

# Private Systems Resilience

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## Chapter 5



## Chapter 5: Working for Resilience in Private Systems

Private households and businesses face many of the same risks as the overall community, including risks related to financial condition; critical infrastructure such as transportation, facilities, and energy; life support systems such as food and water; and critical goods and support services. This portion of the Master Plan takes a closer look at resilience in the private sector, and how individuals and communities together can address risks and opportunities. Goals and strategies are contained in Chapter 7: Strategic Plan.

### OVERVIEW

Chocolay Township's population has leveled since 1980, as shown in **Figure 5-1**. This is in contrast to the population of Marquette County, which declined after 1980<sup>29</sup> and rebounded slightly between 2000 and 2010 for an overall slightly downward trend.<sup>30</sup> This plan assumes a stable or slightly rising population in Chocolay Township as the baby boomers move toward old age and people search for affordable housing options near the City of Marquette.

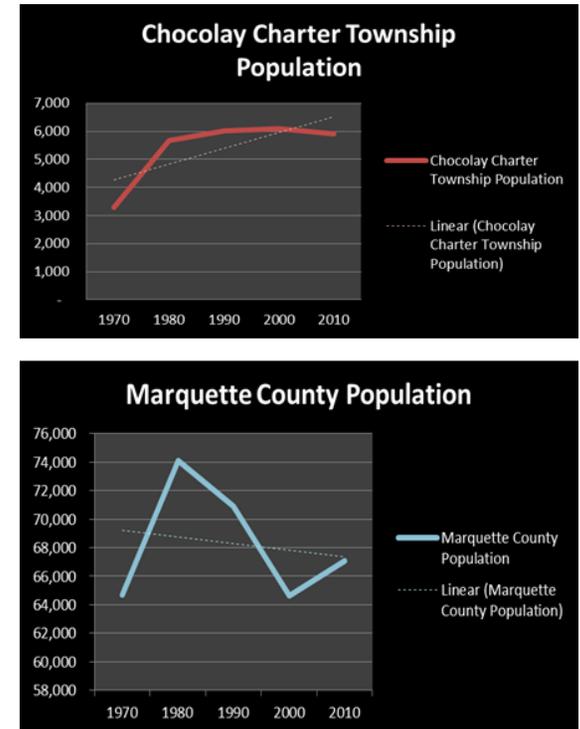
Compared to the State of Michigan, Chocolay Township has a greater percentage of the population of working age (assumed to be 18 to 64 years of age). See **Table 5-1**, which shows that Chocolay has a greater support ratio of working to non-working age population (1.85 vs. 1.67 in Michigan).<sup>31</sup> The difference is that Chocolay Township has fewer people in the younger age bracket. The percentage of people age 65 and older is the same in the Township and State. However, the median age is much higher in Chocolay Township than the State (almost 45 years in Chocolay Township versus almost 39 years in Michigan). See population pyramids in Appendix P for a visual representation for 2010.

The people of Chocolay Township have higher educational attainment in comparison to the City of Marquette, Marquette County, State of Michigan, and the United States, as shown in **Table 5-2**. This is evidenced by higher percentages of the population with education beyond a high school degree, and lower percentages of the population with high school degree or lower. Additionally, in Chocolay Township, at every level of educational attainment, there are higher percentages of people in the labor force who are employed. Chocolay Township has higher percentages of people with an educational attainment greater than high school degrees that are not in the labor force, probably indicating more retirees. This is especially true of people with Bachelor's degrees or higher. These people may be particularly important in lending their time and skills to community initiatives involving volunteerism.

