CLOSUP Student Working Paper Series
Number 56

April 2020

Solar Energy on Michigan's Preserved Farmlands: A Content Analysis of Michigan Print Media

Trevor J. Force, University of Michigan

This paper is available online at http://closup.umich.edu

Center for Local, State, and Urban Policy
Gerald R. Ford School of Public Policy
University of Michigan

Trevor J. Force

ENVIRON 302

April 29, 2020

Solar Energy on Michigan's Preserved Farmlands:

A Content Analysis of Michigan Print Media

Abstract

As the effects of climate change intensify and Earth's supply of fossil fuels continues to dwindle in the face of expanding consumerism and rising populations, the development of clean energy alternatives is more important than ever. Michigan's state government has recently opened 3.4 million acres of privately owned preserved farmland to potential solar development in a move to encourage clean energy development and to make it easier for farmers to convert their lands to solar farms. However, not everyone wants solar production on their farmland, and others do not want the government dictating what they do with their own farms. This paper evaluates public commentary on this issue to determine the positive and negative aspects of the policy change and to inform future solar policy in Michigan. The results imply that support for solar is growing but has not increased significantly over the past 10 years; however, the policy change opens a lot of opportunities to farmers and solar developers in Michigan. Though this research cannot draw significant conclusions about how the policy change has affected Michigan energy consumers since its inception, it does conclude that the changes set up the Michigan solar market to grow and prosper in the future.

Introduction

As the effects of climate change intensify and Earth's supply of fossil fuels continues to dwindle in the face of expanding consumerism and rising populations, the development of clean energy alternatives is more important than ever. Currently, the US generates about 17% of its electricity from renewable energy (RE) sources, as compared to 37% from natural gas-fired power plants, 24% from coal, and 20% from nuclear (Energy Information Administration, 2020). With continued development and more government support, the EIA (2020) expects RE production to surpass both coal and nuclear energy by 2021 as solar power continues to expand and outpace wind energy.

Historically high costs of implementation for RE have always given coal the upper hand in the cost conversation, providing good margins for American coal plants. However, the past decade of advancement in energy harnessing and storage technology has been evening the playing field bit by bit. For example, the benchmark price for solar development dropped by 84% between 2010 and 2019 (Broom, 2019). Many local and state governments seem to be responding to this downward trend in cost of RE by taking steps towards becoming more RE-reliant with initiatives such as Renewable Portfolio Standards (RPS), carbon neutrality commitments, and carbon taxes (Kolesnikoff et al., 2019; Detz, 2019). The way in which different cities and states do this varies widely, and the energy policies meant to promote RE are often controversial due to the varying effects that they have on different industries and stakeholders. Solar and wind development, for example, are often inhibited by questions of visual aesthetic, land use, and zoning restrictions.

In the state of Michigan, the question of land use is vital to the further development of solar energy. In June of 2019, Governor Gretchen Whitmer and Michigan Department of Agriculture and Rural Development's (MDARD) director Gary McDowell announced a change to the state's Farmland and Open Space Preservation Program (commonly known as P.A. 116) that would allow for commercial solar development on its preserved farmlands, an idea that was developed by a workgroup that was investigating ways to integrate solar panels with the larger farmland preservation effort. This program gives tax incentives to landowners who enter agreements to keep their land for agricultural use, and with 3.4 million acres of farmland enrolled at the time, this amendment opened a lot of land to potential solar development (MDARD, 2020). Previously, the program had excluded solar panels as an acceptable means of preservation, which had a limiting effect on solar development since the P.A. 116-enrolled lands could not be utilized by large-scale solar developers that lease large tracts of land for their solar farms. Now, Michigan farmers have more options with opportunities for solar tax incentives and clean energy production opening across the state.

However, some prefer to not replace Michigan's farmlands with solar panels, with common dissenters citing the destruction of land fertility, uncertain costs of installation and removal, and local zoning restrictions as reasons to rethink MDARD's change. This paper seeks to understand how Michiganders have reacted to this policy change and how those associated attitudes towards solar development have shifted over time. To do so, the study conducts a content analysis of local newspaper coverage on the subject across the state, evaluating support or the lack thereof by the diction used in discussing solar development, farmland preservation, and other related subjects. This analysis aims to highlight trends in support for solar and RE

development in Michigan and uncover insights that could inform future decisions around solar policy and land use.

