment is approximately 4.5 acres in area and is at a higher elevation than either home. Two compressor stations are located within one mile of both homes. The owners have a variety of companion and farm animals, and reported no unusual pet morbidity or mortality preceding drilling operations. Predrilling tests on water sources were not done for either home. Soon after drilling began, the owner of Home B noted that her well water had an odor and black sediment, and the owners of Home A observed a decreased quantity of their water sources (a well and a spring). Once the wastewater impoundment was constructed, the owners of Home A noted a dramatic decrease in quantity, as well as poor quality, of both the well and spring water. The spring served as the sole source of water for the owners' farm animals. Approximately nine months after drilling began, the owners of Home A began hauling water from a nearby creek, to supplement the spring water.

Since drilling operations began, both owners have observed wastewater being spread on the roads during all weather conditions, and noted that cats and dogs in their neighborhood licked their paws after walking on the road, and also drank from wastewater puddles; some of these animals became severely ill and died over a period of one to three days following these exposures. According to the owner of Home B, the wastewater impoundment was not initially fenced and animals had direct access to the wastewater. An accident involving the wastewater impoundment was noted by both owners; after filling, a truck carrying wastewater drove away from the impoundment site with an open valve, releasing approximately 20 gallons of wastewater onto the impoundment access

During high-volume hydraulic fracturing, substances that occur naturally in the shale, including arsenic, come to the surface in wastewater. In this case, the wastewater was stored in the impoundment, where aerators misted the chemicals into the air, increasing the chances of inhalation by animals and people; also, surface spillage of wastewater, as noted above, could have contaminated the ground water. Tests on well water from both Homes A and B, and the spring from Home A, did not show elevated levels of arsenic; however, it is possible that, given fluctuations in the water table and water quality, high levels of arsenic may have initiated symptoms in the child in Home B and then dropped to low levels before water testing was done more than one year later. Also, reported arsenic levels may be deceptively low because arsenic can be converted to arsine—a toxic gas that dissipates rapidly [38]. In people, both acute and chronic oral exposure to inorganic arsenic causes gastrointestinal effects as well as effects on the nervous system: short-term effects include headaches, weakness, and delirium, while long-term effects include peripheral neuropathy [39]. Acute exposure of people to arsine can produce many effects including abdominal pain and headaches [39]. Animals exposed acutely to inorganic arsenic may show many symptoms including staggering gait, extreme lethargy, and intense abdominal pain, while animals exposed over a longer period of time may manifest signs including anorexia, depression, and partial paralysis of the rear limbs [40]. Animal studies show that arsenic can also cause fetal malformations and fetal death [41].

As the family in Home B continued to be screened for toxicants, random urine tests on all family members were positive for phenol, a metabolite of benzene, with dramatic increases over a period of a few months. Based on occupational health studies [e.g., 42], the testing laboratory judged these results to be consistent with chronic exposure to 0.5 to 4.0 ppm benzene in the air. The most recent symptoms observed by families in both homes include extreme fatigue, headaches, nosebleeds, rashes, and sensory deficits (smell and hearing). The child in Home B also had difficulty breathing, and again had to be taken out of school. Doctors of the families in both homes warned them to leave their homes for at least 30 days or suffer more severe health consequences. The owner of Home B followed her doctor's advice, and moved her children out of her home, returning each day to care for her animals; the owners of Home A elected to remain at their home to care for their animals. After one month of being away, the phenol levels as well as the symptoms of the children in Home B decreased, while the owner of Home B, who returns to the home for a few hours each day, has increased phenol levels and worsening of symptoms. One of the owners in Home A, who works at home, has experienced worsening of symptoms.

This case illustrates the importance of considering both animal and human health. Animals live among us and are exposed to the same environmental influences; however, they tend to suffer more direct exposure and have shorter life and reproductive cycles. If it were not for the numerous deaths of animals

use; the water for the herd comes from a creek that originates from springs above and below the well pad, and spillover from a pond below the well pad. The gas wellhead is 300 feet from the farmers' house and 250 feet from their water well. The well pad is 75 feet from their barn at higher elevation, and slopes directly down to the door. A one-acre impoundment, used to collect wastewater from the high-volume hydraulic fracturing operations, and a 1/3-acre drilling muds pit, used to collect the chemicals and fluids brought to the surface during drilling operations, were both within 350 feet of the farmers' water well, and within 200 feet of the creek and the pond where the cattle drink.

Soon after hydraulic fracturing operations concluded, the farmers noticed that on the far bank of the wastewater impoundment, two dark spots could be seen adjacent to a 20-acre cow pasture. According to the farmers, these two spots were a concern as they grew in size from day to day; approximately one month after first observing these spots, the farmers found ankle-deep water in one-third of an acre of the pasture with the wet area extending another one-quarter of an acre into the pasture; the pasture grass in these areas appeared to be burned. Fearing their herd drank the wastewater, they voluntarily quarantined their farm and notified the state environmental regulatory agency.

According to the farmers, drilling company workers informed them that the liners of both the wastewater impoundment and the drilling muds pit had two-foot tears, and that the tear in the liner of the wastewater impoundment had caused the leak into the cow pasture. Except for the two bulls, the entire herd was exposed to the wastewater leakage.

Four notices of violations were issued to the drilling company by the state environmental regulatory agency: failure to notify the agency, improperly lined impoundment (pressure testing of liner revealed a failed patch), pollution of a spring and farm pond due to leakage of the impoundment, and mismanagement of residual waste (wastewater leaked from the impoundment onto the ground and surfaced in an adjacent pasture).

Testing of the wastewater in the impoundment indicated the presence of calcium, iron, magnesium, manganese, potassium, sodium, strontium, fluoride, chloride, sulfate, and bromide; there was no reported testing for any organic compounds. Strontium was of most concern: it can be toxic to both animals and people because it replaces calcium in bone, especially in the young, and because it may take years to be eliminated from the body [43]. The state environmental regulatory agency placed a quarantine on the herd such that mature cows would be held from slaughter for six months, yearlings would be held for nine months, calves exposed in utero would be held for eight months, and growing calves would be held for two years. Six of the exposed cows eventually went on to slaughter, and, according to the farmers, there was no testing before or after slaughter.

Pre-drilling tests were not done on any of the cattle's sources of water; post-drilling tests were done and revealed no significant findings. Soil tests done

be changed to facilitate better data collection and to avoid obvious risks to animal and human health.

Practices for Providing Better Assessment of Health Impacts

Nondisclosure Agreements

Nondisclosure agreements between injured parties and corporations make it difficult to document incidents of contamination. Compensation in the form of cash, payment for all settlement expenses, an offer to buy the property and/or payment for medical expenses in exchange for a nondisclosure agreement prevents information on contamination episodes and health effects from being documented and analyzed. Nondisclosure agreements are common in all areas of business and are often essential to protect intellectual property. However, when documentation of health problems associated with gas operations is shielded from public scrutiny by a nondisclosure agreement, this is clearly a misuse of this important business tool and should be prohibited. Likewise the lack of prior testing of air and water, and of follow-up testing during drilling and after incidents of suspected contamination, impedes the analysis of health impacts. Even when testing is done, the results are being withheld from interested parties either by government agencies (e.g., by incomplete responses to FOIA requests) or by the industry. If the industry, government agencies, and the public truly want the facts, then appropriate testing must be done, and full disclosure of all data associated with both baseline and incidents of suspected contamination must be made. Without full disclosure of all facts, scientific studies cannot properly be done. Science should drive decisions on whether or not to use a practice such as shale gas drilling, and until scientific studies can proceed unimpeded, then an accurate assessment cannot be made.

Food Safety

A major problem is the lack of federal funding for food safety research. We documented cases where food-producing animals exposed to chemical contaminants have not been tested before slaughter and where farms in areas testing positive for air and/or water contamination are still producing dairy and meat products for human consumption without testing of the animals or the products. Some of these chemicals could appear in milk and meat products made from these animals. In Case 3, a quarantine was instituted after cattle were exposed to wastewater. However, basic knowledge, such as hold times for animals exposed to chemical contaminants as a result of gas operations, is lacking, and research in this area is desperately needed to maintain an adequate level of food safety in our country [53]. Without this information, contaminants in the water, soil and air from gas drilling operations could taint meat products made from these animals, thus compromising the safety of the food supply.

take into consideration effects at significantly lower concentrations (e.g., endocrine disruption [5]). Furthermore, the disclosure of all chemicals involved in the drilling and hydraulic fracturing processes is not required if a component can be justified as a "trade secret." In order to be complete, air, soil and all sources of potable water used for humans and animals in the vicinity of a well site (at least within 3,000 feet for soil and water tests [57], and five miles for air monitoring, based on dispersion modeling of emissions from compressor stations [58]) must be tested for all components that are involved in drilling and are likely to be found in wastewater, before any work on the site commences. Sampling must then be repeated at intervals following the commencement of drilling as well as upon suspicion of adverse effects. The following practices must be part of a testing protocol:

1. The sampling must be done by a disinterested third party with a clear chain of custody between sampling and testing. A certified independent laboratory must do the testing, and the results must be available to all interested parties.
2. All chemicals (with IUPAC names and CAS numbers) used in the hydraulic fracturing fluid at any concentration for each well must be disclosed to the property owners within a five-mile radius, testing laboratories, local governments, and state agencies. Material Safety Data Sheets (MSDSs) for each chemical and chemical mixture must accompany this disclosure. Following this procedure will allow prior testing to be targeted to specific chemicals to be used in the drilling process for a specific well, as well as providing valuable information to first responders and hospital personnel in the case of an accident.
3. Upon suspicion of adverse health effects, testing must include air, soil, wastewater, all sources of drinking water, and blood, urine and tissue samples from affected animals and humans. If methane is present in drinking water, isotopic analysis to determine the origin (thermogenic vs. biogenic) must be done.
4. As illustrated by several cases we documented, air canister tests are essential. This must be done as a baseline before drilling begins and during and after well flaring. It must also be done after a wastewater impoundment and a compressor station have been established.
5. Any fracturing fluid chemicals and chemicals released from the shale that are known or possible human carcinogens, are regulated under the Safe Drinking Water Act, or are listed as hazardous air pollutants under the Clean Air Act must have MCLs, which are set by the EPA. Many of the chemicals to which both people and animals are exposed as a result of high-volume hydraulic fracturing are not listed as primary contaminants, and thus have no enforceable MCL. More than half of the chemicals listed as toxic chemicals in a recently released U.S. House of Representatives report [59] have no MCL.

wastewater should be stored in open impoundments. Whereas this may be economically advantageous to the drilling company, the environmental and agricultural impacts are too great to allow this practice to continue. In Pennsylvania, some progress has been made in recycling increasing fractions of the wastewater. This decreases the total volume of wastewater but increases its toxicity due to the successive increase in the concentrations of total dissolved solids. The alternative is to store wastewater in metal containers at the drilling site before it is removed for disposal.

Finally, the disposal of wastewater presents significant environmental risks. Cases of alleged dumping of untreated wastewater in streams have been documented in the press (e.g., [60]). In the southwestern United States, wastewater is disposed of in injection wells; however, the prevalence of nonporous sandstones and shales in Pennsylvania and New York State largely precludes the use of disposal wells. An earthquake of magnitude 3.2 was associated with injection into a hydraulically fractured vertical well on February 3, 2001 near Avoca, New York [67], suggesting that seismic considerations may further limit the development of injection wells in New York State. Similar seismic occurrences in other parts of the country, most recently in Ohio [68], may mean that New York and Pennsylvania will have fewer options for disposal of wastewater due to shale gas drilling. In May 2011, a voluntary moratorium was placed on the acceptance of hydraulic fracturing wastewater at sewage treatment plants in Pennsylvania. These plants are not equipped to handle either the radioactive and toxic compounds or the high salt content of this waste, and the increased use of recycling has magnified the problem. Discharge of water treatment plants into the Monongahela River led to the contamination of drinking water in Pittsburgh in 2010 [63]. Sewage treatment plants clearly are not a viable option for disposal of wastewater, and despite the industry's progress in recycling, suitable injection wells are unlikely to be located to support the scale of drilling planned in Pennsylvania and possibly New York State.

