

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of DTE Electric
Company for approval of its integrated resource plan
pursuant to MCL 460.6t, and for other relief.

Case No. U-20471

DIRECT TESTIMONY
AND EXHIBITS
OF
ROBERT RAFSON

On Behalf of

Great Lakes Renewable Energy Association

August 21, 2019

I. QUALIFICATIONS

Q. Please state your name and business address for the record.

A. My name is Robert Rafson, and 200 Viridian Drive, Muskegon, MI 49440

Q. On whose behalf are you testifying?

A. I'm testifying on behalf of the Great Lakes Renewable Energy Association ("GLREA"). I am a member of GLREA IRP Committee and a ratepayer of Consumers Energy. I am also the owner of Chart House Energy, LLC, a renewable energy development company.

Q. What is the GLREA?

A. The GLREA is a 501(c)(3) (non-profit) corporation based in Michigan. GLREA's Mission Statement is to "Promote the Use of Renewable Energy in Michigan and in the Great Lakes Region, By Empowering Our Members and the Public Through Advocacy, Education and Strategic Collaboration. GLREA's vision statement is: "We believe that current and emerging clean, renewable energy solutions can provide 100% of the electrical energy demand in the Great Lakes Region. Furthermore, we believe that increasing development and access to clean, renewable energy that is locally produced, operated and utilized, supports economic development, creates new good paying jobs and is essential to supporting healthier, more resilient communities that advance climate justice."

Q. What is Chart House Energy, LLC?

A. Chart House Energy ("Chart House") is a renewable energy development firm focusing on solar photovoltaic ("PV") resources and some energy efficiency measures. Chart House built the first commercial system under Consumers' EARP program in June 2010,

then largest PV project in Michigan at the time. Chart House also built the then largest PV system in Iowa at the time as well as many larger commercial sized solar PV systems throughout Michigan and a few other places around the state and Midwest.

Chart House comes from an economically distressed community. Chart House recruits, trains and hires from low- and moderate-income (“LMI”) populations throughout the state. Presently, Chart House in partnership with the City of Ypsilanti won honorable mention (4th place of 141 teams) U.S. Department of Energy (“USDOE”) SunShot Solar in Your Community Challenge where we have trained LMI people in Ypsilanti, Detroit, West Bloomfield, Muskegon, and will be in Flint and other communities. The training includes actual installs and pays workers a living wage. After the installation we assist trainees to obtain permanent construction jobs some with PV installers. We believe that renewable energy jobs provide the transition from under- or un-employment to good paying construction jobs and that this can be the more important part of the transformation change created by renewable energy deployment.

Q. Please describe your educational background.

A. I received a Bachelor of Science degree in Mechanical Engineering from the University of Wisconsin-Madison and a Professional Engineering License in Wisconsin, Illinois and Michigan. I also have received North American Board of Certified Energy Practitioner (“NABCEP”) certification as a certified PV designer and installer.

Q. Please describe your relevant business experience.

A. I have been a Brownfield Developer for more than 25 years and started installing renewable energy and energy efficiency measures on my buildings for roughly 15 years.

In 2009, I started Chart House Energy and have developed more than 4 MW of solar. In addition, I participated in the MPSC Distributed Generation workgroup and DTE Distributed Generation tariff case.

Q. Are you sponsoring an exhibit with your direct testimony?

A. Yes. I am sponsoring **Exhibit GLREA-4 (RR-1)**, Resume of Robert Rafson.

Q. Was this exhibit prepared by you or at your direction?

A. Yes.

Q. Have you previously presented testimony before the Michigan Public Service Commission (“MPSC” or the “Commission”)?

A. Yes. In the DTE PURPA Case U-18091, in DTE rate case U-20162, and in the IRP case for Consumers Energy Company, U-20165.