Average household size in Chocolay Township in 2010 is slightly lower than in Michigan (2.4 compared to 2.49). Again, this is related to lower percentages of children. Almost 28 percent of Chocolay Township households had individuals under 18 years compared to 31.6 percent of State households. Average household size of renter-occupied housing units in Chocolay Township is smaller in comparison to owner-occupied units (2.04 compared to 2.46).<sup>32</sup>

In Chocolay Township, a lower percentage of householders live alone than in the State (23 percent compared to 28 percent). Of the 572 single person households in Chocolay Township in 2010, there were more males (303) than females (269). However, there were many more female single householders age 65 and older (106 females, 41 males). This is because women tend to live longer than men. Additionally, there were 89 female-headed households (no husband) with children under 18 compared to 52 male-headed households (no wife) with children under 18.<sup>33</sup> Single-person households and single householders with children may be more vulnerable and have more specialized needs than the general population.

Figure 5-1 - Chocolay Township and Marquette County Population



<sup>29</sup> The County population decline was due in part to the closure of the K.I. Sawyer Air Force Base in 1995.

<sup>30</sup> U.S. Census data, 2010 Decennial Census.

<sup>31</sup> Ibid.

<sup>32</sup> Ibid.

<sup>33</sup> Ibid.

OVERVIEW

Table 5-1 - Support ratio

2010 Support Ratio	Michigan	Chocolay Township
Total Population	9,883,640	5,903
Non-working population (under 18; 65 and older)	3,705,598	2,069
Working population (18 to 64)	6,178,042	3,834
Ratio working / non-working	1.57	1.85
% working age	62%	65%
% under 18	24%	21%
% 65 and over	14%	14%
Median age	38.9	44.7

Table 5-2 - Educational attainment

2012 American Community Survey Estimates	United States	Michigan	Marquette County	Marquette City	Chocolay Township
<b>Less than high school graduate:</b>	12.3%	9.0%	4.4%	5.9%	2.4%
In labor force:	61.6%	54.5%	42.0%	21.7%	75.3%
Employed	85.8%	76.4%	82.0%	91.1%	94.8%
Unemployed	14.2%	23.6%	18.0%	8.9%	5.2%
Not in labor force	38.4%	45.5%	58.0%	78.3%	24.7%
<b>High school graduate:</b>	26.8%	28.8%	31.0%	25.0%	21.2%
In labor force:	74.4%	70.4%	64.4%	48.4%	79.5%
Employed	89.9%	85.3%	90.0%	88.9%	89.6%
Unemployed	9.8%	14.7%	9.8%	11.1%	10.4%
Not in labor force	25.6%	29.6%	35.6%	51.6%	20.5%
<b>Some college or associate's degree:</b>	30.6%	34.9%	34.2%	31.1%	37.1%
In labor force:	80.4%	78.5%	75.3%	73.1%	76.7%
Employed	91.4%	89.3%	94.5%	95.7%	97.8%
Unemployed	7.7%	10.5%	4.9%	3.7%	2.2%
Not in labor force	19.6%	21.5%	24.7%	26.9%	23.3%
<b>Bachelor's degree or higher:</b>	30.2%	27.4%	30.4%	38.0%	39.2%
In labor force:	86.2%	85.2%	83.3%	87.2%	77.9%
Employed	95.3%	94.9%	96.2%	97.8%	98.3%
Unemployed	4.1%	5.0%	3.8%	2.1%	1.7%
Not in labor force	13.8%	14.8%	16.7%	12.8%	22.1%

**HOUSEHOLD FINANCIAL RESILIENCE**

Household financial resilience is related to level of income in comparison to expenditures, and decisions on saving versus spending. Expenditures are impacted by household location in relation to jobs and goods (transportation expenses) and in relation to services (utility fees). Expenditures are also impacted by housing choice (costs for upgrades, repairs and energy). Taxes impact disposable income. Household resilience is also strongly related to levels of debt.

**Profile**

Chocolay Township households reside in and pay taxes to multiple jurisdictions, including the Township, school district, and the County. Other millages may be approved by voters of the tax district, such as the millage for the library, Iron Ore Heritage Trail and fire hall. Residents may locate themselves in places with a favorable fit between the taxes they are willing to pay and the services they want to receive. Chocolay Township currently has a moderate level of general operating millage levied in comparison to other jurisdictions within Marquette County (see sidebar).