Literature Review

Michigan, in comparison with states that generally receive more sunlight or have more aggressive RE policies, has had little research done on solar energy and the factors affecting its development throughout the state. Research with regards to solar development on Michigan farmland is even more sparse and is yet to evaluate the effects of the P.A. 116 change. In order to better understand Michigan's current stance on solar development, this paper draws on research from other states and countries that evaluate what factors may promote solar energy and what policies best facilitate positive reactions to solar development.

Siting Solar Development

There is generally a positive correlation between population size and the adoption of solar in a city (Hsu, 2018). With more people in a town, there are more people to own/install solar panels, and more energy to be produced and consumed. On the other hand, low-density communities have a higher rate of solar PV installations due to the presence of more single-family homes and less shade from larger buildings (Hsu, 2018). These two trends are slightly paradoxical, but they make more sense when considering mid-size cities where there are large populations, not a lot of tall buildings, and a large surrounding suburban presence. Other factors affecting the rates of solar development include the presence of municipal utilities; those using municipal resources are less likely to receive credits for their excess solar production (in California, where Hsu's study was done, the California Solar Initiative rebates do not apply to municipal utilities), whereas investor-owned utilities (IOUs) are more likely to compensate solar

panel owners (Hsu, 2018). In states that leave their utilities in the hands of the investors, installing solar panels would be much more cost-effective. More educated populations also correlate positively with solar installations; lack of education is often cited as an inhibitor of acceptance of solar development (Hsu, 2018; Schelly et al., 2019).

In identifying which towns and communities are most likely to adopt solar development, it is also important to figure out which locations in those communities are best fit for accommodating solar panels. According to an ongoing survey of the solar power preferences of Long Island residents, rooftop solar, carport solar, and ground-mounted systems on landfills proved to be the most popular with about 75% support each, but projects on agricultural lands still garnered 72% support (Schelly et al., 2019). Though the involved stakeholders showed a general awareness of environmental issues and RE technology, there was an apparent need for education regarding the financing, funding, and utility motivations for undertaking mid to large scale solar projects. The study found little backlash to the proposed solar projects based on visibility of panels or visual aesthetic, but they did consider general lack of knowledge, transparency, and trust to be the most prevalent reasons for dissent. One of the most common points against solar is the high cost; if everyone knew how much more cost-effective renewable energy has become in the past decade, they may be quicker to support further investment in it (Broom, 2019).

Policies which Promote Solar

There are a variety of ways to kickstart solar energy development, and the policies that do so appear at federal, state, and local levels, though this paper only focuses on the latter two. Research by Li and Yi (2014) shows that the establishment of state-specific renewable portfolio standards “has significantly contributed to the deployment of solar PV panels in the cities,” and

they attribute this trend to the "mandatory nature of the policy design" which "creates a large market demand for solar technologies." States have established standards of varying urgencies and expectations; more than half of the United States have state-level RPS with RE goals ranging from 10-100% over the next 30 years (Kolesnikoff et al., 2019). Michigan's RPS sets a goal of 15% RE production by 2021 and 35% by 2025 (MPRC, 2020). Based on the proven positive effects and nationwide diffusion of the idea, RPS has the potential to become even more widespread and continue to raise the stakes for statewide RE development. Research also finds that interconnection standards are a significant promoter of solar distributed generation (DG) and serve well as a market-opening policy to precede RPS establishment; this step is very simple in the grand scheme of state-wide solar advancement, and is a small investment considering the vast solar opportunities it opens up (Li & Yi, 2014; Krasko & Doris, 2013). City-distributed financial incentives like solar rebates and feed-in tariffs (FITs) have been found to positively influence local installed solar capacity, while the state-level equivalents can get complex and inefficient in under-developed markets (Li & Yi, 2014; Krasko & Doris, 2013). Some states are more ready for higher goals than others, and oftentimes the sequence in which the policies are laid out can have a significant effect on how well they are received by the public and relevant industries. Krasko and Doris (2013) found that building on a "low public cost policy foundation" (e.g. interconnection standards) helps lead to the creation of a more successful solar market in the future.