Q. What is the purpose of your direct testimony?

A. The purpose of this testimony is to address how DTE relies on traditional, backward thinking business as usual practices compared to ideal forward thinking planning processes. **We discuss ways to create fair rates, lack of public engagement, distributed generation, PURPA and the impact of this plan on Low to Moderate Income (LMI) customers.**

We advocate that DTE, the MPSC and other relevant parties should work towards regulation that embraces:

- Simplicity
- Understandability

- Public acceptance
- Freedom of controversies of interpretation
- Effectiveness of yielding total revenue requirements under fair return standard
- Rate stability
- Avoidance of undue discrimination

Q. Does the IRP or existing rate structures result in total revenues consistent with a fair return standard?

A. No. There has been a shift over the past few years from energy based rate structures to demand based cost recovery. Presently, 75% of cost recovery is demand charges. Demand charges are created by taking the total revenue requirements and dividing by the coincident peak (max demand during the month). This seems reasonable, but it is then applied to each customer's non-coincident peak. Adding up all of the demand charges collected results in over recovery of 1.7 to 1.8 times according to the EIA. This over recovery is pure profit to DTE because there is no PSCR to correct. The result is a failure to create structure yielding total revenues under fair return standards.

Q. Did DTE Energy make enough efforts to engage the public to achieve understandability, public acceptance, and avoid undue discrimination with respect to this IRP plan?

A. No. Several colleagues attended DTE's public events which seriously failed to engage the public. The meetings were a forum for the public to discuss their opinions with little or no direct discussion or comment from DTE. It is important to engage the public, as the Commissioners have been doing, to best understand the issues that most concern the

ratepayers and incorporate their concerns in the planning and implementation of the IRP.

It is clear that the IRP does not consider anyone's opinion other than what is best for DTE.

Q. Is the IRP clear and understandable?

A. The IRP fails to be clear and understandable. There appear to be no effort to simplify or explain what they plan or how it impacts ratepayers.

Q. Does the IRP address the growing disparity between residential, commercial, and industrial customers?

A. Rates continue to increase more for residential than commercial or industrial customers. This disparity is increasing the cost recovery gap where the residential customers are carrying a larger share than commercial or industrial. This is most heavily felt by the customers with the lowest usage including LMI customers and those who have chosen to invest in solar. By increasing fixed fees these customers are most affected. Programs to help LMI customers do not fix the disparate cost recovery that result in very high \$/kWh rate and thus discriminate against the smallest users.

Q. What is are your overall thoughts on DTE Energy Integrated Resource Plan (“IRP”) proposal?

A. As Charles Allen Goodman of Lawrence Berkley National Labs wrote in his paper, “Creating the future, Integrated Resource Planning for Electric Utilities”,

“Integrated resource planning (IRP) helps utilities and state regulatory commissions assess consistently a variety of demand and supply resources to meet customer energy-service needs cost-effectively. Key characteristics of this planning paradigm include: explicit consideration of energy-efficiency and load-management programs as alternatives to some power plants,

consideration of environmental factors as well as direct economic costs, public participation, and analysis of the uncertainties and risks posed by different resource portfolios and by external factors. IRP differs from traditional utility planning in several ways, including the types of resources acquired, the owners of the resources, the organizations involved in planning, and the criteria for resource selection.”

DTE utterly fails to do this. It is more a strong armed attempt to keep “business as usual” which includes preventing competition, continuing with a minimum level of adoption of new technology and massively overcharging customers to increase corporate profits in a time of level demand. DTE is in sharp contrast to Consumers in public participation, where Consumers has embraced collaboration with other parties to come to agreement in overall and detailed planning for the utility operations. In contrast, DTE failed to make any substantive attempted to include the public.

Q. How does DTE fail to “Create the Future” in their IRP?

A. Attached is Exhibit GLREA-5 (RR-2) a graphic from Union of Concerned Citizens which shows approximately what the effect of DTE’s IRP plans. DTE’s BWECC is a combined cycle natural gas plant that will replace upcoming retiring coal plants. This and the additional proposed natural gas electric generating plants. instead of alternative energy, as shown in the graphic move from coal generated coal to natural gas, will result in very little reduction in CO2 emissions to address increased global temperature and worsening climate change. While it is better to have natural gas than coal in the short term, it does not resolve the decarbonization we need to achieve.