CONCLUSION

Animals, especially livestock, are sensitive to the contaminants released into the environment by drilling and by its cumulative impacts. Documentation of cases in six states strongly implicates exposure to gas drilling operations in serious health effects on humans, companion animals, livestock, horses, and wildlife. Although the lack of complete testing of water, air, soil and animal tissues hampers thorough analysis of the connection between gas drilling and health, policy changes could assist in the collection of more complete data sets and also partially mitigate the risk to humans and animals. Without complete studies, given the many apparent adverse impacts on human and animal health, a ban on shale gas drilling is essential for the protection of public health. In states that nevertheless allow this process, the use of commonsense measures

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to reduce the impact on human and animals must be required in addition to full disclosure and testing of air, water, soil, animals, and humans.

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NOTES

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6. All testing expenses must be a part of the cost of doing business for gas drilling companies.

Testing before and during drilling operations is an important part of documenting health effects. If health effects are related to a chemical pre-existing in a pond or well, this would prevent a false association between drilling and water contamination. Alternatively, if a change in chemical composition is correlated to health changes, then a strong justification for compensation is provided. In numerous cases that we documented, compensation was not provided because adequate prior testing had not been done. By doing complete testing, at the proper times, a clear scientific justification can be made for providing or denying compensation. Beyond that, a better understanding of what practices lead to water contamination can be obtained. This will be a benefit to people living in the midst of shale gas drilling and will, in fact, benefit the industry by providing consistent and useful data to guide operations. The current practice of under-testing and denying any link between drilling and water, air, or soil contamination is beneficial to neither the public nor the industry.

Practices for Avoiding Animal and Human Exposure to Environmental Toxicants

As shale gas drilling expands across the northeastern United States, exposure of animals and humans to environmental toxicants can result from negligence, illegal actions, catastrophic accidents (at drilling pads or compressor stations), or normal operations. Negligence and illegal actions are difficult to prevent and may have contributed to the health problems we documented. Suspected illegal dumping of wastewater and the alleged compromise of the liner of a wastewater impoundment were most likely responsible for cattle deaths in two instances that we studied. Cases of alleged wrongdoing [60] illustrate the vulnerability of agricultural operations in the midst of large volumes of toxic waste. Dumping and other intentional violations are difficult to prevent or regulate given the large numbers of small companies involved in servicing drilling operations and the lack of willingness and funding on the part of state environmental regulatory agencies to investigate and fine the gas industry. The prevalence of small subcontractors increases the possibility that best practices will not be followed due to inadequate training and supervision.

Although accidents might be minimized with strict safety standards and careful inspection, regulatory agencies would require sufficient staff to monitor operations. This is obviously not the case in Pennsylvania, where 666 environmental health and safety violations have been reported in 2011 as of June [61]. With a staff of 37 inspectors [62] and 64,939 active wells (as of December, 2010), regulatory oversight is essentially impossible. The situation is even worse in New York State, where only 16 inspectors are currently on the staff of the Department of Environmental Conservation. Although the number of staff

Routes of Exposure

The major route of exposure in the cases documented here is through water contamination. This is perhaps the most obvious problem (seen in all three case studies), but other routes of exposure are of serious concern. Soil contamination can be significant in situations such as that described in Case 3. Although the cases we have documented thus far include only a handful of exposures through affected air, the actual incidence of health effects may be underestimated due to a lack of air sampling. In Case 1, toxicological testing suggested high levels of ambient benzene due to a nearby impoundment pond, but air canister tests were not done at the time. Neither drilling companies nor state environmental regulatory agencies routinely offer air canister tests as a part of testing protocols, and due to the expense, many property owners are reluctant to pursue them on their own. Nevertheless, the effects of air pollution on cardiovascular and respiratory health have been well documented [54], and we believe that exposure to contaminated air may contribute significantly to the health problems of both people and animals living near gas drilling operations. In several cases where air monitoring was done, the results confirmed the presence of carcinogens commonly known to originate from gas industrial processes such as exploration, drilling, flaring, and compression. Thus, the Environmental Protection Agency (EPA) must include a study of air in its congressionally mandated hydraulic fracturing study [55] if it is to be complete.

Testing

The most important requirement for an assessment of the impact of gas drilling on animal and human health is complete testing of air and water prior to drilling and at regular intervals after drilling has commenced. This includes chemicals used in the drilling muds, fracturing fluid and wastewater (the latter contains heavy metals and radioactive compounds normally found in a particular shale [56]). Currently, the extent of testing (particularly for organic compounds) is frequently inadequate and limited by lack of information on what substances were used during the drilling process. In a number of the cases that we have studied, drinking water is clearly unsuitable for human and animal consumption, based not only on the smell and turbidity, but also on pathological reactions to drinking the water. Nevertheless, because of inadequate testing, the water is deemed fit for consumption and use, and neither bottled water nor the large plastic containers known as "water buffaloes" are typically provided for the affected individuals-and even less commonly for animals living on those farms. In Case 1, water was reluctantly provided for the humans (after considerable effort) but not to the animals living on the farm. Even when identified, the health effects of chemicals associated with the drilling process are unknown in many cases. No Maximum Contaminant Levels (MCLs) have been set by the EPA for many of the compounds used, and those that have been set are based on older data that does not

on the cow pasture contaminated by the leaked wastewater revealed high levels of chloride, sulfate, sodium, and strontium when compared to background samples. The liners from both the wastewater impoundment and drilling-muds pit were removed, the affected soil removed, and areas remediated; sulfate concentrations remained at high levels in the cow pasture despite remediation.

During the spring of the first calving season following the leakage of wastewater into their cow pasture, the farmers lost two calves: one calf was aborted late-term, and the other calf lived for approximately seven days before dying [44]; both calves were exposed in utero to the wastewater. In the second calving season post-drilling, the farmers lost 11 out of 17 calves: seven were stillborn, three died a few months after birth and one was born alive but severely ill; the dams of all the calves had previously been exposed to the wastewater. The severely ill calf and a stillborn calf were sent for necropsy: the ill calf was diagnosed with *E. coli* septicemia, and the stillborn calf was diagnosed with goiter (diffuse thyroid hyperplasia); both calves were also diagnosed with low liver vitamin E and selenium.

This case illustrates several important points. First, the testing was not complete. According to the farmers, they were not informed of the chemicals used during either drilling or hydraulic fracturing operations. Testing of the water well and cattle's sources of water excluded organic compounds except for a pasture spring; the wastewater analysis also excluded organic compounds. No toxicology tests were done on live cattle, and the tests at necropsy omitted volatile organic compounds, endocrine disruptors, and many minerals present in the wastewater. The cattle's sources of water were tested only after the farmers lost many calves. Soil tests were not done in the area affected by the leakage of the drilling-muds pit. Second, the cattle were exposed to sulfate in the wastewater for at least one month and to elevated sulfate in the grass and soil [45, 46] for over a year. Studies show that increasing dietary sulfur decreases the bioavailability of selenium [47-50], and that Vitamin E and selenium deficiency is associated with reproductive failure in cattle [51, 52]. Third, the liner tear and subsequent leakage of drilling fluids onto the farmers' land were not considered a potential problem and not officially recorded as a violation by the state environmental regulatory agency. Due to gas drilling operations on their property, the farmers now have 26 head of cattle instead of 33, and have lost 40 to 50 acres of hayfields. These farmers received no compensation from the drilling company for the loss of their animals, damage to their land, or the treatment of the animal health problems they have encountered since gas drilling began.

DISCUSSION

The most striking finding of our investigations was the difficulty in obtaining definitive information on the link between hydrocarbon gas drilling and health effects. However, the results point to a number of ways policies can

soon after shale gas operations began in this neighborhood, the child's doctor might not have ordered toxicology tests, as arsenic poisoning is not a common diagnosis.

Case 2

In this case, a beef cattle farmer had a herd of 96 cattle (Angus Limousine cross) that was divided among three pastures. The farm is located in an area of intensive gas drilling, with two active shallow vertical gas wells on the farmer's property and approximately 190 active gas wells within five miles of the property; of these, approximately 11 are shale gas wells and approximately 26 are deep vertical gas wells. In one pasture, 60 cows (a mixed herd, mostly 5- to 10-year-old bred cows) had access to a creek as a source of water. In a second pasture, 20 cows (bred yearlings) obtained water from hillside runoff, and in a third pasture, 14 feeder calves (8 to 14 months old) and two bulls had access to a pond. Over a three-month period, 21 head from the creek-side pasture died (17 adult bred cows and 4 calves). All the cattle were healthy before this episode. Despite symptomatic treatment, deaths occurred 1 to 3 days after the cows went down and were unable to rise. Basic diagnostics were done, but no cause of death was determined. On rendering, 16 of the 17 adults were found to have dead fetuses, nearly doubling this farmer's losses. Of the 39 cows on the creek-side pasture that survived, 16 failed to breed and several cows produced stillborn calves with white and blue eyes. The health of the cattle on the other two pastures was unaffected; on the second pasture, only one cow failed to breed. Historically, the health of the herd was good, the farmer reporting average losses of 1-2 cows a year in his herd of nearly 100 cattle.

This is an interesting case because it has a natural control group. That is, the cattle that were kept along the creek suffered severe problems while the cattle in pastures at a higher elevation and away from the creek experienced no morbidity or mortality. As discussed below, the contamination of the creek may have been caused by illegal dumping of wastewater. Fortunately, these cows were not taken to slaughter, as they died on the farm. However, they still may have entered our food chain as well as that of our pets: rendering plants produce feed for many non-ruminants including chickens, pigs, cats, dogs and horses, so it is possible that chickens, raised for egg production or meat, and pigs were fed the flesh from these cattle.

Case 3

This case concerns farmers that have raised beef cattle (Herford Simmental cross) for the past 21 years. Before drilling operations began the farmers lost one or two animals out of a closed herd of 33 (yearlings, heifers, mature cows, two bulls) every few years to illness or accident. There is one active shale gas well on the farmers' 530-acre property, and approximately six active shale gas wells within two miles of their property. A private well provides water for the family's

road and onto the road near the property of Home A. Most recently, both the drilling company and the state environmental regulatory agency were notified of a spill from the wastewater impoundment that flowed past temporary barriers and into a creek; based on soil erosion patterns, the owners of Homes A and B reported that this spill had been ongoing for months. Soon after this accident, a malfunction occurred in the wastewater impoundment aeration system, producing a raw sewage smell that persisted in the air around Homes A and B for days and sickened the families in both homes. When the owner of Home A complained, the drilling company offered to pay motel expenses for her and her family; this offer was declined because the owner refused to leave her animals.

Approximately a year after drilling began, an 18-year-old intact female American Quarter Horse in Home A had an acute onset of anorexia, malaise, rapid weight loss, and mild incoordination after testing normal on a physical examination a few weeks earlier. The horse was treated symptomatically with an antibiotic, steroid, and antihistamine. A few days later, the horse had become ataxic, and was treated for equine protozoal myeloencephalitis, although no diagnosis was made. The horse did not improve after three to four days and was treated again. Within a few days, the horse's neurological symptoms had progressed such that the horse was unable to rise. Blood and clinical chemistry parameters indicated acute liver failure due to toxicity. The veterinarian suspected heavy metal poisoning as a cause of the horse's sudden illness; this was not confirmed, as toxicology tests were not done. The horse was euthanized two weeks after onset due to poor prognosis and failure to respond. Similar neurologic signs were reported in another case in this study that involved two horses living adjacent to a deep, vertical gas well operation.

In addition, both homeowners were caring for animals that were bred at this time: the owner of Home B had a three-year-old intact female Boer goat that aborted two kids in the second trimester, and the owners of Home A had a five-year-old intact female Boxer that experienced dystocia with a fourth litter (after previously whelping three normal litters), producing one stillborn pup and one pup with cleft palate that died soon after birth. This same dog subsequently whelped a fifth litter of 15 pups in which seven pups were stillborn and eight pups died within 24 hours. All the pups were afflicted with congenital hypotrichosis; that is, they were born with the complete or partial absence of normal hair.