Benefits to the Farmers

Motivators for adopting RE range from purely financial considerations to those of a moral and ethical basis. Research shows that an ascription of responsibility to environmental degradation significantly increases a consumer's willingness-to-pay (WTP) for green energy,

with awareness of a behavior's consequences also making a big impact (Ndebele, 2020). By demonstrating how farming activities can negatively impact the environment, green education programs would help farmers gain knowledge as well as a sense of responsibility for their less-sustainable actions. While farming is a very natural process that is essential to human survival, there are many ways to do it without being sustainable or environmentally conscious. One big problem in the US is over-fertilization, which pollutes waterways, causes eutrophication and harmful algal blooms, and drives up supply costs (WOR, 2010). Another is soil erosion; if farmers over-till their fields, the soil will lose its moisture and nutrients and erode more easily, causing problems for farmers and their crops as well as local waterways (Trautmann et al., n.d.). Awareness of these harmful effects is the first step of action; if farmers know they contribute to the problem, they should be more likely to want to be part of the solution. Brudermann et al. (2013) found that positive attitudes towards the solar technology itself is hugely important in influencing the decisions of farmers when considering solar energy on their farmlands, and that adopting such technology has a compounding effect on increasing their trust of other technological solutions to environmental problems. Filling their fields with solar panels can be intimidating; starting with smaller scale installations or even different renewable sources altogether could be the key to getting farmers comfortable with integrating renewable technology in their operations. Not surprisingly, there is also a social aspect to the adoption of solar on farmlands. Brudermann et al. (2013) argued that once someone in a farmer's "personal environment" adopts solar PV, "barriers to adoption become much weaker." Again, this largely comes down to trust of the technology, installation process, and potential costs. If someone's trusted neighbor is willing to install solar panels, then they are more likely to do the same.

Support for solar energy development is manifested in many ways, and there are many factors influencing a stakeholder's decision to adopt solar PV. There is extensive research on solar policy and how to best promote solar development but little on the placement of solar panels on agricultural lands. In exploring this topic and seeking to better understand the solar market in Michigan, this paper aims to answer the following question: how have attitudes in Michigan about solar development on farmland changed over the past 10 years, particularly in light of the recent change to the state's Farmland and Open Space Preservation Program with respect to solar development?

Methods

To get an idea of where different stakeholder groups in Michigan stand on the farmland solar development issue, this study performs a content analysis of Michigan-based print media, including newspapers and magazines. This analysis aims to understand public commentary more than anything, so newspaper articles are used over policy briefs and political documentation which would not be helpful besides helping figure out exactly what the policy/policy changes are.

Using NewsBank Inc.'s *Access World News* database, a dataset of 199 articles that contain the keywords 'farmland' and 'solar' was compiled, drawing only from Michigan news sources. 42 duplicate articles were identified by reading through the articles and searching for similar dates, titles, and content, leaving 28 post-policy change and 129 pre-policy change articles to be examined. The 'farmland' and 'solar' keywords were chosen over other, more specific choices, such as 'P.A. 116' and 'farmland preservation,' because they showed up in

more articles and are more generalized to fit the overall topic of farmland solar without limiting the data to only articles about the P.A. 116 Farmland Preservation policy or the related amendments. The articles are from years 2010-2020, which also factored into the selection of keywords because they must be relevant during the entirety of the time period. The selection of those years was made in order to capture a variety of pre-amendment commentaries on solar development in general, which is then complemented by an uptick in farmland solar commentary following the Farmland Preservation change in 2019. This study aims to draw conclusions about the reactions to the aforementioned amendment as well as those about the ways in which attitudes towards farmland solar have shifted over the past decade in light of technological advances, the increase in proposed large-scale solar developments, and other influential factors that could help or hurt the case for farmland solar, which is why this particular time period is being analyzed.

The content analysis of these articles employs a thematic coding search that indicates whether the article is in support of or against solar development or RE in general, and whether their opinion extends to that on preserved farmlands. Table 1 lays out the choices in themes, with 1-4 being associated with anti-solar attitudes and 5-8 being associated with pro-solar attitudes.