Q. What should DTE move towards?

A. GLREA believes that the energy future needs to embrace the three D’s:

Decentralization

Digitalization

Decarbonization

Q. How will Decentralization improve utility operations and reduce costs?

A. Decentralization modernizes the grid and improves reliability, integrates distributed energy resources (DER), improves power quality and decreases costs by supporting adoption of lowest cost power generation from distributed energy resources (DER) and decreasing O&M and distribution. While other utilities are moving forward towards meaningful pilot tests like Consumers (including pilot tests that fail but provide useful guidance on how to move forward), DTE has barely explored pilots that can guide future IRPs. DTE needs to proactively move forward with decentralization to prevent future reactive IRPs.

Q. How does Decentralization improve reliability?

A. Renewable energy adoption is by its very nature distributed. Large central power plants are being replaced with a larger number of much smaller, even tiny, power plants: photovoltaic (utility scale and rooftop), biogas and biomass, hydroelectric and wind turbines. These distributed generation will be supported by other types of generation and storage and the combination need to be integrated into a new micro-grid style distributions system. These interconnected smaller grids (built on the existing substation branch grid system) will be more reliable than centralized grid system by allowing each area to operate independently.

Nearly everyone has experienced a power outage last year, whether due to a storm or a technical glitch in the grid. Decentralized power using smart grid technology, new energy

storage methods, and a new grid architecture would reduce the size and severity of outages and allow for safer more rapid grid repairs thus improving reliability.

This IRP fails to address decentralization because it almost completely lacks a discussion or planning of any alternatives beyond utility owned, utility scale (centralized) assets.

Q. Does DTE address behind the meter solar?

A. No. There is an almost complete lack of inclusion or planning for DG renewable energy. It is almost as if they believe that the 1% minimum adoption is an absolute cap and that it will stop at that point and therefore no further consideration be needed. GLREA believes that behind the meter solar will exceed 1% by the end of 2020 and that this IRP should and must include a plan for behind the meter DG expansion.

Creating a DG tariff at a fair and reasonable rate should provide fair compensation to both the DG customer and to the utility. Therefore, we believe that there should be no cap on DG and ask the commission to explicitly write this into this IRP or convince DTE to include expanded DG in their planning. The Commission should direct DTE to amend their IRP with a fact-based evaluation of using behind the meter solar to fulfill the appropriate part of the IRP objectives.

Q. Why is Digitalization important?

A. Digitalization allows DER, energy efficiency, DR and DG to be controlled and result in better power quality and more reliable operation. DTE appears to have embraced digitalization, though they nearly completely lack any consideration or discussion of digitalization with regards to DER and DG. The Commission should direct DTE to include DER and DG in their planning and control strategies as they implement

Digitalization. DG is already nearly 1% of generating capacity and is a huge opportunity to provide distributed grid support that DTE seems to be failing to understand and take advantage at very little cost.

Illinois utilities are purchasing smart inverters for their DG customers so that they can first have access to the data generated and eventually to allow voltage and VAR control of the out of the inverters which in turn will allow the utilities to create higher quality power to all customers on that part of the distribution network. There are opportunities like this that need to be considered as we work towards the grid of the future.

Q. What about Decarbonization?

A. Consumers Energy's IRP plan embraces the shift from expensive polluting coal and natural gas generated power to renewable energy and DER. In contrast, DTE's IRP embraces "business as usual" by a slow shift from centralized coal to centralized natural gas and a slow adoption of renewable energy, mostly in the form of company-owned centralized wind farms. As above described, there are significant benefits to decentralization. However, DTE's IRP focuses on remaining in control of as much generation as possible, while focusing on fossil fuel based generation and keeping out competition. It is unfortunate that DTE twisted the modeling assumptions to support their plan for more centralized natural gas plants, thereby foreclosing the better option of planning cheaper decentralized DER. By comparing capacity and energy natural gas plants with energy only DG and DER, DTE argues that natural gas plants are prudent. This is not only not a fair comparison but deceptive and expensive both to the ratepayers and environment.

Solar is now the cheapest generation technology followed closely by Wind. Consumers has proven through their IRP this to be true with a fair and balanced analytical approach as compared with DTE's approach that fails to include all costs and benefits when evaluating generating technologies. Additionally, Wind tends to be far from load centers and thus require significant transmission and distribution infrastructure as does some utility scale solar. In contrast, both behind the meter and mid-scale solar are on the distribution network close to local load centers.