Soon after drilling and hydraulic fracturing began for the first well, a child living in Home B began showing signs of fatigue, severe abdominal pain, sore throat, and backache. Six months later, the child was hospitalized with confusion and delirium and was given morphine for abdominal pain. After the deaths of several animals as cited above, the child's physician suspected that the child's symptoms were of toxicological origin. A toxicology test revealed arsenic poisoning as the cause of the child's sickness. The family stopped using their well water despite test results indicating that the water was safe to drink, and the child gradually recovered after losing one year of school.

wastewater into creeks, and spills or leakage of wastewater from impoundments were believed by farmers to result in deaths over time periods typically ranging from one to three days, with cows going down and unable to rise despite symptomatic treatment. The most commonly reported symptoms were associated with reproduction. Cattle that have been exposed to wastewater (flowback and/or produced water) or affected well or pond water may have trouble breeding. When bred cows were likewise exposed, farmers reported an increased incidence of stillborn calves with and without congenital abnormalities (cleft palate, white and blue eyes). In each case, farmers reported that in previous years stillborn calves were rare (fewer than one per year). In most cases where diagnostics were pursued, no final diagnosis was made; in other cases, acute liver or kidney failure was most commonly found. Of the seven cattle farms studied in the most detail, 50 percent of the herd, on average, was affected by death and failure of survivors to breed. In one case, exposure to drilling wastewater led to a quarantine of beef cattle and significant uncompensated economic loss to the farmers.

The most dramatic case was the death of 17 cows within one hour from direct exposure to hydraulic fracturing fluid. The final necropsy report listed the most likely cause of death as respiratory failure with circulatory collapse. The hydraulic fracturing fluid contained, among other toxicants, petroleum hydrocarbons and quaternary ammonium compounds (tetramethylammonium and hexamethylenetetramine). Although petroleum hydrocarbons were reported to be found in the small intestine, lesions in the lung, trachea, liver and kidneys suggested exposure to other toxicants as well, and quaternary ammonium compounds have been described as producing similar lesions [37].

Two cases involving beef cattle farms inadvertently provided control and experimental groups. In one case, a creek into which wastewater was allegedly dumped was the source of water for 60 head, with the remaining 36 head in the herd kept in other pastures without access to the creek. Of the 60 head that were exposed to the creek water, 21 died and 16 failed to produce calves the following spring. Of the 36 that were not exposed, no health problems were observed, and only one cow failed to breed. At another farm, 140 head were exposed when the liner of a wastewater impoundment was allegedly slit, as reported by the farmer, and the fluid drained into the pasture and the pond used as a source of water for the cows. Of those 140 head exposed to the wastewater, approximately 70 died and there was a high incidence of stillborn and stunted calves. The remainder of the herd (60 head) was held in another pasture and did not have access to the wastewater; they showed no health or growth problems. These cases approach the design of a controlled experiment, and strongly implicate wastewater exposure in the death, failure to breed, and reduced growth rate of cattle.

Companion animals were defined as those animals that were kept as pets, and included horses, dogs, cats, llamas, goats, and koi. Companion animal exposures typically occurred when animals ingested affected water from a well,

Table 2. (Cont'd.)

Case	Type of gas well ^a	Source	Animal	Health impact
16	HHV	Well/spring water	Llama	Reproduction, upper respiratory
			Human	Endocrine, upper respiratory, burning of eyes, vascular, dermatological, sensory
17	HHV	Well/spring water Flaring of well	Canine	Urological
			Feline	Gastrointestinal, dermatological
			Human	Upper respiratory, burning of eyes, urological, dermatological, headache
18	HHV	Well/spring water	Ovine	Sudden death
		Storm water runoff from well pad	Poultry	Sudden death
		Flaring of well	Human	Vascular, gastrointestinal, headache
19	HHV	Well/spring water	Equine	Reproduction
		Hydraulic fracturing fluid spill from tank	Ovine	Reproduction
		Wastewater dumped into creek	Human	Neurological
20	HHV	Compressor station malfunction	Canine	Upper respiratory
		Flaring of well	Human	Upper respiratory, burning of eyes
21	HHV	Well/spring water	Bovine	Neurological, reproduction
		Pond/creek water	Equine	Neurological
		Compressor station malfunction	Poultry	Sudden death
22	HHV	Well/spring water	Human	Vascular, immunological
			Ovine	Neurological
			Fish	Dermatological
			Human	Dermatological, gastrointestinal

Table 2. Summary of Individual Cases

Case	Type of gas well ^a	Source	Animal	Health impact
1	SV	Wastewater dumped on property and into creek	White-tailed deer	Body condition
2	SV	Well/spring water	Bovine	Reproduction, milk production
3	SV	Well/spring water Pond/creek water Drilling fluids overran well pad during blowout	Bovine	Reproduction
4	SV	Well/spring water Pond/creek water Wastewater impoundment allegedly compromised	Bovine Fish	Reproduction, growth Sudden death
5	DV	Well/spring water Pond/creek water	Equine Canine Human	Neurological Urological, gastrointestinal, dermatological Upper respiratory, burning of eyes, headache, gastrointestinal, dermatological
6	DV	Pond/creek water	Bovine	Reproduction
7	DV, HHV	Well/spring water	Canine Poultry Human	Reproduction, dermatological Sudden death, musculoskeletal, dermatological Upper respiratory, burning of eyes, neurological, gastrointestinal, headache
8	HHV	Well/spring water Pond/creek water Wastewater impoundment not contained Wastewater dumped into creek	Song birds Human	Sudden death Neurological, immunological
9	HHV	Pond/creek water Storm water runoff from well pad	Fish	Sudden death

industry's use of nondisclosure agreements. Nevertheless, the value of this study is twofold. First, clear health risks are present in gas drilling operations. These cannot be eliminated but can be decreased by commonsense reforms. Second, our study illustrates not only several possible links between gas drilling and negative health effects, but also the difficulties associated with conducting careful studies of such a link. Again, simple commonsense policy reforms could facilitate the collection of data that would lead to a careful assessment of the health consequences of gas drilling on both humans and animals.

SUMMARY OF THE EFFECTS OF GAS DRILLING ON PRODUCTION AND COMPANION ANIMALS AND ANIMAL OWNERS

To describe how exposures may occur, and to report health effects, we conducted interviews with animal owners in six states (Colorado, Louisiana, New York, Ohio, Pennsylvania, Texas) affected by gas drilling. In all but one case, we spoke directly with animal owners. The exception was a case that had previously been documented by the state environmental regulatory agency [36]. When possible, we interviewed the owners' veterinarians. Where available, we have obtained the results of water, soil, and air testing as well as the results of laboratory tests on affected animals and their owners. Documentation was obtained from the animal owners, the veterinarians (with permission of the owners), drilling company representatives, state regulatory agencies, and a Freedom of Information Act (FOIA) request from the Pennsylvania Department of Agriculture. Cases were identified by requesting referrals from environmental groups and individuals actively involved in influencing shale gas policy and studying its effects. For each case, a standard series of questions was asked, including the exact location of each owner's property; details on wells in the area (subsequently verified by crosschecking with state records and, using software developed for this project, mapping the wells relative to the owner's property); details of seismic testing and well flaring; location of wastewater impoundments; results of water, soil, and air testing; details of animal husbandry and medical records preceding, during and following drilling, depending upon the individual case; a list of animals (species, breed, age, sex, use (e.g., livestock)), sorted into those healthy and those unhealthy; health history for all animals; observations of wildlife in the area; and health histories of the humans living in the household. As each case is different, the standard form was used as a starting point, with additional information invariably supplied by individuals being interviewed.

More than one-third of the cases involved conventional wells (shallow or deep vertical wells), with the remainder comprising horizontal wells subjected to high-volume hydraulic fracturing. Because of the scale of the horizontal well drilling operations, such wells were more commonly associated with animal health problems. However, conventional wells have also had problems

Communities living near hydrocarbon gas drilling operations have become de facto laboratories for the study of environmental toxicology. The close proximity of these operations to small communities has created a variety of potential hazards to humans, companion animals, livestock and wildlife. These hazards have become amplified over the last 20 years, due in part to the large-scale development of shale gas drilling (horizontal drilling with high-volume hydraulic fracturing), encouraged by the support of increased drilling and exploration by U.S. government agencies [1]. Yet this large-scale industrialization of populated areas is moving forward without benefit of carefully controlled studies of its impact on public health. As part of an effort to obtain public health data, we believe that particular attention must be paid to companion animals, livestock, and wildlife, as they may serve as sentinels for human exposures, with shorter lifetimes and more opportunity for data collection from necropsies.

All phases of hydrocarbon gas production involve complex mixtures of chemical substances. For example, in hydraulic fracturing fluids, chemical substances other than water make up approximately 0.5 to 1 percent of the total volume; however, the very large volumes used require correspondingly large volumes of a variety of compounds. These substances range from the relatively benign to the highly toxic. Some of these are reported to the public and others are not, but the quantities and proportions used are largely considered trade secrets. In addition to these added chemicals, naturally occurring toxicants such as heavy metals, volatile organics, and radioactive compounds are mobilized during gas extraction and return to the surface with the gas/chemical mix (wastewater); of the 5.5 million gallons of water, on average, used to hydraulically fracture a shale gas well one time [2], less than 30 percent to more than 70 percent may remain underground [3]. Hydraulic fracturing takes place over 2 to 5 days and may be repeated multiple times on the same well over the course of the potential 25- to 40-year lifetime of a well [4]. Many of these chemicals are toxic and have known adverse health effects, which may be apparent only in the long term. A discussion of these compounds and their health effects is beyond the scope of this article; however, Colborn et al. [5] have analyzed this topic in depth.

The large-scale use of chemicals with significant toxicity has given rise to a great deal of public concern, and an important aspect of the debate concerns the level of proof required to associate an environmental change with activities associated with gas drilling. Environmental groups typically invoke the precautionary principle [6]. That is, if an action is suspected of causing harm to the environment, then in the absence of a scientific consensus, the burden of proof falls on the individual or organization taking the action. The oil and gas industry has typically rejected this analysis and has approached the issue in a manner similar to the tobacco industry that for many years rejected the link between smoking and cancer. That is, if one cannot prove beyond a shadow of doubt that an environmental impact is due to drilling, then a link is rejected. This approach