Table 1: Thematic Coding Scheme

Code ID	Theme
1	Environmental Degradation/Pollution
2	Diversion of Farmland
3	Less Productive/More Expensive than Alternatives
4	Other Issues w/ Land Use
5	Promoting Clean/Renewable Energy
6	Financial Incentives/More Profitable than Farming
7	Reducing Carbon Footprint
8	Diversification of Resources/Farmland
101	Supports Solar
102	Indifferent/Unclear
103	Against Solar
201	Supports Policy Change
202	Indifferent/Unclear Stance on Policy Change
203	Against Policy Change

Many of the negatively associated themes refer to the high costs of solar development and the diversion of production from agricultural purposes, which are some of the obvious reasons for which consumers would not want solar development on their farmland. The positively associated ones are centered around clean energy motivations and sustainability, as well as financial incentives that may result from solar production. These eight positively and negatively oriented themes were created based on brainstorming of pros and cons of solar energy or its use on farmland and the subsequent readthrough of randomly selected ranges of articles. The themes that were mentioned and did not seem to overlap in subject with the other themes were used to create the codebook. Codes 101-103 sum up the pro and anti-solar comments within an article to determine whether it has a clear stance on solar energy overall; this process is based on critical reading and qualitative judgement.

Further evaluations are made based on the date on which the source was published. Those released prior to June of 2019 cannot be considered as reactionary to the change to the Farmland Preservation Program and those released after are associated with one of codes 201-203

depending on whether they explicitly mention the policy change. Attention is also paid to how the frequency of mention of themes changes over time; if a certain code comes up much more often in one year than another, conclusions could be drawn on why public commentary is shifting in that way.

Results

Excluding duplicates, 157 articles contributed to the results of the research conducted in this paper. Of those, 129 were published before the change to the Farmland and Open Space Preservation Program and 28 afterward.

Pre-Policy Results

Of the 129 articles, 48 (37.8%) were found to be in support of solar development/solar development on farmland, 79 (61.2%) were unclear on their stance, gave mixed thematic code results, or were found to be otherwise irrelevant, and two (1.6%) were in objection to it. Table 2 displays the counts of how often each thematic code was mentioned in the articles.

Table 2: Pre-Policy Change Code Prevalence

Theme	Pre-Policy Change Count	Percentage of Pre-Policy Change Articles (%)
Supports Solar	48	37.2
Indifferent/Unclear	79	61.2
Against Solar	2	1.6
Environmental Degradation/Pollution	0	0
Diversion of Farmland	27	20.9
Less Productive/More Expensive than Alternatives	3	2.3
Other Issues w/ Land Use	20	15.5
Promoting Clean/Renewable Energy	72	55.8
Financial Incentives/More Profitable than Farming	36	27.9
Reducing Carbon Footprint	13	10.1
Diversification of Resources/Farmland	7	5.4

The most common topics mentioned in support of solar energy or its use on farmland are Clean/Renewable Energy and Financial Incentives, mentioned in 55.8% and 27.9% of pre-policy change articles, respectively. There were fewer mentions of arguments against solar energy or its use on farmland, but the most common argument was about Diversion of Prime/Productive Farmland (20.9%). Other Issues with Land Use, which is a catch-all that includes zoning and setback concerns, distrust of government regulations or commercial development on private land, and destruction of community values were mentioned in 15.5% of articles before the policy change.

Post-Policy Results

Of the 28 articles, 19 (67.9%) were found to be in support of solar development/solar development on farmland, six (21.4%) were unclear on their stance or were found to be otherwise irrelevant, and three (10.7%) were in objection to it. Regarding the policy change, seven (25%) were in favor of it, 16 (57.1%) were unclear on their stance or did not explicitly mention the policy, and five (17.9%) were against it. Table 3 displays the counts of how often each thematic code was mentioned in the articles.

As with the pre-policy change results, Clean/Renewable Energy and Financial Incentives are the most prevalent codes, mentioned in 71.4% and 28.6% of post-policy change articles, respectively. A higher proportion of post-policy change articles mentioned arguments against solar than before the policy change, but Diversion of Farmland and Other Issues w/ Land Use were still the most common ones, mentioned in 25% and 21.4%, respectively. Environmental Degradation/Pollution also increased proportionally, growing to mentions in 7.1% of the post-policy change articles, up from 0 mentions prior to the policy change.

