

Climate Change and Housing Policy: The Case of Michigan, USA

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Abstract—This study evaluates the climate change perception of Michigan State Housing Development Authority's (MSHDA) only through determining MSHDA's institutional identity and understanding its housing policy responding in climate change adaptation. MSHDA's certain plans and strategies for housing policy are analyzed and the contents of these documents are examined in terms of Michigan Climate Action Plan (CAP) objectives. In the first part of the study, a sectoral assessment based on carbon emissions is presented. In the second part, MSHDA housing policy is explained by text-based analysis. With this text-based analysis it is possible to define MSHDA's institutional climate change perception.

Index Terms—MSHDA, housing policy, climate-sensitive housing policy, climate change, Michigan, US

I. INTRODUCTION

In the last 15-20 years, climate change impacts on human settlements have been manifested worldwide. The new structure of the international climate regime forces local governments to include measures and policies for climate mitigation and adaptation. The Paris Agreement, for instance, invites both developing and developed countries to define their GHG reduction targets in a realistic manner and in line with the 2 °C target of the agreement. Local governments control measures related to 30-50% of greenhouse gas emissions. As a result, local governments mainly have a relevant control and certain responsibilities on the following main sources of pollution in their communities: Buildings; Energy generation, distribution and use; Transportation; Waste management; Water management. They own a large number of buildings and offices and can manage social housing and educational facilities – either directly or through a management agency. These areas can usually directly be influenced from a municipal sector perspective.

In Michigan, climate action planning has a history of about 10-12 years and is quite new. Therefore, it is obvious that Michigan is now able to develop an effective and a comprehensive housing policy for the successful implementation of the global climate goals and the sustainable development goals. In 2007, 30 mayors from Michigan cities signed the US Conference of Mayors

Climate Protection Agreement that draws attention to reducing CO₂ emissions and forcing state and federal governments to address climate change [1]. In March 2009, the Michigan Climate Action Council released the Michigan CAP focusing on carbon pollution, but also recognizing the risks that climate change will pose to the state. The Michigan CAP also recommends the preparation of a statewide Climate Adaptation Strategy, although no official adaptation plan has been adopted (as of August 2018) [2].

In the light of this background, this paper sets out to investigate the current state of housing policy based on MSHDA documents within the framework of climate change. In this sense, the paper is discussing the relationship between Michigan's climate policy and housing policy by reviewing MSHDA (Michigan State Housing Development Authority) policy documents (plans, strategies, etc) and is trying to understand its strengths and weaknesses. In this sense, the study provides a general overview of Michigan housing policy, with a particular emphasis on climate change local programs and policies.

There are two integrated stages in Michigan's Climate Action Strategy. The first is based on state-based advocacy for strong national and international action on climate change. A framework describing the key elements of a national climate policy is summarized in the first stage. The second stage requires integration of national climate action policies and efforts with those that the Michigan Climate Action Council (MCAC) recommends for implementation in Michigan to achieve significant reductions in GHG emissions for every sector. The housing sector is examined in the Michigan Climate Action Plan (CAP) within the residential, commercial and industrial sector.

MSHDA as the main public actor of state housing policy does not yet have a climate-sensitive strategy document although there are some policy documents based on federal laws and the environmental principles of the EPA (US Environmental Protection Agency). Nevertheless, all MSHDA housing policy documents have some shortcomings in terms of meeting climate change targets. Briefly, this study aims to provide a general framework on this aspect of housing policy.

II. OVERVIEW OF U.S. GREENHOUSE GAS EMISSIONS (GHGS) BY ECONOMIC SECTOR

In 2017, the US emitted about 6.5 billion metric tons of greenhouse gases (CO₂ equivalent). The primary sources of greenhouse gas emissions in the US and their percentages for 2017 are as follows: (1) Transportation (28.9%), (2) Electricity production (27.5%), (3) Industry (22.2%), (4) Residential and Commercial (11.6%), (5) Agriculture (9.0 %), (6) Land Use and Forestry (offset of 11.1 % of 2017 GHGs emissions). Residential and commercial GHGs come from businesses and homes that arise primarily from fossil fuels burned for heat, the use of certain products containing greenhouse gases, and the handling of waste [3].