ANDREW J. BACEVICH: SHAME ON YOU, PAUL WOLFOWITZ

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BAKKEN BUSINESS

The Price of North Dakota's Fracking Boom

By Richard Manning

THE UNRAVELING OF BO XILAI

China Loses a Populist Star

By Lauren Hilgers

DEEPER WINTER

A story by Alexander Maksik

Also: Pico Iyer and Jonathan Lethem



BAKKEN BUSINESS

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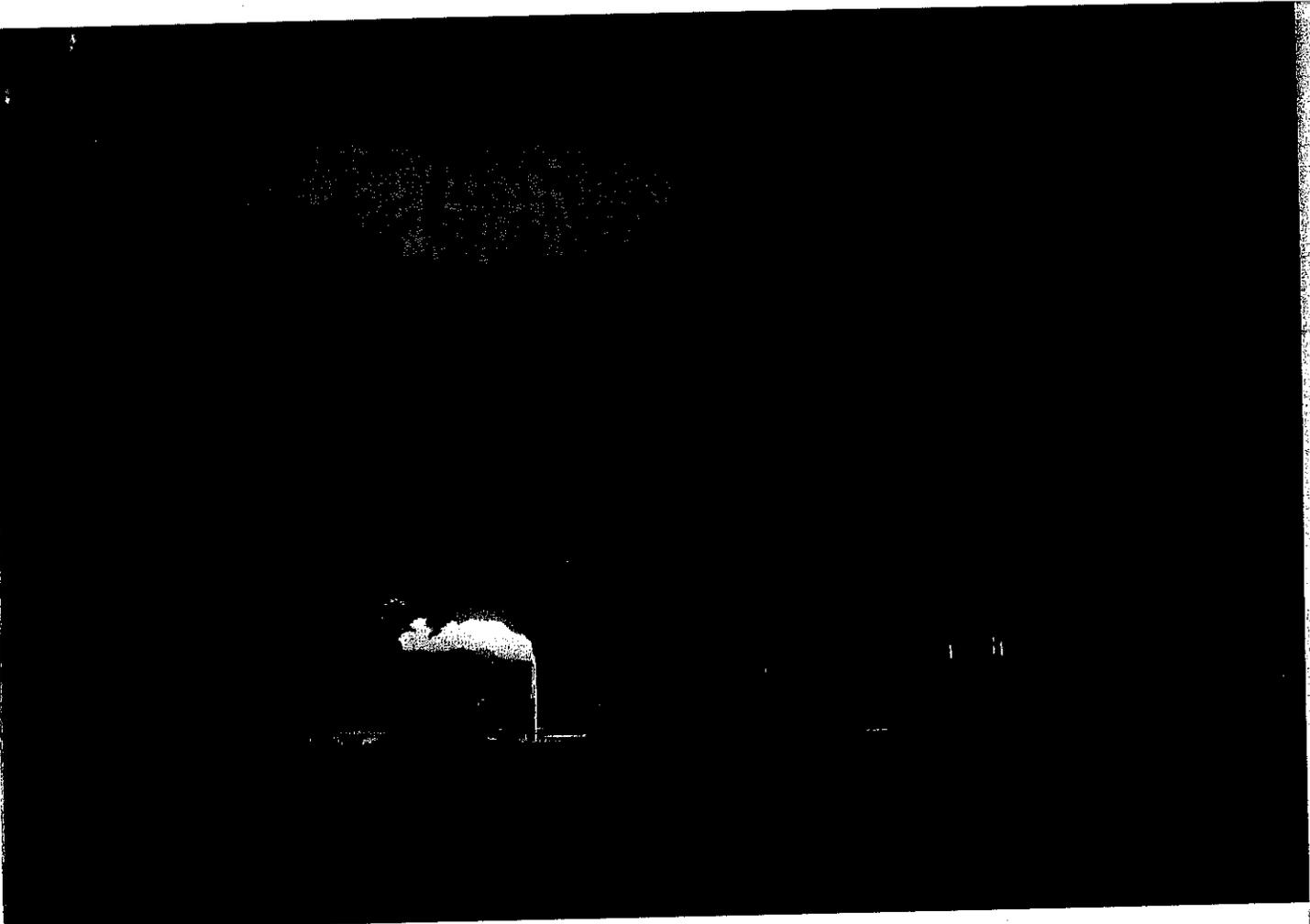
The prairie reveals. Any hilltop's field of vision opens to evidence of energy and motion, fresh tracks, today mostly tire tracks of the present, but also old tracks through time. I

Richard Manning's ninth book, It Runs in the Family, will be published this year by St. Martin's Press. His last article for Harper's Magazine, "The Oil We Eat," appeared in the February 2004 issue.

have come to North Dakota to single out a particular and peculiar set of tracks—hoofprints, really—for what they tell us about our destruction of the natural world.

Theodore Roosevelt arrived in the town of Little Missouri, in the center of the Dakota Territory, in 1883, in his early twenties, then all buckskin, bluster, teeth, and glasses. He came first of

all to kill animals and then to write about it. But Roosevelt was already an accomplished naturalist and convinced Darwinist, and he came also to see the raw nature then on display in the Badlands, a stark landscape of eroded clay and red scoria in the southwest corner of what is now North Dakota, a bit of geologic chaos that serves as counterpoint to the gentle prairie all around.



The year that followed was disastrous for Roosevelt. On Valentine's Day 1884, his mother, Mittie, and his young blue-blood wife, Alice Lee, herself recently a mother, died in the same house on West 57th Street in Manhattan. That summer, at the Republican National Convention in Chicago, he suffered a professional setback to go with his personal catastrophe when his preferred candidate was kept off the ticket. Instead of heading home from the convention, Roosevelt took a train straight from Chicago back to the Badlands, this time intending to stay a while. He bought a ranch, which he named the Elkhorn. Roosevelt wrote volumes about the Badlands, but never about what settled his grief while he was there. In any case, when he returned to New York and to politics, in 1886, he was transformed.

Before heading west, Roosevelt had already made a name for himself as viscerally and implacably opposed to corruption, taking on Tammany Hall in the New York legislature, laying the foundation of what would

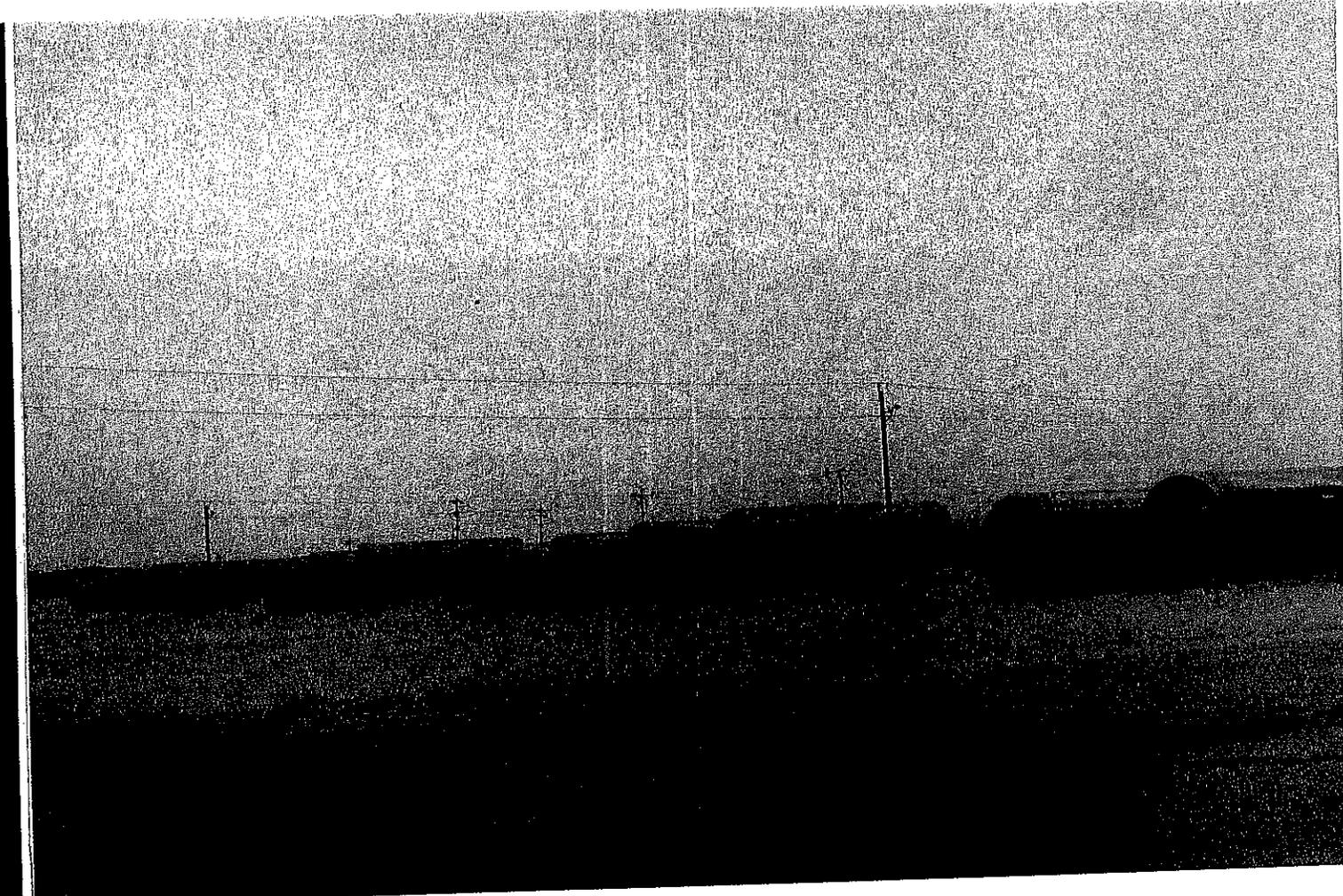
become a career of trust-busting that closed the Gilded Age and eventually broke up John D. Rockefeller's megamonopoly, Standard Oil. But at the Elkhorn he learned a deep engagement with the landscape, a love of the wild, and he reinforced an obsession with the strenuous that would take him through life. His character formed. What happened there propelled Roosevelt almost single-handedly to found the American conservation movement, leading one Roosevelt scholar to call the Elkhorn the "cradle of conservation."

As president, Roosevelt would call monopolists like Rockefeller "the most dangerous members of the criminal class—the criminals of great wealth." The grit of this excoriation may perhaps have come from the Elkhorn, but certainly it came from no place modern political leaders have been. Today, the Elkhorn is home to at least five active oil wells run by men in John D. Rockefeller's line of work.

Asks to rank American oil-producing states in order of produc-

tivity, most of us would begin with Texas and Alaska. Some might think to add California. Until very recently, that was correct. But North Dakota surpassed California in December 2011 and Alaska the following March. Production in the state has quadrupled in less than a decade. At this rate, it will surpass Texas in another decade, around the time the United States surpasses Saudi Arabia as the world's leader in oil production. All of this will be thanks to lessons learned extracting oil from the Bakken formation, which happens to include Roosevelt's ranch.

The Bakken is a massive bed of rock in three layers: dark ones on top and bottom and a lighter one sandwiched between, the middle layer's pores richly endowed with oil—light tight crude. The image of the Oreo cookie, often invoked to describe the Bakken, captures its uniformity of structure and its color scheme but fails miserably to describe the obduracy and scale of this 25,000-square-mile slab, which is in places up to one hundred feet thick. It sits two miles below the surface—



mostly in western North Dakota but also extending into eastern Montana and the southern edges of Manitoba and Saskatchewan.

Geologists have long known there is oil beneath the northern Great Plains—the formation got its name in the 1950s from the farmer who owned the site of the first producing well. But for almost half a century, the region's few wells were thought to draw from isolated pools. Shortly before his death in 2000, a United States Geological Survey scientist named Leigh Price circulated a paper concluding that the Bakken was a single deposit that held 413 billion barrels of oil. Price's methods remained contested for some years, but even conservative estimates now put the Bakken's holdings above 100 billion barrels. (By comparison, current "proved reserves"—the known amount of oil that can be economically extracted with current technology—for the entire United States are 23 billion barrels.) Around the time Price first outlined the true scope of the Bakken fields, refinements in extraction techniques suggested how to make them pay.