Table 3: Post-Policy Change Code Prevalence

Theme	Post-Policy Change Count	Percentage of Post-Policy Change Articles (%)
Supports Solar	19	67.9
Indifferent/Unclear	6	21.4
Against Solar	3	10.7
Supports Policy Change	7	25
Indifferent/Unclear Stance on Policy Change	16	57.1
Against Policy Change	5	17.9
Environmental Degradation/Pollution	2	7.1
Diversion of Farmland	7	25
Less Productive/More Expensive than Alternatives	3	10.7
Other Issues w/ Land Use	6	21.4
Promoting Clean/Renewable Energy	20	71.4
Financial Incentives/More Profitable than Farming	8	28.6
Reducing Carbon Footprint	2	7.1
Diversification of Resources/Farmland	5	17.9

Analysis

General opinions surrounding solar energy and the development of it on farmland in Michigan have not changed much over the past decade, but the P.A. 116 change in June 2019 makes it much easier for solar-friendly farmers to implement panels on their fields and support is starting to rise. The ratio of solar-supporting articles to indifferent/unclear articles is much higher after the policy change. To further explain this shift, this paper analyzes the individual codes and their significance before and after June 2019, the comparison of which is summarized in Table 4.

Table 4: Pre- vs. Post-Policy Change Code Prevalence Comparison

Theme	Percentage of Pre-Policy Change Articles (%)	Percentage of Post-Policy Change Articles (%)
Supports Solar	37.2	67.9
Indifferent/Unclear	61.2	21.4
Against Solar	1.6	10.7
Supports Policy Change	N/A	25
Indifferent/Unclear Stance on Policy Change	N/A	57.1
Against Policy Change	N/A	17.9
Promoting Clean/Renewable Energy	55.8	71.4
Financial Incentives/More Profitable than Farming	27.9	28.6
Diversion of Farmland	20.9	25
Other Issues w/ Land Use	15.5	21.4
Reducing Carbon Footprint	10.1	7.1
Diversification of Resources/Farmland	5.4	17.9
Less Productive/More Expensive than Alternatives	2.3	10.7
Environmental Degradation/Pollution	0	7.1

Promoting Clean/Renewable Energy

This is the most commonly observed theme and is highly correlated with support for solar or solar on farmland; only three of the 67 articles that support solar/solar on farmland do not directly promote clean or renewable energy. Those three articles focus on the financial benefits and potential profitability of solar development and do not mention any positive environmental/renewable aspects of solar energy. The other 64 mention clean, renewable, or carbon-neutral energy in some way or acknowledge the environmental impacts of using solar energy, and the last 28 mentions (92 total) are from articles that do not directly support solar/solar on farmland but still recognize its value as RE. Of the 92 mentions, 20 come after the policy change, representing a near 16% increase in prevalence. Additionally, all seven of the articles that directly support the policy change mention this theme; along with the increase in frequency of this theme over time, this shows that Promoting Clean/Renewable Energy is one of the main goals and effects of the policy change.

Financial Incentives/More Profitable than Farming

This is the second most mentioned theme in support of solar/solar on farmland with 36 mentions before the policy change and eight after, and is also mentioned 14 times by articles that do not directly support solar. While most of the articles do not give exact figures, they all share confidence in the tax incentives from solar development and net metering policies in Michigan; one farmer estimates that by developing a portion of his preserved farmland into solar panels, he can get "two or three times prices for solar than from crops" (Greenejgreene@crain.com, 2019). While state-distributed incentives like these promote solar development, Li and Yi (2014) also found that "financial incentives offered by city governments are positively correlated with local installed solar capacity," showing that local legislation could further benefit solar development. Articles that refute the profitability of solar development do so on the basis of the relative lack of sunlight in Michigan, the use of prime/productive farmlands for solar development, and the costs of installation/removal of the panels.

Diversion of Farmland

This is the most heavily mentioned anti-solar-on-farmland theme in both the pre- and post-policy change periods. There are two main constituents of this group; the first is primarily concerned with the potential waste of prime and productive farmland but is relatively open to the idea of marginal-land or brownfield development, while the second is wholly against solar development on farmland. The first group is not generally against RE or solar development on farmland altogether, but just wants to ensure that any development makes use of marginal land that would be unprofitable as farmland anyway. Research has shown that consumers in general,

not just farmers, highly favor siting solar development on carports, rooftops, and landfills, with a 75% approval rate for each location (Schelly et al., 2019). Building solar panels on under-utilized spaces like these is an efficient use of land and does not disrupt ongoing operations like agriculture, keeping all stakeholders happy.

The second group is noticeably less open to solar and tends to have more concerns with land use and government interference than other articles do; the articles that fit into this second group often mention Code 4, Other Issues with Land Use, which include many other land use issues that may indirectly inhibit solar panel development. Eight articles mention both Codes 2 and 4 with three of those coming after the policy change, two of which are in direct opposition to the policy change. One of those articles claims that "larger animals, such as cows, can damage solar arrays"; articles like these use a wide variety of reasons to oppose solar development (The Daily Telegram, 2019).