Comparing solar levelized avoided cost of energy, \$0.0403/kWh (EIA 2018), and DTE's \$0.085/kWh cost recovery for BWEC in case U-18419, it should be obvious that the solar would be a better, cheaper option. The Levelized Cost of Energy approach fails to account for the time of generation and that makes solar even more valuable.

Q. How would you compare Consumers' and DTE's IRP as it relates to planning for our "energy future"?

A. While we credit Consumers commitment to install 5,000 MW of solar by 2030, the Union of Concerned Scientist's analysis shows this is only about ½ as much as we need to achieve the levels of penetration needed to avoid the worst of the effects of climate change. While DTE's IRP proposal "moves away from coal" (according to DTE website corporate goals), DTE is presently building the 1,150 MW BWEC natural gas plant, and proposes multiple 414 MW natural gas plants. It is disingenuous for DTE to pat themselves on the back for reducing their carbon emissions when most of that reduction is derived from inefficient coal generation to more efficient natural gas, and energy efficiency which they don't even pay for. The cost of the change from fossil fuels to

renewable energy is not only the right thing to do, it also is economically viable as proven in Consumers IRP.

Q. Are there other concerns you have about DTE's IRP?

A. GLREA is concerned that DTE should:

- Ensure the benefits generated by renewable energy are shared equitably
- Create sustainable jobs in Michigan for long-term economic vitality and growth
- Support a strong and diverse renewable energy workforce
- Keep energy customers informed
- Implement a distributed generation ("DG") tariff which will ensure future development of solar resources and support the grid by being distributed.

Q. Why is PURPA important to the GLREA in this IRP?

A. Regarding the Public Utility Regulatory Policy Act ("PURPA"), I am adopting the Union of Concerned Scientists' evaluation of PURPA. that PURPA

“was passed in 1978, in the midst of the energy crises that ripped through industrial world economies. Faced with predictions that the price of oil would rise to \$100 a barrel, Congress acted to reduce dependence on foreign oil, to promote alternative energy sources and energy efficiency, and to diversify the electric power industry.

“One of the most important effects of the law was to create a market for power from non-utility power producers, which now provide 7 percent (sic) of the country's power. Before PURPA, only utilities could own and operate electric generating plants. PURPA required utilities to buy power from independent companies that could produce power for less than what it would have cost for the utility to generate the power, called “the avoided cost”.

“PURPA has been the most effective single measure in promoting renewable energy. Some credit the law with bringing on line over 12,000 megawatts of non-hydro renewable generation capacity.”¹

PURPA-based contracts remain critically important in diversifying electrical generation while causing a decrease in generation costs. Non-utility power producers also provide more jobs in more diverse locations than utility projects. GLREA supports PURPA based contracts.

Utilities argue that long stable contracts for power increase power rates but that is simply not true. The PURPA rate was established by the MPSC using a “cost of service” study that results in lower cost for the utilities to operate and, though conditions might change in the future, those stable contracts will by nature produce capacity and energy at a lower cost than the utility themselves would have created them. In contrast, utility-owned facilities are always equal to or more expensive than PPA facilities and utility-owned facilities increase over their lifetime and have indefinite facility time spans.

Q. How often should the capacity requirements be revisited?

A. DTE has indicated that they foresee no capacity need for the next ten years but have also indicated by 2023 (L.K. Mikulan Q 118):

1,644 MW Plant closures

<1,150> MW BWEC

494 MW Resulting Capacity short fall

¹ See, Union of Concerned Scientists. https://www.ucsusa.org/clean_energy/smart-energy-solutions/strengthen-policy/public-utility-regulatory.html#.W8Gn0RNKiuV.

This accounts for most of the 600 MW indicated capacity DTE says they need. Additionally the PCA indicates 11 MW of solar and storage and 50 MW of 2017 completed solar committed to MIGreenPower Voluntary Green Pricing program. Therefore, nearly 700 MW of capacity needed but DTE falsely assumes no capacity need. If they don't achieve goals in EWR, DR, VCR, or have any other equipment losses or changes in customer usage (like increase in EV adoption faster than assumed by DTE), then the capacity need will grow. If the IRP is approved as written then DTE will be able to fill capacity as they desire without considering less expensive alternatives like PPA's, or behind the meter solar.