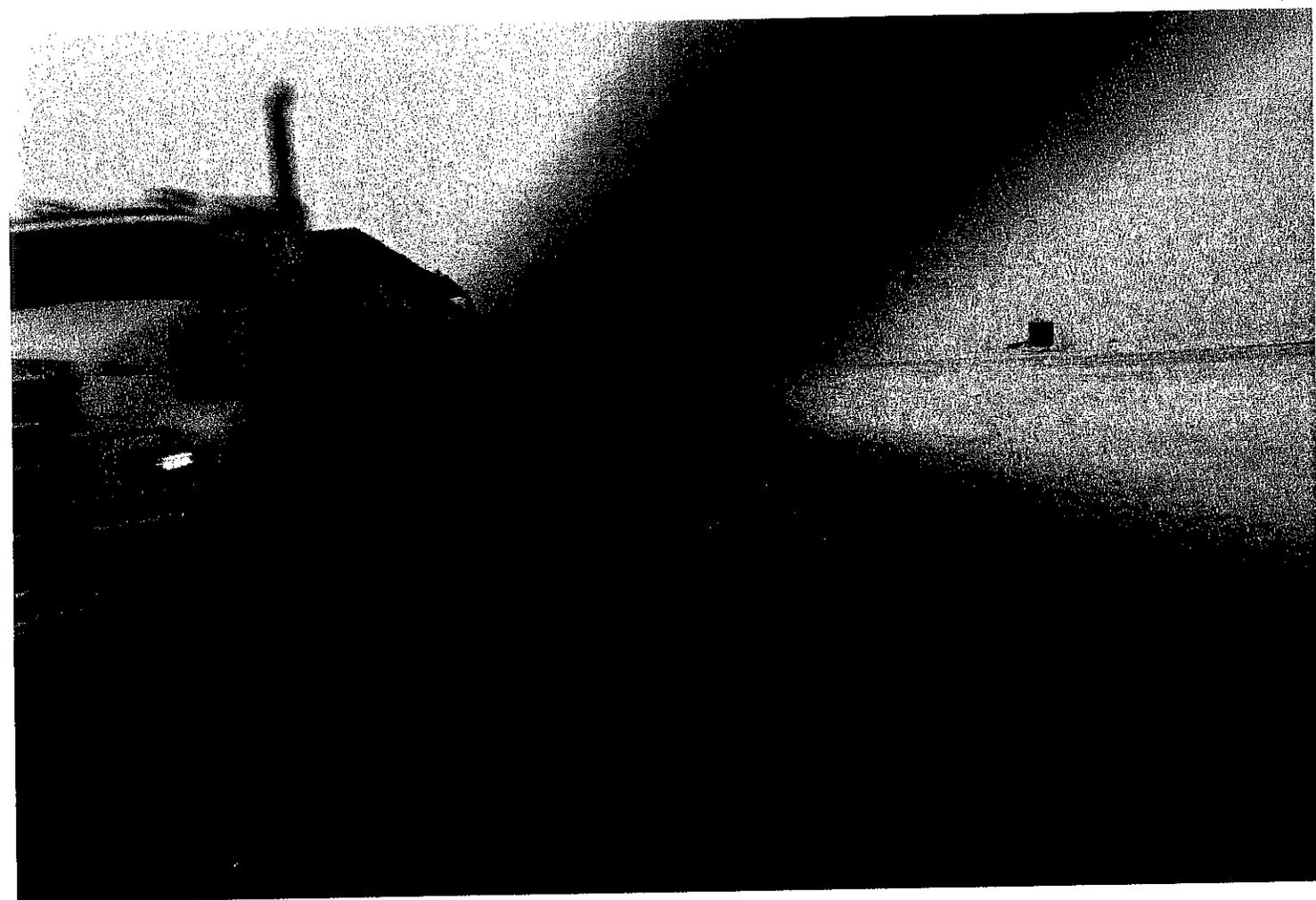
Hydraulic fracturing—now widely referred to in shorthand as "fracking"—uses water treated with chemicals to break apart rock formations. Oil and gas have long been coaxed from fissures, gaps, and cracks in rocks; fracking is simply a way to artificially induce more cracks (some of them more than half a mile long) by filling a bore hole with water, pressurizing it to as much as 8,000 pounds per square inch to split the rock, and forcing coarse material like sand and ceramic in to keep the new clefts open, thereby allowing them to produce for decades.

Fracking was developed in Texas in the late 1940s, but this technique alone would not have been enough to unleash the full potential of the Bakken. All the formation's oil was tied up in a thin layer of rock, a puny target when viewed down a narrow vertical well, but plenty big if approached horizontally. A 2005 breakthrough in directional drilling finally gave oilmen the ability to bore two miles down to the oil-laden white layer of the Oreo, then send a second, flexible drill to bend the well before drilling another two miles horizontally. But

even after this development, it took a 2009 innovation called multistage fracking to make the oil flow profitably. Bit by bit, the oilmen learned that the rocks yielded best when drill operators sent rubber-coated plugs into the hole at thousand-foot increments, expanded those plugs to block the hole, fracked, then moved the plugs down the line to frack again, a sequence they repeated dozens of times. The process takes about a week, sucks down as many as 3 million gallons of water from 400 or so tanker-truck loads, and requires the assembly of a small army of supply and pumper trucks at each wellhead.

Here is the revolutionary discovery of the Bakken, a discovery that threatens to replay in vast, currently untapped oil-shale deposits in North America and worldwide: It no longer matters where an oilman drills a well. What matters is what he does in the hole once it is drilled.

To the north of Watford City, an hour's drive from Roosevelt's former ranch, is the nucleus of what was once a prairie farm town, but it has



been swallowed in a highway sprawl of workers' camps, truck yards, pipe yards, fuel stations, machine shops, dust, and gravel. An oil-industry spokeswoman in Bismarck acknowledged the effect of the boom to me the day before I visited Watford, but added that I should report the people there were living in a "progress zone."

This isn't the kind of language one hears from Gene Veeder, the county's director of economic development, who is not simply a glad-handing booster of commerce but a thoughtful, genial guy with a guitar case propped in the corner of his office. He started on this job nineteen years ago, when it was much like being the economic-development director in any small town in the Great Plains, a region that has been losing rural population since 1909.

"Now I meet more people in a week here than I met in twenty years," he says. Before, his job was simply impossible; now it is something like being charged with ensuring that the wind blows.

Veeder is open enough about the downsides of the oil boom: "It did

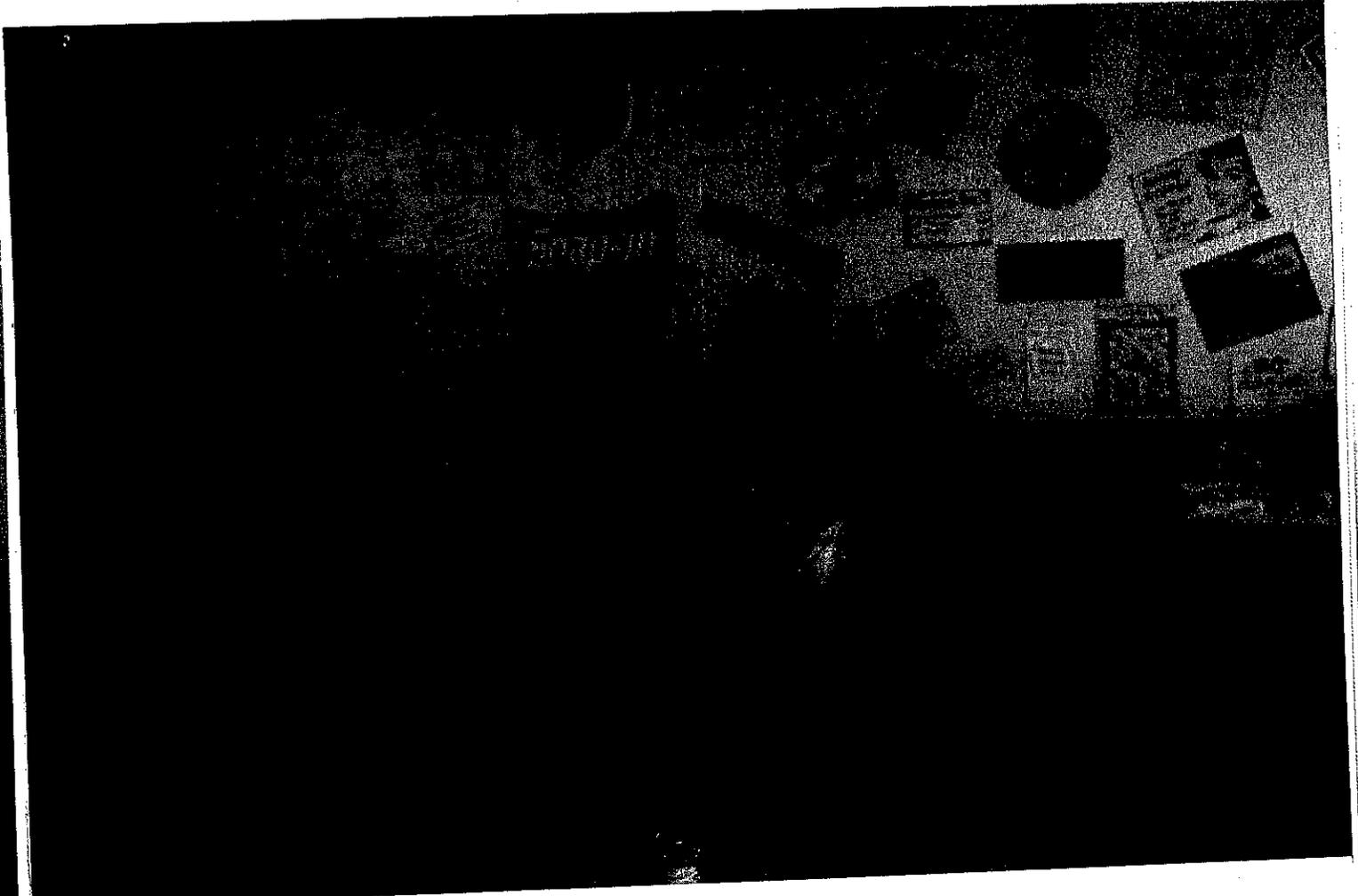
bring the world outside into the community, and that was an eye-opener," he says. "People are just overwhelmed with the drugs and prostitution and fights and all the things that come with oil fields."

He tries to get to know some of the men, a few with families, arriving in the unbroken string of pickup trucks, and he finds they bear news from the Rust Belt, the logging towns of the Northwest, the housing-busted South. He hears again and again from men coming to start their first jobs in years: truck drivers, electricians, carpenters, equipment operators—men who were raised to expect that if they worked they would get paid, who for a long time and in a lot of places in this country found that to be untrue but are now finding it true in Watford. Difficult to imagine the politician who will now stand between these men and their oil-field paychecks.

Veeder was born and raised nearby, on his father's 3,000-acre ranch, which he now owns along with the knowledge that no one can run a

ranch that small in western North Dakota and make it pencil. He did not get rich in the oil boom. His ranch is typical in having been cobbled together bit by bit from smaller farms of homesteaders busted in the Dust Bowl. Many of those people had already sold off their mineral rights, so these days decisions about whether to lease to prospectors are often made not by those who own and occupy the land but by shirttail relatives and descendants who never saw the farms. Veeder himself retains mineral rights on about 10 percent of the acreage of his ranch, a proportion he says is typical.

"I'm looking at oil wells right now from my house, and if I had 'em, well my God," he says. Nevertheless, his daughters, who had moved away to begin lives elsewhere, have moved back. One son-in-law works at Marathon, the other at Halliburton, senior-level people. "They are building new houses right now," he says. "That's something nobody talks about, but one [daughter] is living on the ranch, and she could not live on the ranch without oil."



"For me personally, having the ranch out there, I wish [the oil boom] would have never been here. Okay. But I do remember when my last child left home, and she was never coming back," he says. "Now I get to live the rest of my life the way I want to."

This is not to say that out-migration has ceased; it has simply shifted demographics. Longtime residents are leaving, sick of the clutter, noise, and crime and pushed by the fact that free-and-clear houses are worth five, six, seven times what they were a few years ago.

The popular mythology of oil leans heavily on the figure of the wildcatter, the man who takes on undeniable risk and wins megabuck rewards as he pioneers the world's great deposits of petroleum. There are no wildcatters in the Bakken, not now. Every single well drilled in the area has a 99 percent chance of producing oil for about thirty years in predictable and tapering amounts. Wells drilled into the proven area generally enter the black when oil is above fifty or sixty dollars a barrel,

which it has been for most of the past eight years. This is no longer wildcatting; this is plumbing. The odds of success are set in stone.

There are 8,025 producing oil wells in North Dakota. Their density and layout form a haphazard pattern so far determined by the caprice of the market, offering little idea of what shape development will take in the future. What one sees is not so much production as flags and stakes claiming territory. Almost all of this landscape is privately held as ranches and farms, meaning that the 2,000 new wells to be added this year could require nearly as many separate leases. The technical breakthroughs since 2005 have yielded a rush of three-year exploration deals. Drillers generally must complete a producing well within this period to extend the lease. Then they can go back and drill as many wells as necessary to get all the recoverable oil.

Every Bakken well produces natural gas in addition to crude oil, but there is insufficient infrastructure—pipelines and processing plants—to handle it. Natural gas's current low

price undermines the incentive to build this infrastructure, and anyway there is no time to wait, given the competitiveness of oil extraction. About a third of the natural gas now flowing from the Bakken, enough to heat half a million homes each day, is set alight at the well-head, producing a landscape of flames in robust competition with the stars. Recent nighttime satellite imagery of the plains between Minnesota and Montana shows two big sprays of light on the ground below: one is formed by the urban area around Minneapolis-Saint Paul, the other by Bakken gas flares around Williston, North Dakota.

The future promises to be even brighter. The optimum spacing for wells is something like one every two or three square miles. The oil in the stone slab below does not move or vary considerably in distribution, so grab a map and start sticking it with pins. Make a grid that roughly replicates the property survey first imposed on this landscape with white settlement. People have done the math; fully developed, plumbed,

and producing, the Bakken will support between 35,000 and 45,000 profitable oil wells, at least seven times the current number.