Other Issues with Land Use

This topic is mentioned almost as often as Diversion of Farmland with 20 mentions before the policy change and six after. Articles that fit this theme give more specific reasons for not giving up their land than just not wanting to lose their farmland, and many of these are Letters to the Editor or other opinion pieces. Many of these articles use reasons like aesthetic value, distrust of government or utility management of private land, and property value depreciation to oppose the solar developers. Schelly et al. (2019) found that behind economic and environmental considerations, "people's level of trust in developers… is the third most important factor shaping the decision to install solar panels." This research shows that higher

levels of transparency and amicability between developers and farmers could improve these relations and allow for higher levels of solar installment.

Another group of these articles are specifically concerned with zoning considerations, and while these articles do not oppose solar energy directly, many of them favor more restrictive zoning laws on solar development. The most common of these restrictions are solar setbacks, which determine how far a constructed solar panel must be from the nearest lakeshore, residence, property line, etc. Some of the documented setback proposals reach two miles from any lakeshores, while others only request half a mile. Others propose single mile setbacks from every residence, which essentially eliminates any viable options for large scale solar development in even most small towns.

Reducing Carbon Footprint

This theme received 13 mentions prior to the policy change and two after, and was counted every time an article specifically mentioned carbon neutrality or reducing carbon emissions as a reason to invest in solar development. This occurred less often than did mentions of RE/clean energy, which are often used interchangeably with carbon emissions reduction since they are working towards the same goals of reducing greenhouse gases and helping the environment. This code was used to evaluate how solar supporters talk about the benefits of solar energy, and the results show that not everyone invests in it for the same reasons. Studies on consumers' willingness-to-pay for green electricity have found that "education, 'concern for greenhouse gas (GHG) emissions'… have a positive effect on WTP for green electricity" (Ndebele, 2020). Therefore, if all farmers and energy consumers knew exactly how solar

development would benefit the Earth by reducing GHG emissions by replacing coal, then they may be more willing to support it. The drop in prevalence and overall lack of mentions of carbon neutrality relative to those of RE show that some Michigan communities could benefit from more comprehensive green energy and climate change education.

Diversification of Resources/Farmland

This is the least-used theme of those that support solar/solar on farmland, but its proportional prevalence increased over three times after the policy change. This is likely because diversification of farmland and farm revenue options was one of the main goals of the P.A. 116 change. Following the decision by MDARD, Governor Whitmer stated in a press release that "by preparing for and investing in renewable energy, we're protecting our environment while diversifying revenue options for Michigan farmers" (MDARD, 2019). For many farmers with land already enrolled under the Farmland Preservation Program, this policy change opened their options of alternate uses for their land and provided extra revenue options. In one such example, the policy change is allowing John Forell, who grows corn, soybeans, and wheat in Eaton County, "to lease 300 acres, or 6 percent, of his farmland to Geronimo Energy" for solar development (Greenejgreene@crain.com, 2019).

Other articles mention a shift towards solar energy as a way of diversifying Michigan's energy production profile. Whether of land use or energy use, diversification can be a small motivator for solar projects.

Less Productive/More Expensive than Alternatives

This is the second-least prevalent code observed and is used equally before and after the policy change (mentions increased by ~8%). This relative lack of mentions is likely due to how much the cost of installing and storing solar power has decreased as of late (benchmark price for solar decreased by 84% from 2010-2019) as well as the financial incentives that make the solar development worth it (Broom, 2019). Those articles that did fit this code questioned the costs of installing and removing the solar panels and advocated against developing on prime or productive farmland, where profit margins for farmers can be significantly higher than on marginal or brownfield land. Several articles also brought up how little sunlight Michigan gets relative to more solar-friendly states and how this could affect the investment in solar energy. Over seven times more articles mentioned the financial incentives and profitability of solar development than those that mentioned the costs or potential losses from it, further showing how complaints of the costs of solar panels are waning relative to the other arguments used against it.