Census Bureau estimates show that in Chocolay Township 75 percent of all families with children up to 17 years old have both parents in the labor force.<sup>34</sup> Median household income estimates are shown in Table 5-3. Chocolay Township’s median household income is estimated to be higher than all areas of comparison.

Table 5-3 - Median Household Income

Median Household Income Estimates 2008-2012				
Michigan	Marquette County	Chocolay Township	Marquette City	Marquette Township
\$ 48,471	\$ 45,349	\$ 61,268	\$ 37,355	\$ 56,313

Figure 5-2 shows estimated percentage of households in various income brackets in 2012 inflation-adjusted dollars (household income and benefits). Chocolay Township shows lower percentages of households in the lower income brackets (up to \$49,999) than comparison areas, and higher percentages of households in the higher income brackets (\$50,000 and higher).

Census 5-year estimates show about 6 percent of the population in Chocolay Township to be below poverty level, or around 358 people. This percentage is lower among people under 18 years (3.4 percent) but higher among people 65 years and over (about 8 percent).

Poverty among people age 25 and over who are high school graduates with no further schooling is about 11 percent. Poverty levels for people age 25 and over without a high school diploma is even higher at 19 percent.

Poverty levels are particularly high among female householders with no husband present (29 percent) and especially those with children (39 percent).

It is estimated that about 27 percent of the population over 65 years (about 265 people) has a disability, with the most common disabilities being hearing and ambulatory difficulties.<sup>35</sup>

**TAX COMPARISON**

*A 2013 comparison found that Chocolay Township’s general operating millage was sixth highest of County jurisdictions at 3.7897 mills.*

*This is third highest among Townships, being significantly lower than Forsyth Township (6.0807 mills) and Marquette Township (4.9095 mills).*

<sup>34</sup> 2008-2012 American Community Survey Estimates.  
<sup>35</sup> Ibid.

## HOUSEHOLD FINANCIAL RESILIENCE



### Risk Assessment

Some risk factors for household financial resilience include variable or fixed incomes, rising costs, and rising debt. Those who have part-time jobs with variable hours cannot fully anticipate income. Those who live on fixed incomes (typically the aging) may not always be able to anticipate variable expenses. These households are more vulnerable to rising costs for energy, food, medical care, and transportation. The variability of the stock market also impacts those trying to live off investment income.



### Opportunities

*The best ways for households to work toward financial resilience is to reduce debt, put aside savings for contingencies, make sure they have effective insurance, and implement cost control measures in relation to transportation, energy, and sustenance.*

These cost control measures will be explored in the following sections.

## PRIVATE TRANSPORTATION RESILIENCE

This section will examine the impact of transportation costs on household resilience.



### Profile

Because public transportation is limited, and the majority of Township residents work and shop outside the Township (see Appendix Q for County-wide information), transportation infrastructure is a critical local need. Reliable transportation improves the ability of participants to get to jobs, improve their financial situation, and change spending and saving patterns. It also improves access to health care, nutritious food, educational opportunities, and day care options, and increases community involvement.