Most of the CO₂ emissions are caused by energy production. Focusing on the housing sector, approximately 50% of energy use and carbon emissions are as a result of energy used for heating (space and water heating), cooling, and lighting in buildings [4]. Similarly, the International Energy Agency [5] points out that buildings worldwide account for 122 EJ of final energy in 2010, which translates to 33% of the total final energy and 54% of electricity. Accordingly, this amount of final

energy corresponds to about 9 Gt of carbon emissions [6], [7].

The Fig. 1 below shows energy-related CO₂ emissions by state for 2016. Total state CO₂ emissions comprise those from direct fuel use across all sectors including residential, commercial, industrial, and transportation, as well as primary fuels consumed for electricity generation. According to the data given in the Fig. 1 Texas has the largest percentage.

Texas is followed by California, Florida, Pennsylvania and Louisiana. Michigan ranks 10th which is also a high emission rate.

Michigan energy related total carbon emission for 2016 is 151.8 million metric tons of CO₂. When looking chronologically at Michigan energy-related carbon emissions by sector, it is seen that electric power is the first (with 36 percent of total state emissions), transportation sector is the second (with 33 percent of total state emissions), *residential sector is the third with 12 % of total state emissions*. These sectors are following by industrial (12% of total state emissions) and commercial sectors (7% of total state emissions). (see Fig. 2).

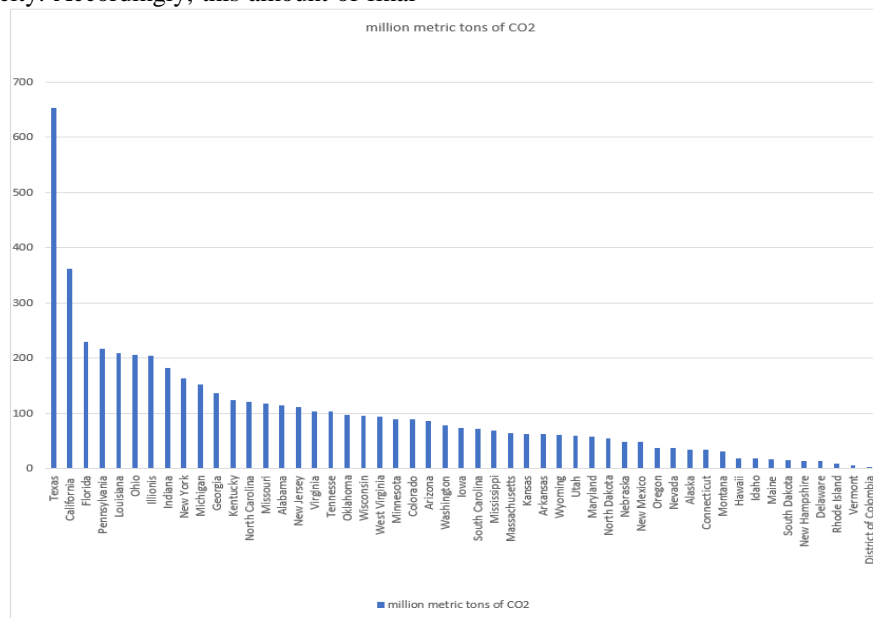


Figure 1. Energy-related CO₂ Emissions by State, 2016 [8].
Million metric tons of carbon dioxide (CO₂)

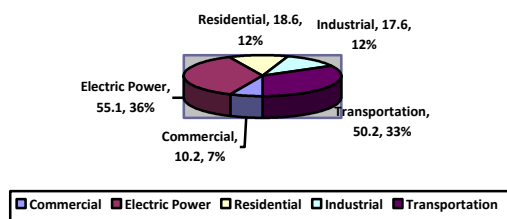


Figure 2. 2016 Michigan energy-related carbon dioxide emissions by sector [9]

The data from the residential sector shows that Michigan has achieved a gradual reduction in emissions

since 2009 (since the Michigan Climate Plan was prepared). (see Fig. 3).