Even the trivial effects seem not so trivial in multiplication. During the first year of a well's life—the hustling year of drilling, plugging, and fracking—it will require 2,000 truck trips. The beat-up two-lanes and gravel or red-scoria section-line roads that thread between wells handle at least 4 million trips a year. Farmers and ranchers who live on these back roads no longer open windows in summer because of the dust. The usual roadside litter is now dependably punctuated with “trucker bombs”—spent plastic soda bottles filled with urine—rest stops on the prairie being few and far between.

Trucks need drivers; roads need builders; fleets need mechanics; men need houses, which need carpenters; rigs need workers; the hundreds of new companies in the Bakken need accountants, flacks, lobbyists, surveyors, negotiators, paymasters; and all these need Walmarts, Holiday Inn Expresses, ATV dealerships, gun shops, strip clubs, and greasy spoons. What reaches the outside world is the bottom line: North Dakota has the lowest unemployment rate in the nation. The oil companies cannot deploy workers or build rigs fast

the national rate. The sanitation department in Dickinson, a city of 23,000 whose population is expected to double in seven years, cannot retain its employees, many of whom are licensed truck drivers and have been recruited literally right out of the cabs of their garbage trucks by the oil companies. Skilled workers of any level easily make six figures.

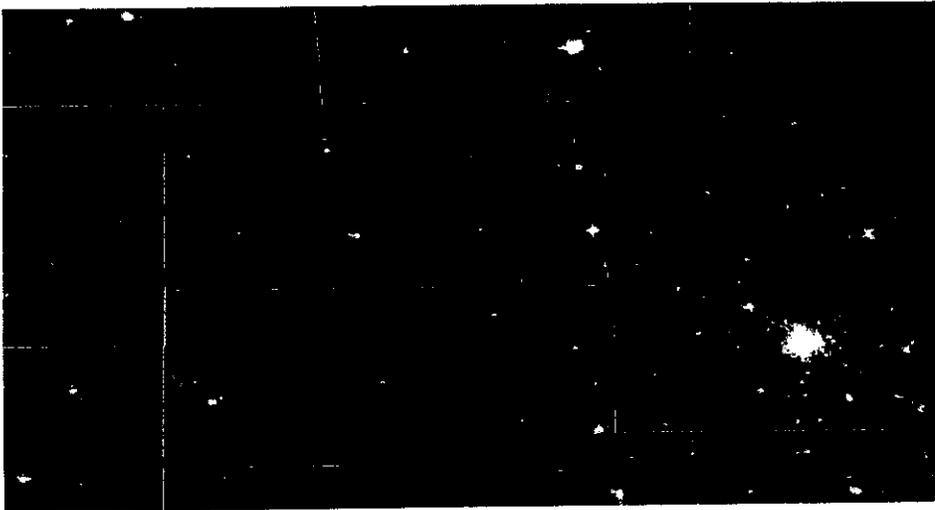
The evidence of this growing labor force is more apparent on the land than are the wells themselves. Williston, which in the 2010 census was recorded as having fewer than 15,000 people, built a total of 166 houses and apartments in 2009; this year, planners expect to build about 2,300. Watford City was a wide-spot-in-the-road village of 1,700 people three years ago. No one knows the population today, but the best guess is 7,000 and growing. All of the towns are ringed by “man camps,” the local term of art for barracks-like installations of trailers and modular homes that can hold upward of a thousand workers. Companies add housing in chunks, taking some effort to provide the best, since desirable quarters serve as recruiting tools.

Newcomers lacking company housing live in trailers and RV parks, or, failing that, in clutches in parking lots at the ragged edges of

cars. In February of last year, the Williston Walmart reversed its longstanding policy of allowing campers to squat in its parking lot. This, by the way, is the same Walmart where Michael Spell and Lester Waters, having come to the Bakken from Colorado in search of oil work, bought a shovel (which they returned for a refund three days later) to bury the body of Sherry Arnold, a schoolteacher from Sidney, Montana, they allegedly killed while on a crack binge. Besides traffic, people here talk about the crush of population growth, by which they mean outsiders; the capstone of this discussion is Arnold. It isn't simply talk: in the months after the murder, newspapers in the region reported an increase in sales of handguns and pepper spray in this place where less than a decade ago no one locked doors. In January, the *New York Times* noted a spike in sexual assaults in Williston, where single men outnumber single women almost two to one. Pharmacies there have been held up for prescription painkillers, OxyContin being a favorite. Last summer, a group of enterprising Korean women began running a prostitution ring from an RV in Bainville, Montana, a hamlet once dominated by the white steeple of a clapboard church, now by an oil derrick.

All this is entirely in keeping with the historical record. These towns are, after all, boomtowns, specifically oil boomtowns. The industry began in western Pennsylvania just before the Civil War. One early example was the aptly named Pithole Creek. “The whole place,” a visitor wrote, “smells like a corps of soldiers when they have the diarrhoea.” Reported *The Nation*, “It is safe to assert that there is more vile liquor drunk in this town than in any of its size in the world.”

“Our quality of life is gone,” a county commissioner named Dan Kalil testified last January to the North Dakota legislature's Energy Development Committee. “It is absolutely gone. My community is gone, and I'm heart-



enough to get the job done. The Walmart in Williston offers seventeen dollars an hour to start, twice

towns or on plots leased out by farmers at prices far above the market yield of wheat. Many live in

A composite of nighttime satellite images of the midwestern United States. Natural-gas flares from the Bakken formation are visible in red. Courtesy the National Geophysical Data Center

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and now I don't know
what I'm going to do."

Mike McEnroe is a biologist
retired from a career in the U.S. Fish
and Wildlife Service. He remains
active in the North Dakota Wildlife
Society, a chapter of an internation-
al group that traces its roots directly
to the early-twentieth-century envi-
ronmentalist Aldo Leopold and in-
directly to the circle of New York
patricians and scientists a young
Theodore Roosevelt recruited to
serve in the country's nascent con-
servation movement. In early 2011,
the chapter gathered for its annual
meeting, usually a mostly social
event; but talk soon turned to the
Bakken, beginning, as these things
do, with some problems concerning
wetlands and an obscure little bird,
the piping plover.

A delegation was got up to go have
a look. McEnroe says he envisioned
packing clubs and coolers of beer in
the trunk and spending a few fine
days in prairie country alternating be-

tween rounds of golf and tours of wet-
lands. The visit, however, coincided
with the summer melt, which fol-
lowed two winters of significant snow-
fall. The Little Missouri and Missouri
Rivers were in full flood.

The recent national opposition to
the Keystone XL—an extension of
the pipeline system currently deliver-
ing oil from the Canadian tar sands
to the United States—rallied around
the possibility of spills of crude in Ne-
braska's Sandhills. There were at
least 1,100 spills in North Dakota's
stretch of the Bakken during 2011.
We don't know much about the na-
ture of each of these, but McEnroe's
group saw something of the scope of
the problem in touring a few dozen
of the Bakken's nearly 5,000 wells.

At one site, the group counted
nine active oil wells, all of them
flooded with Missouri River Basin
water. The oil company in charge of
the site had had to pump its oil-
storage tanks full of water to prevent
them from floating away. Each active
drilling site has a "reserve pit," a
swimming-pool-size hole adjacent to
the rig that catches what workers call

"cuttings"—the rock dust produced
by drilling—as well as salt water and
frack water and chemicals pumped
back out of the hole along with the
first few barrels of crude. State regula-
tors do not keep track of this mix-
ture, but one landowner in Stanley,
North Dakota, did, sending a sample
of reserve-pit soil and water to a lab.
It contained benzene, toluene, and
xylene (all suspected carcinogens),
along with diesel fuel.

McEnroe's group arrived at one site
two months after spring floods had
sent reserve-pit water into the Mis-
souri. They found the berm designed
to prevent runoff still breached. Biol-
ogists reported streams with layers of
belly-up fish floating near the surface
downstream from wells. The path-
ways of previous drainages were
marked by a sort of scorched earth:
dead vegetation, killed by effluent.
They shot photographs, wrote a re-
port, and sent it off to the state in
December 2011. McEnroe says they
haven't heard much back.

Anne Marguerite Coyle is an ea-
gale biologist, and just before the
boom, she tagged eighteen juvenile

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golden eagles as part of a routine monitoring effort. All are now dead or gone. In one case, a drilling rig landed close to one of the eagles' nesting sites, so when that bird disappeared, she asked people nearby what had happened. "Oh, somebody shot that one," they said. Gunplay, the roads, the rigs, the noise, the trucks, the off-duty oil workers on ATVs, the general disregard for anything living that is the consequence of industrializing a once-wild landscape—these make it impossible to pinpoint oil's role in the eagles' fate. But if they weren't killed by oil, they were likely killed by the things oil brings with it.

Coyle reminded me of a biological phenomenon called allelopathy, a devious and successful survival tactic of a number of species of plants that secrete chemicals to alter their environments, making it impossible for other species to inhabit the same places—not killing competitors, but subtly forcing everything else to go away.

Drillers talk about the "recipe," the particular combination of technique and chemicals that makes a particular bed of rock yield its payload. Once we got the Bakken's recipe right, there were no more decisions to be made, save the hundreds or thousands of piecemeal decisions made over kitchen tables when people sign leases. You might hate the idea of oil rigs on the family ranch, but if you don't sell someone else will, and it's all going to hell anyway, so might as well sign. We do not decide whether to drill oil. Price decides. Price and how much is in the ground.

Current extraction methods have placed as many as 24 billion barrels of Bakken oil within reach. But the recipe can still be improved: this number is less than 3 percent of some estimates of the amount of oil in that Oreo. Drillers in some areas report recovering as much as 12 percent of the oil they estimate to be in the rock. Existing technology, which for all intents and purposes has been in use about four years, is now being tinkered with on 5,000 wells. How will all this newfound

ability and knowledge play out across continent and globe? The U.S. Energy Information Administration estimates there are 220 billion barrels of shale oil now technically recoverable in the United States, nearly ten times current proved reserves.

Fracking of the Marcellus formation in the Northeast has met some resistance—partly because the formation yields natural gas, which is harder to contain than liquid oil, but mostly because the greatest force of environmentalism—"not in my back yard"—is in full rage in a region that has not only actual back yards but also major media markets. The Bakken, meanwhile, has developed as it has without so much as creating the nation's political discussion.

With this lesson in hand, how about Wolfcamp in Texas, a shale deposit oilmen are now touting as being bigger than the Bakken, part of the much larger Permian Basin? How about the Eagle Ford in South Texas and the Barnett in North Texas? Colorado's Niobrara, Arkansas's Fayetteville, Michigan's Antrim, and the Monterey in California? There are at least twenty active shale plays in the United States. Worldwide? There are major shale deposits in Argentina, Australia, Canada, China, Mexico, and South Africa.

Amid a devastating national recession, North Dakota boasts about its 3 percent unemployment rate and about attracting its kids back home from the Twin Cities with high-paying jobs. Amid catastrophic cutbacks in state governments nationwide, North Dakota socked away a \$1.6 billion budget surplus. The state has led the nation in wage growth since 2009, with an average of 9.3 percent a year. The closest competitor is South Dakota, at 5.1 percent. Meanwhile, the boom is pushing the United States toward energy independence.

"Our dependence on foreign oil is down because of policies put in place by our administration, but also our predecessor's administration," President Obama said last year. "And whoever succeeds me is going to have to keep it up."

In our divisive political world, anything this bipartisan is a done

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deal. Obama's statement came dur-
ing a series of speeches he made last
March that included an appearance
in Cushing, Oklahoma, where he
restated his support for the building
of the southern half of the Keystone
extension, the construction of the
northern half of which his adminis-
tration tabled in a fight with Repub-
licans in Congress. Obama's support
has little to do with delivering Can-
adian tar-sands oil to refineries in
the Gulf and lots to do with the
Bakken, which the Keystone would
tap at Baker, Montana. The pipe-
line is designed to relieve a bottle-
neck caused, in part, by a glut creat-
ed by increased Bakken production.
Current transportation costs elevate
gasoline prices elsewhere in the
country and lower profits coming
back to the Bakken. The lack of a
pipeline does not pinch off Bakken
oil (or oil from the tar sands, for
that matter): the producers ship
what they can in one of the region's
eight existing pipelines, and the rest
ships on trains or trucks. But pipe-
lines are cheaper (and safer, and
have a smaller carbon footprint),
and a new pipeline could mean, say,
twenty-five dollars a barrel on
100,000 barrels a day in the Bak-
ken. Ultimately, the Keystone ex-
tension will be built.