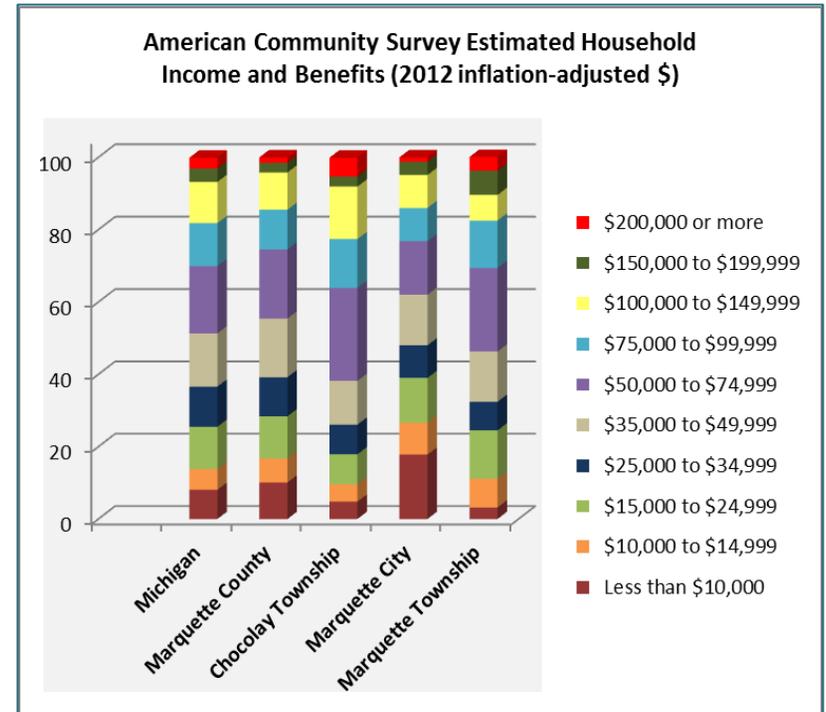
According to Census Bureau data from 2002 - 2011, an average of 1,241 people are employed in Chocolay Township but live elsewhere. An average of 2,627 people live in Chocolay Township but are employed elsewhere (mostly in Marquette). An average of only 153 people live and work in Chocolay Township.<sup>36</sup> Most workers commute to jobs.



### Risk Assessment

People with lower incomes and those traveling greater distances are most vulnerable to fuel price increases. **Table 5-4** illustrates the impact of increased fuel prices for various income brackets, assuming Chocolay Township residents travel approximately 15 miles per day at an average efficiency of 20.3 miles per gallon.<sup>37</sup>

Figure 5-2 - Percent households in various income brackets



<sup>36</sup> U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, averages 2nd Quarter of 2002-2011), Inflow/Outflow analysis. all workers, primary jobs. See Appendix Q.

<sup>37</sup> Based on US EPA's computer model - MOBILE 6.2 - for estimating emissions from highway vehicles.

**PRIVATE TRANSPORTATION RESILIENCE**

Table 5-4 - Impact of fuel prices on income

Impact on Income: Increasing Fuel Prices at Average MPG & Average VMT					
Price per Gallon	\$2	\$3	\$4	\$5	\$6
Cost per mile @20.3 average MPG	\$0.10	\$0.15	\$0.20	\$0.25	\$0.30
Costs per capita per day @ 15 miles per capita per day	\$1.48	\$2.22	\$2.96	\$3.69	\$4.43
Costs per person per year, assume travel 6 days / week	\$461.08	\$691.63	\$922.17	\$1,152.71	\$1,383.25
Fuel expenses as % yearly per capita income \$29,758*	1.55%	2.32%	3.10%	3.87%	4.65%
Fuel expenses as % yearly per capita income \$15,000	3.07%	4.61%	6.15%	7.68%	9.22%
Fuel expenses as % yearly per capita income \$10,000	4.61%	6.92%	9.22%	11.53%	13.83%
* U.S. Census Bureau, Selected Economic Characteristics, 2008-2012 American Community Survey 5-year estimates					

Notice that at an average gas mileage of 20.3 mpg, and a gas price of \$5 per gallon, average miles driven would have to decrease from 15 to 6 miles per capita per day for the percentage of fuel expenditures to income to stay the same as they were at \$2 per gallon. Assuming residents do not cut back on driving and continue to average 15 miles per capita per day, at a price of \$5 per gallon, fuel economy would have to increase to almost 51 miles per gallon for the percentage of fuel expenditures to income to stay the same as they are at \$2 per gallon and an average fuel efficiency of 20.3 miles per gallon. Of course, purchasing a fuel efficient vehicle may be beyond the reach of low income households. Therefore, the most likely scenario is that people with lower incomes will

have to reduce vehicle miles traveled since they can't substantially increase the percentage of fuel expenditures as part of their income. They can do this by moving closer to jobs, if housing is affordable, or they can look for alternative transportation options, such as walking, bicycle, public transit, or carpooling.