A three-year assessment period leaves two years of the IRP window without determination or guidance. The IRP suggest more frequent capacity reporting but not a consistent review. GLREA recommends annual capacity reporting along with outage reporting.

We would suggest that the MPSC set the amount of PURPA capacity to be built in each five-year IRP development period. This could be done in conjunction with developing the PURPA rate by means of a cost-of-service study each five-year period. This provides time to plan and implement for both the power company and independent power producers and provide stability and transparency while maintaining MPSC regulatory authority. The Commission should not let DTE set the rate, process, or length of time between review periods within the IRP submission.

This is appropriate because Certificate of Need is approved by the Commission as a regular course of regulating the utilities. The utilities provide ten- and twenty-five-year planning windows. It is reasonable that the Commission will be able to determine what is

the best course of action when reviewing the Certificate of Need applications from time to time. The IRP statute gives the Commission authority to determine the reasonableness and prudence of investments, including cost for facilities (which in part will be set by the PURPA rate).

Q. How long should a PURPA contract be?

A. The standard contract should continue to be at least twenty years. The developers need a long-term contract to get financing for their project. Even at twenty years, this leaves the QF developer at a disadvantage compared with utility-owned facilities because the utilities can run the renewable energy to the end of life of the equipment (forty plus years for solar). In fact, we support extending the contract period to twenty-five years, to match the capacity outlook period of the IRP process, and the warranty period most commonly offered on PV modules. We would recommend that DTE consider extending these contracts for longer periods to increasing stability in pricing while keeping cost of power low.

Q. Should PURPA contracts be preferred over utility owned assets?

A. By their very nature, PURPA contracts will always be cheaper than utility owned assets. PURPA contracts encourage deployment of renewable energy, at diverse locations, and at stable, fair and reasonable rates.

Q. Is there a need for solar capacity?

A. Yes. Solar is synergistic with wind. We are approaching fifteen percent (15%) wind generation in the state. To balance that generation, which is stronger during the winter and at night time, solar fills in during the summer daytime. Ideally, the balance should be

about 2 Watts of solar for each Watt of wind. This is highly relevant to DTE's IRP since they plan to expand wind without much solar. Thus, we have a very large need for solar in the state to make the transition to renewable energy.

We credit DTE for embracing at least some solar, although in highly deficient amounts. In contrast, Consumers has advertised, "We're proposing 5,000 megawatts of solar energy with a ramp-up throughout the 2020s to prepare for the retirement of the Campbell units and the Karn 3 and 4 peaker units, as well as the end of our power purchase agreement with the Midland Cogeneration Venture."². And Consumers' settled PURPA queue for 584 MW solar needs to achieve their 2023 goals. GLREA supports this program made by Consumers.

In contrast, DTE fails to address the PURPA queue. The only way they address capacity need is through purchasing energy and capacity on the open market if they don't have a persistent need. This is not an acceptable way to address capacity or energy need or for that matter planning which is the whole point of the IRP.

Q. Should the "standard contracts" process and size for PURPA applications be changed?

A. No. 3 MW (commercial scale) should continue as a standard contract as specified in 2016 PA 341. This will promote distributed generation with little or no impact on existing grid and in fact will decrease additional cost of infrastructure by reducing load throughout the grid. The 3 MW systems provide significant impact with little or no cost

² Consumers Energy 2018 IRP Executive Summary page 4, see, <https://www.consumersenergy.com/-/media/CE/Documents/sustainability/integrated-resource-plan-summary.ashx?la=en&hash=9F602E19FE385367FA25C66B6779532142CBD374>

for additional grid infrastructure changes. 3 MW can be carried by nearly every power line in the present grid structure. There are significant economies of scale in going from 150KW to 3 MW. Smaller, incremental facilities are desirable to a certain degree, but 3 MW is large enough to achieve utility scale pricing.

Additionally, the standard contract should be consistent with the principles listed the standard contracts should be simple, understandable, and free from controversy of interpretation. The standard contract offer proposed by DTE is horrendous and created more barriers to PURPA developers than DTE has for it's own developments. This is neither fair nor the intent of the standard contract offer which was to make a contract that would not have to be negotiated by each of these relatively small projects.