Just before the Civil War, with de-
velopment of the first "rock oil"
drills in Pennsylvania, marketers be-
gan touting the virtues of kerosene.
As one handbook had it:

Those that have not seen it burn,
may rest assured its light is no moon-
shine; but something nearer the
clear, strong, brilliant light of day, to
which darkness is not party....
[R]ock oil emits a dainty light; the
brightest and yet the cheapest in the
world; a light fit for Kings and Royal-
ists and not unsuitable for Republi-
cans and Democrats.

This is not ad copy; it is political
science. There have been no advanc-
es in the field since.

And so we come to the point
where the congregation rises and the
preacher intones the usual analogy
of oil to addiction, but the truth is
that oil is no more an addiction than
food is. Food and energy are necessari-

ties in all species, and oil is how we
handle energy in this life
as we know it.

Theodore Roosevelt was a leg-
endary documenter of himself. He
detailed every hunting trip he took
and sold multiple articles on each,
some cut-and-paste jobs of earlier
pieces. He hustled freelance assign-
ments, books, and speeches on ev-
ery set of deer antlers, on every buf-
falo mount and elk hide, on every
lark and thrush he saw. Sometimes
he wrote well and philosophically,
especially about the odd notion of
his that wilderness itself was of val-
ue, an irreplaceable force in shaping
American character. It is a quaint
notion, today as forgotten and an-
tique as his condemnations of John
D. Rockefeller.

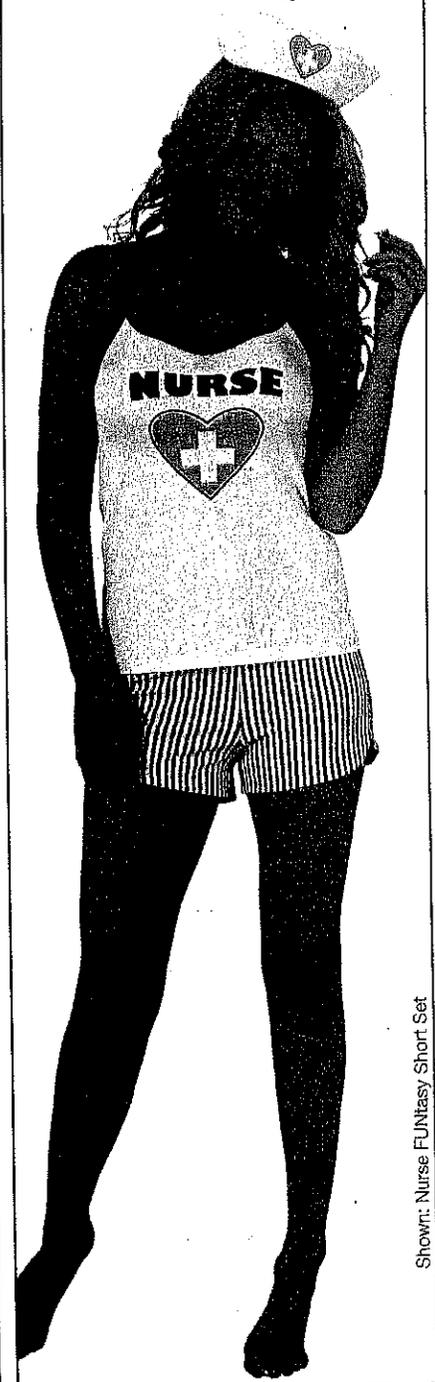
He did not, however, write about
what he learned and felt in this place
that allowed him to deal with the
death of his mother and young wife.
Too bad, because we're down to grief
now, and what he learned about it
here is what we need to know.

I've had enough of these winter
two-lanes, and so find my way to the
unpaved scoria of Magpie Road,
headed due west from the roar of the
highway into the relative quiet of the
Badlands. I have a spot in mind just
northeast of what was Roosevelt's
Elkhorn Ranch. There's a trailhead
where I can leave my Jeep. A fine
running path wraps around buttes
and coulees, leading on for miles,
eventually on to Elkhorn Ranch it-
self. Somewhere Roosevelt's tracks are
no doubt set in midlayers of this very
trail, just above the deeper layer of
moccasin tracks, so I run, because I
am a runner, trying now to build the
chuff of my breathing loud enough to
overmatch the whir and creak of
pump jacks every few miles.

It's late February and still plenty
cold, despite the sun. I have a decent
pair of cleated running shoes made in
China and delivered to me by diesel
fuel. I have fleece and polyester mir-
acle fabrics that disguise their common
origin in petroleum, so I am warm.
My Jeep Liberty burned through six
and a half tanks of gas in reporting
this story. Roosevelt's ranch is within
my range, but I stop short. ■

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If you wish to speak today, please complete the following:

Name: SEAN MADDEN
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Email: maddensean87@gmail.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
b. Energy Optimization / Efficiency Standards
c. Electric Choice
d. Other Additional Energy Topic
(Please specify): COMPARABLE STATES
COMBINED WITH JOBS.

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Testimony of Sean Madden (UFCW)

March 18, 2013

- Thank you for holding today's hearing on renewable energy in Michigan, and for giving me the opportunity to give testimony.
- My name is Sean Madden, and I'm a 2004 graduate of Western Michigan University and a current employee of the United Food and Commercial Workers International Union (or UFCW) Local 951 in Grand Rapids, Michigan. UFCW Local 951 represents nearly 30,000 grocery, retail, meat packing, and food processing workers in our great state.
- I'm here today because I believe our ability to create a stronger more sustainable economy for our state depends on our ability to create and deploy clean energy.
- Diversifying our energy supply and creating jobs must include renewable electricity and maintaining and expanding clean energy investments that have already worked to grow the economy. Although Clean Energy Investments will not directly create jobs for UFCW members; increasing clean energy jobs in our communities will have a very positive impact in the neighborhood stores that our members work in. This increased spending will indirectly result in more jobs for our members.
- Specifically, I'm here to respond to the question: **How does Michigan's renewables requirement compare to other states/provinces/countries? How are other jurisdictions similar/dissimilar?**
- According to the Database of State Incentives for Renewables & Efficiency, nearly 30 other states have stronger renewable energy or energy efficiency goals than Michigan.
- Michigan's continued use of renewable energy and energy efficiency will create jobs, spark investment and launch new businesses in our state.
 - If we don't keep a close eye on the state of clean energy investments, Michigan will fall behind in the clean energy race.
 - Michigan's clean energy sector supports 20,500 jobs and \$5 billion in annual economic activity and is poised to grow.
- Of the immediately surrounding states including Wisconsin, Illinois, Indiana, and Ohio, Michigan ranks firmly in the middle on renewable energy standards or goals with a renewable energy standard at 10 percent and 1,100 megawatts by 2015.
 - Wisconsin's standard is around 25 percent by 2012 which varies by utility.
 - The Illinois standard is 25 percent by 2025.
 - Indiana's *goal* is 10 percent by 2025.
 - Ohio's is standard 12.5 percent by 2024.
- California has the highest renewable portfolio standard at 33% by 2020.

- States without any renewable portfolio standard or goal include Idaho, Wyoming, Nebraska, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, Tennessee and Kentucky.
- The Recovery Act and the smart policies we've already implemented in Michigan have jumpstarted growth in clean energy here; creating jobs, reducing pollution, and positioning us to compete and win good jobs against China, Europe and the rest of the world.
- We can grow even faster if we lead the charge in innovation and create good, 21st century jobs for American workers.
- We need to double down on the industries of the 21st century that will build a cleaner, more energy efficient and more competitive American economy. Clean energy industries are creating more middle class jobs and represent a second chance for the millions of Americans who are still struggling to secure jobs that allow them to support their families.
- Rebuilding Green, a report by the BlueGreen Alliance and the Economic Policy Institute, examines the success of the Recovery Act two years after it passed. The report shows nearly 1 million jobs were saved or created, including green jobs through the Recovery Act.
- Investments made through the Recovery Act and our own efforts here in Michigan have built a better foundation for future economic growth. Today we have another opportunity to fulfill that promise for a cleaner economic future.
- These hearings are highlighting the important fact that we should continue to expand investments in renewable energy.
- The pursuit of jobs of the future in cleaner, more efficient technologies has only just begun, but the discussion we're having today is an excellent starting point.
- We need to fight for a better future for our children, grandchildren; and in my case, nieces and nephews— That means going beyond simply creating jobs, we need to make sure that the jobs we create ensure good wages and benefits. Together we can bring back jobs from overseas and strengthen our current jobs, all while protecting our environment and reducing our dependence on foreign oil.



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If you wish to speak today, please complete the following:

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Topics you wish to address today:

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- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

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If you wish to speak today, please complete the following:

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Topics you wish to address today:

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- b. Energy Optimization / Efficiency Standards
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(Please specify): Renewable Energy Generally

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If you wish to speak today, please complete the following:

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Topics you wish to address today:

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(Please specify): Renewables

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If you wish to speak today, please complete the following:

Name: Dr. Paul Clements

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If you wish to speak today, please complete the following:

Name: Robert Strong
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Topics you wish to address today:

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Topics you wish to address today:

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Topics you wish to address today:

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If you wish to speak today, please complete the following:

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Email: 3Oaks112@gmail.com

Topics you wish to address today:

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Most people now agree that we need to transition to a low-carbon, renewable energy mix to save the climate from massive change that will affect not only climate, but life forms and human lifestyle as well. Multiple renewable energy scenarios have been published in the last 5 years or so. These scenarios look at current energy demand and supply structure by country and unfold a strategy by 10-year steps through 2050. With a projected target of 95% renewable power generation by 2050, the most recent scenarios show that saving our climate is still within our reach.

Everyone acknowledges the giant challenges facing the renewable energy industry, but people working in the various areas are already tackling the job. By 2050, renewable energy could be a key industry like the IT or car industries today. Millions of people might be employed to avoid nuclear waste and build a sustainable energy supply. This challenge is no more complex than putting a man on the moon, if we have the will.

But the US currently doesn't show leadership in the energy revolution. In 2009, China became the largest investor in clean energy, according to the Pew Charitable Trusts, investing \$34.6 billion compared with \$18.6 billion invested by the US. Germany got the idea for sourcing electricity from renewable sources from the US during the Carter administration back in the 1970s. Germans have created strong incentives for the public to invest in renewable energy and have converted 25% of their power grid to renewable energy sources since 2000. And they do it by involving individuals and cooperatives, rather than utility companies. But Michigan is only targeting 10% renewable energy. We can do better than that!

We also need to stop wasting energy and get smart about the way we use it. The State needs to encourage citizens to exploit all technical potential for energy efficiency including home insulation, consumer efficiency standards, structural changes in the energy grid away from centralized power stations to a decentralized system and energy efficient transportation. We also need to encourage less consumerism and consumption and sustainable local foods networks to reduce the manufacturing waste and waste of energy used for production and transportation of food.

Additionally, carbon fuel (including shale gas) companies should be avoided for support by government agencies and investors. Let these companies change their approach and develop wind, solar photovoltaic, geothermal and hydro energy sources, coupled with smart grid systems and individual and cooperative involvement in power generation such as wind and solar. Other countries around the world are showing us that they can have the will and their politicians and policy makers are hearing the people and clearing the way for engineers and workers to start building renewable energy sources. Let Michigan be a leader in the US and show the other states how its done by studying other countries successes and bringing that renewable energy technology to Michigan to help fund our recovery from the recession and get our people back to work. We can't do this by letting the land men and frackers into our pure lands and waters.