Whether these alternatives are feasible will depend on the distance residents need to travel and the availability and cost of public transit. No doubt, these options will increase typical travel times. A car driving at an average speed of 50 mph (average speed between Harvey and Marquette) travels about 8.3 miles in 10 minutes. At a pace of 3 mph, it would take a person on foot 2.75 hours to travel the same distance on foot. At a pace of 9 mph, it would take a person on

bicycle almost 1 hour to travel the same distance. It is unlikely that these commute times would be acceptable for most people, and our climate does not easily accommodate these alternate modes of travel for much of the year. If enough people were impacted, public transit or carpooling would be a more suitable option for most people. Public transit buses don't take direct routes to individual destinations, and therefore increase commute times. These options would mean a big change in habits since people often make multiple trips to different destinations, which may be difficult or impossible when relying on carpooling or public transit.

The impact on lower income workers may be even more profound since they are more likely to own

## PRIVATE TRANSPORTATION RESILIENCE

older and less fuel efficient vehicles. Gasoline may consume a more significant portion of their income, especially if land use patterns do not permit jobs near housing.

Rising fuel costs will impact the profitability of public transit agencies unless ridership increases or fares are raised. Rising fuel costs will also increase expenses for wholesalers and retailers of goods. These costs will most likely be passed along to the consumer if other costs cannot be decreased to compensate.

### Opportunities

*It is important that Chocolay Township enable a variety of housing to be built in close proximity to Marquette where most people are employed.*

This is particularly important for low income housing options. The best way to do this is to ensure that higher density housing options are permitted in the sewer district surrounding Harvey. It is important to revise the zoning ordinance to accommodate mixed-use options such as apartments above commercial or accessory dwelling units. This will make lower cost housing options available, revitalize the village, and provide property owners with additional income opportunities. The priority is to change how existing structures can be used.

*Another way to mitigate rising fuel prices is to reduce the distance that raw materials, goods, and people must travel to reach their endpoint.* Chocolay Township should ensure there are sufficient commercial and light industrial land use opportunities available so that critical goods and services are undertaken and made available in close proximity to residents.

If fuel prices reach a prohibitive level, Chocolay Township can implement an **electronic carpooling match system** to facilitate ride share opportunities, or collaborate with other organizations to do so. **Additional carpool lots** may be needed in the future, and should be considered along with future development.

The Township can also encourage the development of **car-sharing programs**. A private, for-profit venture would operate as a rental service allowing members to reserve a rental car for variable time periods, and to pick it up somewhere nearby, such as in their neighborhood. This allows people who only use a car occasionally to forego car ownership. The rental rates would cover the fuel, maintenance, insurance, and parking fees for the vehicle at the home site, so these cars would need to have maximum utilization to ensure profitability. A non-profit organization could also coordinate a car-sharing program. Alternately, this type of program could develop from private agreements between neighbors, friends, or family maintaining a vehicle through similar sharing of usage and costs.

To facilitate car-sharing opportunities, Chocolay Township can permit designated car-share vehicle parking stalls throughout the Township at multiple locations on public or private property. The Township

could also work with the City of Marquette to ensure that car-share or bike rental options are available there to facilitate travel to diverse and multiple destinations. The Township can provide examples of car-share agreements to help residents organize their own initiative.

To enhance ridership for public transportation, the Township should investigate opportunities to **construct additional transit shelters** in more locations. One such location is near the Silver Creek Recreation Area in the Village of Harvey west of US-41. These locations can be established by surveying residents regarding their need and willingness to use public transportation and locating stops near anticipated concentrations of users. Additional shelters would make the use of public transit more convenient and comfortable and possibly increase ridership. These shelters should be modest in cost and easy to maintain. Private enterprises might also support the development and maintenance of such structures if they could coordinate pick-ups from them.