Federal law requires the utilities to purchase power produced through PURPA. DTE argues first that they have no capacity need. DTE then argues that they may from time to time need capacity and will fill it through their own construction. The Commission should hold DTE's feet to the fire that all capacity purchased should be through the PURPA capacity already applied for by QFs. The Commission should not wait until the next IRP period, much less 10 years from now.

Q. Should DTE support economic and environmental justice?

A. Yes. There are many examples of how this can be achieved. DTE could preferentially choose projects and contractors who site projects in distressed communities and contractors who train and employ LMI community people. Unfortunately, DTE has only sited one solar array in Detroit and according to the IRP has no intentions of adding any other projects in the City. GLREA believes that renewable energy can be transformational to the communities and people who live in them. Not only does

renewable energy provide clean power to parts of the grid (often under supplied) but also expanded renewable energy would create construction, operations and maintenance jobs, desperately needed property taxes and thus provide lasting positive impacts on those communities in most need.

DTE's consultants testify that EWR help LMI customers. This is true if they can afford the EWR measures.

DTE's IRP does not do enough to achieve Environmental justice. Utilities have taken advantage of poorer communities, siting coal power plants adversely affecting economic, health and safety, and with lack of compensation for the damage done to these communities. What is worse is that utilities have displayed even less compassion for struggling communities, like Highland Park, MI (where instead of figuring out how to address delinquent bills and to decrease services, and to figure out a way to still provide street lighting and maintain safety (which was the initial reason for electrification as described by DTE staff at a recent meeting), DTE instead chose to repossess the light poles leaving the city completely without the safety of street lights.

Q. What role should customer owned systems have?

A. GLREA strongly supports customers who want to install their own renewable energy, and to thereby provide benefits to the grid. Some counties in the state have reached the cap on net metering. GLREA supports lifting the cap and including solar capacity as part of the overall capacity planning. These small generators by their very nature are distributed and reduce stress on the grid, especially at peak times, which is good for all customers and the utilities.

Q. Can true net metering provide economic benefits to non-DG customers?

A. Yes. In a study I did as part of the DG tariff work group last year, I determined that the average customer actually provide \$0.023/kWh savings to the utility beyond true net metering, not including all of the avoided costs and risks not included in existing rates. Thus, all customers who have invested in solar are actually subsidizing all the non-solar customers. The utilities have repeatedly argued to the contrary. At present, DTE modified metering charges includes an additional fee to customers who have invested in systems between 20 kW and 150 kW by only paying customers for energy only outflowing to the grid, thus double dipping on transmission fees when this customer or another customer receives that same fee. We ask the Commission to lift the cap and include this capacity in the overall capacity planning.

Q. Does this end your testimony?

A. Yes.



ROBERT N. RAFSON, P.E.

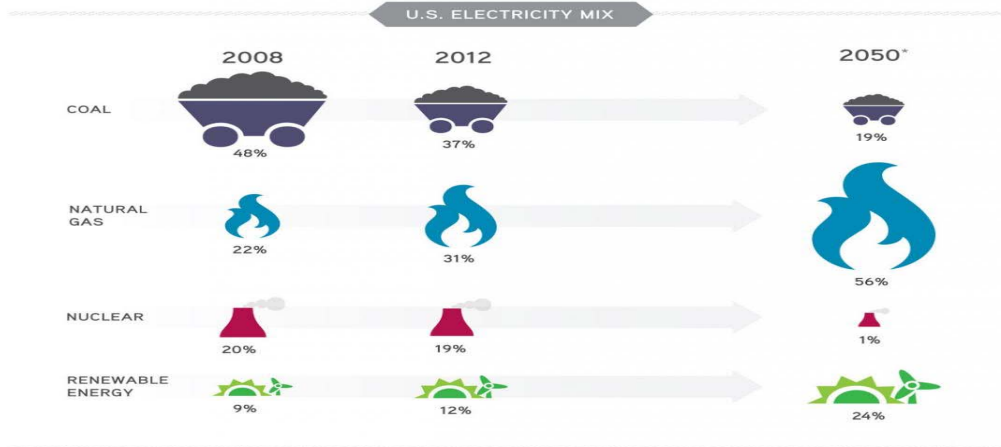
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- Education: B.S.M.E. - University of Wisconsin / Madison – 1983
NABCEP certified Installer - 2012
- Professional Engineer: P. E. Wisconsin - 1988 - (recognized in 16 states)
P. E. Illinois – 1995
P. E. Michigan - 2017
- 2009 to Present: President, Chart House Energy LLC, Renewable energy development firm. Installed the largest solar PV system in Michigan (150kW) and Iowa (200kW) and the second largest PV system in Illinois (630kW). To date, Chart House Energy has installed over 4 MW.
- 1989 to 2010: Owner, Rafson Engineering, Inc. providing comprehensive environmental engineering services including air pollution control design, testing, and training and phase I, II and III environmental assessments and clean up planning and oversight.
- Partner, Greenfield Partners, Ltd. contaminated property buyers involved in all facets of Brownfield redevelopment. 27 property clean ups and redevelopment including 4 SUPERFUND sites. Redevelopment included energy efficiency and renewable energy.
Renewable energy projects include the largest solar thermal system in Illinois.
- Publications: Author, Brownfields – Redeveloping Environmentally Distressed Properties, McGraw- Hill, 1999
- Author, VOC and Odor control manual, McGraw-Hill, 1997