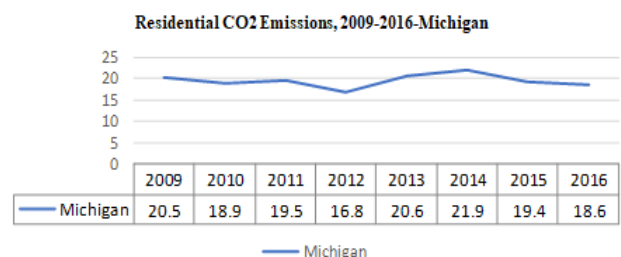


Figure 3. Residential CO₂ Emissions (2009-2016), Michigan [10]

III. THE MSHDA AND ITS INSTITUTIONAL CLIMATE CHANGE PERCEPTION

A. State Housing Policy: An Overview

MSHDA (Michigan State Housing Development Authority) has a history about 53 years and it is the main public institution of housing planning in Michigan. Its policies are based on economic and social programs focusing on how to develop a policy that will provide more opportunities to more people for having their own houses.

According to the MSHDA Production Report for 2018 there are six production programs supporting people to have their own house. These are: (1) Multifamily loan programs, (2) Supportive housing and homeless initiatives, (3) Pass-Through short-term bond program, (4) Single family mortgage loan program, (5) Michigan mortgage certificate program and (6) Property improvement loan program [11].

The MSHDA's mission is defined to four major goals that call for specific palpable objectives: (1) Housing affordability, (2) Homeless solutions, (3) Mission driven (this goal is related to developing new housing strategies to improve the quality of life for Michigan residents), (4) Preserving history. In addition, fair housing policy and safety are the two biggest drivers of the MSHDA [12].

In this study, the MSHDA key plans and programs are analyzed in terms of the state climate change objectives, and the MSHDA's institutional climate change perception is evaluated with a text-based analysis. Within this framework, we examined the strategic plan, administrative plan, consolidated plan and its related programs. Key housing policy instruments of the MSHDA are as follows [12].

1) The Public Housing Authority (PHA) plan

The PHA is a public body created and authorized by state law, and its mission is to develop and operate housing and housing programs for low-income families. *The PHA Plan* is a comprehensive guide to public housing authority (PHA) policies, programs, operations and strategies for meeting local housing needs and goals.

The main goals and objectives of public housing policy developed by a comprehensive PHA can be summarized as follows: (1) Expanding the supply of assisted housing, (2) Improving the quality of assisted housing, (3) Increasing assisted housing choice, (4) Promoting self-sufficiency and asset development of families and individuals, (5) Ensuring equal opportunity in housing for all Americans in the State, (6) Partnering with the designated Michigan Housing Assessment and Resource Agencies (HARAs) to serve as a one-stop shopping for housing, (7) Striving to reduce non-compliance by participants in the Housing Choice Voucher Program [13].

2) The Michigan consolidated plan (2015-2020)

The Consolidated Plan creates the opportunity for strategic planning and citizen participation to take place in a comprehensive context. The purpose of the Consolidated Plan is to describe programs and activities that it will undertake in conjunction with HUD programs

(U.S. Department of Housing and Urban Development) funded with related Federal Fiscal Year budget. It allows local governments, community organizations and citizens to address the larger picture in which these programs operate, offering the State a better chance to shape the various programs into effective coordinated strategies [14].

3) MSHDA strategic plan

The MSHDA strategic plan has a set of objectives to increase its ability to achieve its goals. By carefully monitoring the objectives that attach to each goal, MSHDA will know how much progress it makes and where opportunities to improve its efforts may lie [15].