Environmental Degradation/Pollution

This is the least prevalent of all the codes with its only two mentions coming from the post-policy change period. Both of those mentions come from articles that speak against solar development on farmland and show discontent with the policy change. In fighting solar on farmland, they both argue that chemicals and heavy metals contained in solar panels are “highly toxic” and could endanger communities by “contaminating groundwater, soil, wells, and waterways” (Writer, 2019a). Numerous studies have shown that these substances “do not leach from the modules into the environment under normal conditions or anticipated accidents such as

storm damage or fires," which may explain why so few opponents of farmland solar used this argument (GW Solar Institute, n.d.).

Conclusion

Support for solar development on farmland is rising slowly, though opinions about it have not changed drastically over the past 10 years. The Farmland Preservation Program change makes it much easier for farmers to install solar panels on their preserved farmland and increases ease of access to farmers who were previously trapped between commercial solar projects and the restrictions of P.A. 116. This paper has found that increasing ease of access and education on relevant climate change subjects and solar installment options are key to encouraging solar development, and this has several implications for future policy decisions regarding solar development in Michigan.

Many of the anti-solar on farmland articles were primarily concerned with the diversion of productive/prime farmland, and some of them suggested targeting less productive lands where there is less profit potential from crops. Others advocated leaving farmland alone altogether, suggesting brownfields and other under-utilized spaces as potential sites. Future solar developers and policy makers should keep this in mind; making use of marginal farmlands and other under-developed spaces is the most efficient use of land and space and allows the owners of that land to add a stream of revenue from the solar tax credits. When further expanding consumer options for solar energy, policymakers should consider the value of residential rooftops, parking garages, brownfields, and other under-utilized spaces that could accommodate an array of solar panels without upsetting large groups of stakeholders (e.g. municipal commissions, land developers,

farmers). The carport solar project in East Lansing is a great example of efficient use of parking space and also represents a valuable partnership between Michigan State University and utility companies. If other universities in Michigan create projects like this, it would be great exposure for the green energy industry and would have the potential to encourage future clean energy initiatives in more heavily populated, urban areas.

Further solar-promotional legislation is another aspect of the Michigan solar market that could be improved. The state-level policies like RPS have established goals for the state, but city-established financial incentives and RE goals have also been shown to promote solar development and could help meet those state-wide goals (Li & Yi, 2014). Other initiatives to improve RE and climate change education around the state could also benefit solar development and the meeting of Michigan's RPS goals.

In concluding this study, it is also important to acknowledge any limitations on the data, research methods, and overall process of putting this paper together in order to get a comprehensive view of the information being presented. First is the fact that the policy change being evaluated occurred less than a year ago; therefore, there is not any survey data of response to it, no research has been conducted on its effectiveness, and there is not a lot of mention of it in the media. These restrictions are mostly true of solar energy in general in Michigan, about which there has been little research. This lack of research and media coverage also raises questions about the legitimacy of the data being compiled; since solar does not come up much in newspapers, then it is not fair to consider what is published as fully representative of public opinion. Some towns and counties contributed many more articles than others, which further contributes to that point that the data is slightly skewed.

Aside from the aforementioned data limitations, the main restriction on the research presented in this paper is that it has been performed by a single individual. This limits the legitimacy of the coding scheme as well as any other opinion-based aspects of this paper; when deciding if an article supports solar, these decisions can come down to arbitrary details and keywords that could be disagreed with or overlooked by a second reader. Another inhibitor of the development of this paper is a tight timeline. Writing this over the course of a semester meant that no large-scale surveying could be done to retrieve more conclusive data, and also severely limited the window under which articles could be considered as 'reactionary' to the policy change. Even so, this first look at how farmland and solar is portrayed in Michigan's print media provides insights that could help inform future research and solar development.

References

Broom, D. (2019, May 7). Renewable energy prices have fallen - this is how much. Retrieved from https://www.weforum.org/agenda/2019/05/this-is-how-much-renewable-energy-prices-have-fallen/

Brudermann, T., Reinsberger, K., Orthofer, A., Kislinger, M., & Posch, A. (2013). Photovoltaics in agriculture: A case study on decision making of farmers. *Energy Policy*. https://doi.org/10.1016/j.enpol.2013.06.081

Detz, J. (2019, August 5). Progressive Idea: Municipal Renewable-Energy Utilities. Retrieved April 6, 2020, from https://www.ecori.org/renewable-energy/2019/8/5/progressive-idea-build-municipal-renewable-energy-utilities

Gilchrist, T. (2017, June 7). Thumb's war about wind has left some wounds. *Tuscola County Advertiser, The (MI).* Available from NewsBank: Access World News is provided by the University of Michigan Library: http://haproxy.newsbank.com:11021:11021/apps/news/document-view?p=AWNB&docref=news/164F36AB7393F2F0.