Arranging **flexible work options** can help reduce transportation costs, such as telecommuting and 4-day work weeks.

Chocolay Township should also collaborate in any regional initiatives to bring **passenger rail transportation** to the area.

## HOUSING RESILIENCE

Housing resilience relates to issues of affordability and diversity. Affordability is related to proximity to destinations, energy efficiency, and condition of the structure. Diversity is related to meeting the needs of the population as they continue to age, and providing housing for a variety of economic circumstances.

### Profile

There were 2,824 total housing units in Chocolay Township in 2010, and 87 percent were occupied compared to 85 percent in Michigan. Of the 371 vacant housing units in Chocolay Township, 259 were for seasonal, recreational, or occasional use. Michigan had much lower percentages of vacant housing units for seasonal, recreational, or occasional use (5.8 percent compared to 9 percent in Chocolay Township).

The homeowner vacancy rate in Chocolay Township was a low 0.9 percent, with renter vacancy rate much higher at 7.6 percent. Both these numbers are much lower than the State however, where the homeowner vacancy rate is 2.7 percent and renter vacancy rate is 11.5 percent.<sup>38</sup> The housing market is strong near the City of Marquette. However, the national trend is for retiring baby boomers to abandon large single family homes for housing that fits better with their lifestyle choices and needs. The next boom generation, the millennials, seek more walkable, compact housing options in close proximity to culture, entertainment, and restaurants. So certain housing types, particularly single family homes, may sit vacant or underutilized, while there is an undersupply of alternatives.

Of the owner occupied housing units, 66 percent had a mortgage or loan. The remainder were owned free and clear.<sup>39</sup>

The median value of owner-occupied units in Chocolay Township is estimated to be \$171,100, compared to a median value of \$126,300 in the County and \$128,600 in Michigan. No doubt the lake and river-front properties influence this higher value.<sup>40</sup> The median selected monthly owner costs for housing units in Chocolay Township with a mortgage is moderate at \$1,177, compared to \$1,092 in the County and \$1,355 in the State. Median selected monthly owner costs for housing units in Chocolay Township without a mortgage is estimated to be \$338.<sup>41</sup>

Median gross rent in Chocolay Township is estimated to be \$703, compared to \$504 in the County and \$755 in the State.<sup>42</sup>

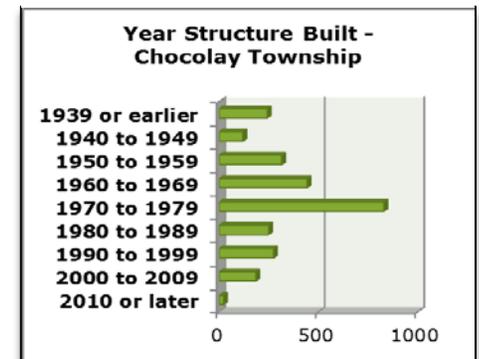
### Risk Assessment

Figure 5-3 shows the percent of housing built per decade. The largest percentage of Chocolay Township housing was built in the 1970's. This may indicate that repairs and energy efficiency upgrades may soon be needed. Homes built between 2000 and 2005 used 14 percent less energy per square foot than homes built in the 1980's, and 40 percent less energy per square foot than homes built before 1950.<sup>43</sup> However, larger home sizes have offset these efficiency improvements.

According to the U.S. Department of Energy, 78 percent of total energy consumption in residential buildings comes from consumption of space heating and cooling, lighting, and water heating.<sup>44</sup> In a climate such as ours, heating is of primary concern much of the year.

Energy efficiency is even more a concern in rental housing. When renters assume the costs of their utility bills, landlords don't have much financial incentive to make their units more energy efficient.

Figure 5-3 - Housing Per Decade



<sup>38</sup> 2010 U.S. Decennial Census data, Summary File 1.