B. MSHDA Policies and Climate Change

The financial characteristics of the key programs of MSHDA and the environmental review process related to climate change are briefly evaluated in this section. These programs do not have any goals for climate change and do not refer to the objectives of the Michigan Climate Action Plan.

1) Financial characteristics of the key programs

There are 8 programs that reflect the *financial characteristics of the MSHDA's housing policy*. These programs can be summarized as follows [12]

1.1). *Federal historic tax credits*: This program encourages investment in vacant or underused older buildings. There is no specific fund for climate change within the program.

1.2). *Hardest Hit Fund (HHF) blight elimination program*: The program helps stabilize property values by establishing more green space or making a good way for future development with working directly with local leaders to identify and demolish dilapidated abandoned homes. Although it does not include a goal directly related to climate change, this program has a structure that is somewhat more important in climate targets due to its purpose.

1.3). *Hardest Hit Fund (HHF)-SFM*: The program provides up to a \$30,000 interest free loan to assist with mortgage, property taxes, and/or condominium association fees. There is no specific goal of climate change within this program as well.

1.4). *Home*: The program helps communities build, buy or rehabilitate affordable housing for rent or ownership, often in partnership with local nonprofit groups. This flexible program allows state and local governments to use HOME funds for grants, direct loans, loan guarantees, rental assistance, security deposits or other credit enhancements. Within this program, a fund that deals with climate change has not been developed yet.

1.5). *Homeless program*: The program provides federal and MSHDA funding to local units of government and public and private nonprofit agencies with 501(c)(3) status that have at least one year of experience in providing case management, homelessness prevention, shelter operating costs and rapid rehousing with short-term tenant-based rental assistance specifically targeted to homeless people.

1.6). *Homeownership*: The program is giving an opportunity to combine the Down Payment Assistance

(DPA) second mortgage with a MSHDA first mortgage toward the purchase of a new or existing single-family home, a multiple-section manufactured home on its own property, or a condominium.

1.7). *The Housing Choice Voucher (HCV) Program*: The purpose of the program is to provide rental assistance to eligible families. The program supplies federal rent subsidies to participants. This program does not also include a supportive tool for climate change policies.

1.8). *Low Income Housing Tax Credit (LIHTC 4%, 9%)*: The program is the most successful affordable housing production program in U.S. history forging public-private partnerships between the Federal government, state allocating agencies and private sector developers. MSHDA uses the 9% and 4% credit to assist in the financing of new construction and the preservation of existing structures.

2) Environmental Review (ER) Process

MSHDA housing policy practices are subject to a comprehensive environmental impact assessment process. This process is based on an institutional review in line with the principles of NEPA (National Environmental Policy Act). Developers and contractors must follow the requirements of this process to have a better understanding the Environmental Review process and associated requirements.

The MSHDA Qualified Consultants List provides developers with a list of environmental consultants that have demonstrated knowledge of MSHDA's Environmental Review Requirements and can provide the necessary reports and documentation needed to meet MSHDA's Environmental Review Requirements. This is a prequalified consultant list that is dividing firms into two categories depending on the type of service they are prequalified to provide: Group A and Group B.

"Group A" consultants are prequalified to provide such services as Phase I and II Environmental Site Assessments with MSHDA "non-scope" items, Baseline Environmental Assessments, Documentation of Due Care Compliance, peer-review services, and, through their own qualifications or those of a qualified subcontractor, lead-based paint Risk Assessments and Inspections, NESHAP-compliant asbestos inspections, AARST-compliant multi-family radon testing, etc. "Group B" services include the writing, preparing, and submitting of specialized Environmental Assessments and/or Statutory Checklist reports to MSHDA for the purposes of demonstrating compliance with the NEPA [16]

C. Suggestions for a Climate-Sensitive Housing Policy

Michigan has various reasons to take part in global efforts to address climate change. Considering the projections mentioned above the demand for residential energy will gradually increase in the next 20-25 years. According to the Michigan CAP, which is prepared by the Michigan Climate Action Council (MCAC) in 2009, much of the growth in GHG emissions over the period can be attributed to an average 0.94% annual growth in electricity demand over the 2005–2025 period for the residential, commercial and industrial sectors. GHG emissions from electricity for each of the three sectors are

projected to grow by 1.1% per year between 2005 and 2025 [17].