Greenejgreene@crain.com, J. (2019, August 26). Solar panels could be cash crop for farmers – Whitmer erased policy that took away agricultural tax breaks on solar developments. *Crain's Detroit Business*, 35 (34), 0001. Available from NewsBank: Access World News is provided by the University of Michigan Library: http://haproxy.newsbank.com:11021:11021/apps/news/document-view?p=AWNB&docref=news/175A0AE5E8CFCCB8.

GW Solar Institute. (n.d.). Do solar panels contain toxic chemicals? Retrieved April 14, 2020, from https://solar.gwu.edu/do-solar-panels-contain-toxic-chemicals

Hsu, J. H. Y. (2018). Predictors for adoption of local solar approval processes and impact on residential solar installations in California cities. *Energy Policy*. https://doi.org/10.1016/j.enpol.2018.03.008

Kolesnikoff, A., Cleveland, M., & Shields, L. (2019, December 31). State Renewable Portfolio Standards and Goals. Retrieved from https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx

Krasko, V. A., & Doris, E. (2013). State distributed PV policies: Can low cost (to government) policies have a market impact? *Energy Policy*. https://doi.org/10.1016/j.enpol.2013.03.015

Li, H., & Yi, H. (2014). Multilevel governance and deployment of solar PV panels in U.S. cities. *Energy Policy*. https://doi.org/10.1016/j.enpol.2014.03.006

MDARD. (2019, June 3). Gov. Whitmer, MDARD to allow commercial solar panels on Michigan Farmland. Retrieved March 12, 2020, from https://www.michigan.gov/mdard/0,4610,7-125--498799--,00.html

MDARD. (2020). Environmental Programs - Farmland Preservation. Retrieved from https://www.michigan.gov/mdard/0,4610,7-125-1599_2558---,00.html

Michigan Public Service Commission. (2020). Renewable Energy. Retrieved from https://www.michigan.gov/mpsc/0,9535,7-395-93308_93325_93423_93502-500271--,00.html

Ndebele, T. (2020). Assessing the potential for consumer-driven renewable energy development in deregulated electricity markets dominated by renewables. *Energy Policy*. https://doi.org/10.1016/j.enpol.2019.111057

Schelly, C., Price, J., Delach, A., Thapaliya, R., & Leu, K. (2019). Improving solar development policy and planning through stakeholder engagement: The Long Island Solar Roadmap Project. *Electricity Journal*. https://doi.org/10.1016/j.tej.2019.106678

The Daily Telegram. (2019, September 1). State gives solar preferences on land "preserved" for farmland. *Daily Telegram, The (Adrian, MI)*, p. A4. Available from NewsBank: Access World News is provided by the University of Michigan Library: http://haproxy.newsbank.com:11021:11021/apps/news/document-view?p=AWNB&docref=news/175B026A4F6A4DE8.

Trautmann, N. M., Porter, K. S., & Wagenet, R. J. (n.d.). Fact sheets :: Modern Agriculture: Its Effects on the Environment. Retrieved from http://psep.cce.cornell.edu/facts-slides-self/facts/mod-ag-grw85.aspx

World Ocean Review. (2010). Over-fertilization of the seas. Retrieved April 22, 2020, from https://worldoceanreview.com/en/wor-1/pollution/over-fertilization/

Writer, S. (2019a, June 17). Solar farms will include toxic chemicals. *Argus-Press, The (Owosso, MI)*. Available from NewsBank: Access World News is provided by the University of Michigan Library: http://haproxy.newsbank.com:11021:11021/apps/news/document-view?p=AWNB&docref=news/17424577194DDC08.

Writer, S. (2019b, July 24). Letters to the Editor: 07/24/2019. *Traverse City Record-Eagle (MI)*. Available from NewsBank: Access World News is provided by the University of Michigan Library: http://haproxy.newsbank.com:11021:11021/apps/news/document-view?

U.S. Energy Information Administration. (2020, January 14). EIA - Independent Statistics and Analysis. Retrieved from https://www.eia.gov/outlooks/steo/