THE CLIMATE RISKS OF NATURAL GAS

THE U.S. ELECTRICITY SYSTEM IS GOING THROUGH ITS BIGGEST TRANSFORMATION IN HALF A CENTURY

Old and inefficient COAL PLANTS ARE CLOSING. The choices we make to replace them will determine our electricity sources for the next 30 – 50 years. Right now WE ARE MOVING TOWARD A NATURAL GAS-DOMINATED ELECTRICITY SYSTEM.



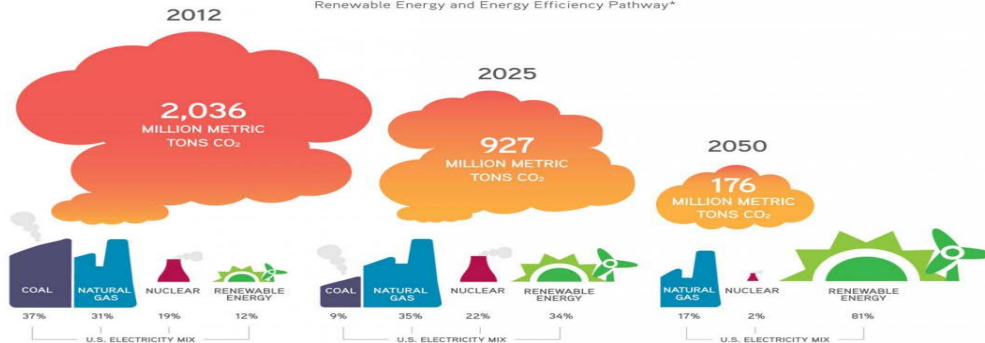
A NATURAL GAS-DOMINATED ELECTRICITY SYSTEM WOULD CONTINUE TO HEAT UP THE PLANET

U.S. EMISSIONS FROM ELECTRICITY PRODUCTION



PRIORITIZING RENEWABLE ENERGY AND ENERGY EFFICIENCY TODAY CAN DRAMATICALLY REDUCE GLOBAL WARMING EMISSIONS

U.S. EMISSIONS FROM ELECTRICITY PRODUCTION
 Renewable Energy and Energy Efficiency Pathway*



Improved energy efficiency would reduce projected U.S. electricity demand in 2050 by **MORE THAN 30%**.

*Based on UCS-led analysis using the National Renewable Energy Laboratory's Regional Energy Deployment System (ReEDS) model. Panels 1 and 2 assume no changes to existing state and federal policies.

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

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ELECTRIC COMPANY for approval of its
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460.6t, and for other relief

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PROOF OF SERVICE

On **August 21, 2019**, an electronic copy of the **Direct Testimony and Exhibits of Robert Rafson** on behalf of **Great Lakes Renewable Energy Association** was served on the following:

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The statements above are true to the best of my knowledge, information and belief.

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Dated: August 21, 2019