In the CAP [17] because of most energy use occurs in buildings, the recommended policies center on improving energy efficiency in buildings. Residential sector is discussed as a separate chapter with the title of residential, commercial and industrial sectors (RCI). The following recommendations are specific to the residential sector: (1) providing for utility-operated incentives for energy-efficiency, (2) focusing on making building energy codes more stringent, (3) setting regulatory policies for incentives promoting renewable energy system, (4) providing education to increase the human capital components of energy efficiency.

The MSHDA documents reviewed in this study do not generally include a program or strategy to climate change and reducing CO₂ emissions. The main objective of the MSHDA is to create a policy based on fair, safe and affordable housing policy. There is no mutual policy interaction between Michigan CAP and the MSHDA policies. Of course, it may not be right to evaluate the state housing policy only through written housing policy documents, but the relevant policy documents provide a strong roadmap for the future implementations and can bring together all parties involved in the developing of housing policy and integrate them into the targeted program. In short, developing a plan or strategy has a power to reveal more than information it contains.

The following table (Table I) summarizes some of the identified deficiencies in MSHDA plans and programs. There is a gap in the structural and institutional identity of the MSHDA regarding the climate change strategy. This gap can first be filled with an institutional structure. In addition to other documents explained above, it can be provided a common climate-sensitive housing strategy covering all aspects of MSHDA (homeownerships, rental, homeless, developers, lenders, neighborhoods).

TABLE I. THE CHARACTERISTICS OF MSHDA PLANS AND PROGRAMS

Benefits	Limitations
<ul style="list-style-type: none"> -Focus on the interaction between the housing market and the economy at large, -Use of aggregated economic and social data -Capable of modelling the relationships between different economic and social variable and energy demand, -Able to model impact of different social cost-benefit energy policies, -Focus on developing fair housing policy in Michigan. 	<ul style="list-style-type: none"> -Do not provide information about climate change strategy, -Do not provide much data and information about emissions, -Have limited capacity to evaluate the impact of energy conservation measures, -Do not require detailed data (based on billing and fund data...), -Use physically measurable data, -Do not have policy about incentives for energy-efficiency, -Poorly describe energy market interactions, -Neglect the relationships between energy use for buildings and macroeconomic activity, -Lack the level of technological detail.

Within this context the climate change strategy can be integrated with other programs of MSHDA. It is also important to implement a training program for all income

groups. A structure that should integrate the predictions of the Michigan CAP with the MSHDA's housing policy objectives will be certainly very helpful tool to develop a climate-sensitive housing policy. Housing policy documents provide a map that is more in line with the principles of the market system. Therefore, developing a strategy that is the climate-based structure will be undoubtedly a useful study at the state level as well

IV . CONCLUSION

Climate change adaptation measures for housing policy encompass land use planning tools such as official plans, zoning and development permits. Land use planning also adapts to climate change risks by using some measures such as environmental standards, energy and water efficiency, modified building codes and changes in urban form to reduce dependencies on transportation, energy consumption and coping with climate hazards.

So, a significant improvement in energy efficiency for the buildings and an increase in the generation of renewable energy would deliver substantial co-benefits, including GHG reduction, energy security, cost savings. On the other hand, Michigan is located in one of the climate change hotspots, where climate change has already proved to be a threat. Consequently, climate change adaptation is an urgent need for Michigan, especially for its cities.

Therefore, MSHDA is responsible for developing a climate-sensitive housing policy with a strong political infrastructure. There is a need for integration between the Michigan Climate Action Plan and other climate plans' predictions on housing policy. There is also a need for stronger regulation on the state level for the climate-sensitive housing market mobility.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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