Cindy Vigneron
Barry Twp



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Topics you wish to address today:

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(Please specify): Compared to other provinces

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If you wish to speak today, please complete the following:

Name: Jane Eggebeen

Affiliation (if any): citizen

Phone: 616-560-0860

Email: janeeggebeen@yahoo.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

Requested time to speak: < 5 minutes 5 minutes

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If you wish to speak today, please complete the following:

Name: Claire McSwiney
Affiliation (if any): St Thomas More Catholic Student Parish @ KVCC
Phone: 269-217-7890
Email: claire.mcswiney@att.net

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

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If you wish to speak today, please complete the following:

Name: THOMAS J. Reinke
Affiliation (if any): Self Reliant Energy Co.
Phone: 517-256-2322
Email: Selfreliantenergycompany

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

Requested time to speak: < 5 minutes 5 minutes

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If you wish to speak today, please complete the following:

Name: JOHN FORD

Affiliation (if any): _____

Phone: 734-9572-0810

Email: bowens140@yahoo.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

Requested time to speak: 3 < 5 minutes 5 minutes

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N/A



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If you wish to speak today, please complete the following:

Name: Samantha Keeney
Affiliation (if any): Great Lakes Renewable Energy Assoc.
Phone: 989-714-5272
Email: Samantha.Keeney@glrea.org

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

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If you wish to speak today, please complete the following:

Name: Michael Kitchon
Affiliation (if any): _____
Phone: 327-1234
Email: MAI@secin/vppw.org

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): EV conversion subsidies

Please prioritize and focus your comments to afford as many as possible, the opportunity to speak. The amount of time allowed for each speaker will be dependent upon the number of people requesting to speak. Please prepare for the time limit for each speaker to be in the 2 – 5 minute range.

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When we discuss energy needs, it is imperative to us that we have personal electric transportation. I want to do an electric car conversion myself. And with the advent of electric motor and controller kits being readily available, we now have that option.

As you should know, the vast majority of people in the US, from the middle class on down, share only 7% of the wealth of our nation. So we need some assistance in the form of subsidies and rebates to make our necessary dream a reality. As you also know, tax incentives have little impact upon us, as we obviously have little tax liability. We need our government in Lansing to make it worth our while to convert our automobiles as is done in some other states, and to make it possible for the vast majority of Michiganders to start reversing the destruction of our planet and, in particular, that of our great state of Michigan.

Our need for personal vehicle will always be with us. Therefore this choice must be fully subsidized. There is no other viable option. We also need subsidies and rebates for small home solar and wind electric generation equipment to make the recharging of our vehicles even more cost effective.

Either we get serious about this issue or all of this talk is worthless. There is no going back. Or we can just run our planet into the ground as we are doing.

Now, I could go on about all the facts and figures that support the wide application of renewable energy resources. But you've heard them before and you well know the facts of the

For Energy Forum

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matter, unless you've been out of touch for a couple decades. We certainly do not need to rehash the solid evidence, and we can most certainly ignore the ignorant opposing positions.

However, let me end by making an additional point. You may know that we live in what might be considered the northern Bible belt. For instance, there are more churches per capita in Grand Rapids than anywhere else. That should indicate that there are a lot of people who call themselves Christian, and who are concerned with how we threat the Creator's world.

I submit to you that we need to work hard to do the right thing; to get rid of anything that causes any type of pollution or harms the Earth in any manner, and to stick with high moral principles not sullied by the self-centered and degenerate ideas of big energy companies.

We believe that the non-renewable resources were buried far underground for a reason, and that reason was not to dig them up. Any industry or process the uses up the Earth's non-renewable resources cannot be good, and there is no long-term excuse for it.

I am asking for men and women of conscience to stand up and speak out with strong voice to stop the use of anything not renewable. We must put our money and time where are hearts are, and not let the evil desire of greed by the few, damage everything for the majority.

Thank you very much.

Michael Kitchen
269-327-1234
mike@socialism.org

Wealth Inequality in America



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If you wish to speak today, please complete the following:

Name: Tom VanHammen

Affiliation (if any): _____

Phone: 616-308-2938

Email: tomcpc@aol.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): Fracking

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If you wish to speak today, please complete the following:

Name: Kat Varshamman

Affiliation (if any): _____

Phone: (616) 204-0219

Email: artinkat@hotmail.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): Energy Diversity & Decentralization

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If you wish to speak today, please complete the following:

Name: Martha Dahlinger

Affiliation (if any): _____

Phone: 269-327-9367

Email: marthadahlinger@att.net

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): State support of various types of energy?

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If you wish to speak today, please complete the following:

Name: Rob Sisson
Affiliation (if any): ConservAmerica
Phone: 269-651-1808
Email: rsisson@conservamerica.org

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): General comments about promoting cleaner energy we have at hand - nuclear, NAT gas, wind, solar.

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If you wish to speak today, please complete the following:

Name: PONNA DUTTON
Affiliation (if any): LOWV
Phone: 269-469-9763
Email: donnadutton95@YAHOO.COM

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

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If you wish to speak today, please complete the following:

Name: Corinne Turner
Affiliation (if any): M.L.A.W.D.
Phone: 269 623 3365
Email: _____

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): OIL + GAS HORIZONTAL DRILLING ECONOMY
VS. FRESH WATER ECONOMY

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If you wish to speak today, please complete the following:

Name: Tara Moore

Affiliation (if any): _____

Phone: (231) 903-5031

Email: ejustice@gmail.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): Nuclear CNG

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If you wish to speak today, please complete the following:

Name: Mary Colborn
Affiliation (if any): Allegan Historic Farm Learning Center
Phone: 360-621-0050
Email: Slugborns@msn.com

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): Carbon Tax

Requested time to speak: < 5 minutes 5 minutes

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If you wish to speak today, please complete the following:

Name: ERIC MARTIS

Affiliation (if any): ICC

Phone: _____

Email: _____

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

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If you wish to speak today, please complete the following:

Name: Kevin Mantos
Affiliation (if any): NCC
Phone: 517-403-2439
Email: Kevin@KevinMantos.ca

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic

(Please specify): _____

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If you wish to speak today, please complete the following:

Name: David Karowe
Affiliation (if any): WMU Biological Sciences
Phone: 387-5630
Email: karowe@wmich.edu

Topics you wish to address today:

- a. Renewable Energy Portfolio Standards
- b. Energy Optimization / Efficiency Standards
- c. Electric Choice
- d. Other Additional Energy Topic Climate change

(Please specify): _____

Requested time to speak: < 5 minutes 5 minutes

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To consider

1. Increase the RPS objectives from 10% to 25%. The increase is highly achievable and will ensure that Michigan maintains momentum for in-state capacity investments.
2. Require that at least 50% of the capacity is met with non-utility owned, in-state distributed generation. This will provide benefits for the distribution system and ensure distributed generators are not disadvantaged. The diversification of Michigan's energy production will expand economic development geographically and increase the industry sectors that participate. This approach has the most potential for strengthening existing Michigan businesses, especially the agricultural sector.
3. Assign interconnection costs for distributed generation projects to utilities to be recaptured in rate base. This is appropriate since currently, a distributed project owner must now pay these costs, but since the utility owns the assets, the project owner receives no depreciation benefit and cannot be assured that the investment will ever be returned. The interconnection costs are also appropriately viewed as a public benefit, since the project avoids the line losses associated with centralized generation and pays for necessary upgrades that have, in many cases, been postponed by utilities. (Overisel example, a proposed- new digester already built but not connected, \$750,000 to upgrade the old substation).
4. To ensure anaerobic digestion/biogas projects can obtain private financing, implement a mechanism that ensures distributed generators receive a fair market price through one of the following: (a) power purchase agreement in which generator receives full value of distributed energy, capacity investment and environmental benefits; (b) where utility refuses to pay a sufficient price, provide option to wheel power at nominal fee to willing 3rd party buyer; (c) feed-in-tariff that provides a minimum of \$0.12/kWh for ten years.
5. As owners of two sites that are generating energy from biomass we feel we need a mandated formula for contract pricing similar to the company owned renewable projects. Our contracts for energy sales will be expiring in just over two years, and we were told that the utility would not be interested in renewing our contracts. This puts us and several others and future projects with a challenge to be a viable participant in the future. We would like to be assured that the investments that have been made and to be made in the future continue to have access to Michigan's distribution system for the future.
6. The benefits to projects like our anaerobic digestion biogas systems is base load energy, reducing greenhouse gas and jobs for Michigan workers, both for construction and operation. I believe that the state of Michigan should keep these projects going and growing with the assurance of market access.

Regards Mike Geerlings

Owner and managing partner of Scenicview Dairy, Brookview Dairy

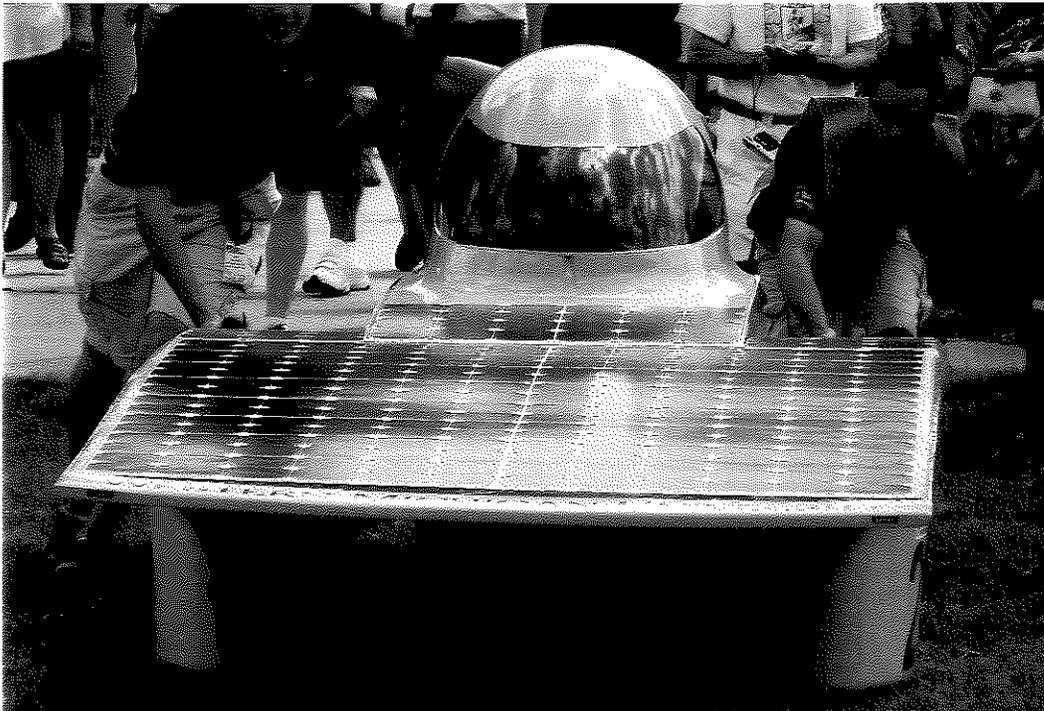
Owner of Geerlings Hillside Farms

Michigan Energy Public Forum
March 18, 2013
Western Michigan University
Written Statement
Robert Alway robertalway@charter.net 269-692-3743

Renewable Energy

Solar electric panels are currently dropping below \$1 per watt rated capacity and the cost of related electronics for grid tie connection of that power dropping as well. Installation costs rather than equipment costs are beginning to dominate the price of solar electric power. The cost of installation is largely governed by the physical size of photovoltaic or solar electric panels. Any increase in efficiency of solar electric panels directly impacts and reduces the cost of an installation. More specifically, an increase in efficiency would increase the output of an individual system design with minimal increase in cost.

Currently available photovoltaic panels designed for grid tie connection have efficiencies on the order of 10-15%. The individual solar cells used in these panels are of the classic single junction silicon design. In recent years there have been a number of improved types of multi junction cells developed with efficiencies on the order of 30%. The cost of these more efficient cells has limited their use to applications where weight and size are critical, such as space craft. However, high efficiency cells have been demonstrated routinely in the college solar electric car race. Both Western Michigan University and the University of Michigan have successfully entered vehicles in that race. I feel that Michigan should encourage the development of low cost production of high efficiency solar cells at our public universities and/or private companies.



WMU Electric Car June 2012



U of M Electric Car June 2012