<sup>39</sup> Ibid.

<sup>40</sup> 2008-2012 American Community Survey 5-Year Estimates.

<sup>41</sup> 2008-2012 American Community Survey 5-Year Estimates. Includes the sum of payments for mortgages and similar debts on property; real estate taxes; fire, hazard, and flood insurance; utilities; and fuels.

<sup>42</sup> 2008-2012 American Community Survey 5-Year Estimates.

<sup>43</sup> U.S. Department of Energy 2011 Buildings Energy Data Book, March 2012.

<sup>44</sup> Ibid.

## HOUSING RESILIENCE

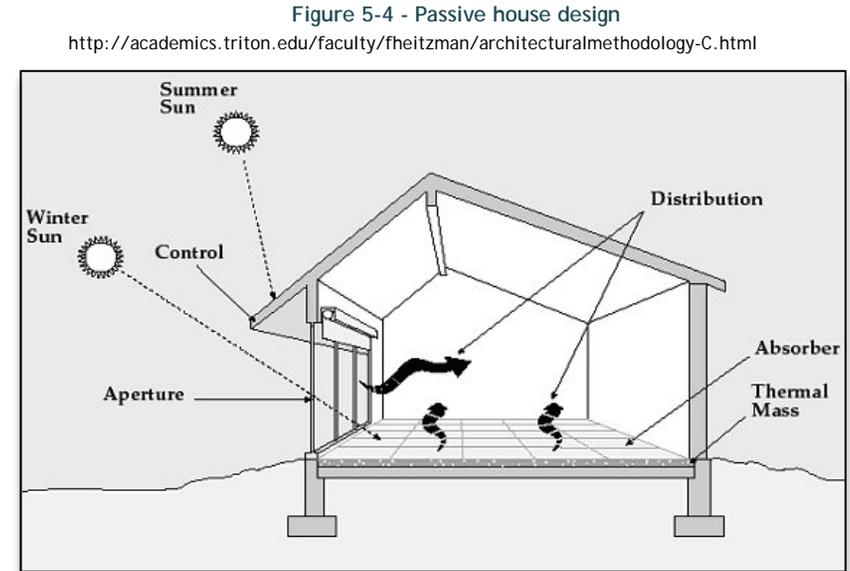
### Opportunities

It will be important to facilitate community awareness of programs to improve housing affordability, such as **energy optimization/weatherization** and **renewable energy programs**. Some lenders offer mortgages that allow the borrower to use the money saved in utility bills to finance energy improvements. In some states, property tax incentives have been used to ensure that the renewable energy system has no impact on assessed value of properties. Currently Michigan does not have a tax exemption policy in place for residential owners. So the tax increase associated with an average solar system could essentially double the cost per kWh to a homeowner, creating a significant disincentive for homeowners to implement photovoltaic systems. If tax laws change and provide an incentive rather than a barrier for these installations, Chocoley Township should encourage homeowners to install renewable energy systems. This will grow these markets, provide jobs, increase sales tax revenues, and improve housing resilience.

It is also important to **permit more multi-family housing, small houses and accessory dwelling units** which offer multiple benefits including energy efficiency, affordability, less maintenance, and care of senior or youth family members. On average, multi-family homes used 9 percent less Btu per household than mobile homes and 40 percent less than single-family homes.<sup>45</sup>

It is also important for homeowners to become more aware of energy usage, and to implement **energy conservation** measures. Changing habits is as important as changing infrastructure.

The construction of **passive solar homes** (see *Figure 5-4*) should be encouraged. In addition to being oriented to take advantage of the sun, these homes are super-insulated, airtight, and use thermal mass for heat storage, thereby reducing energy use significantly. These homes improve resilience in case of a power failure because much less supplemental heat is needed. They have proven successful in northern climates, and have been most widely used in Germany and Scandinavia.



## PRIVATE ENERGY RESILIENCE

This section focuses on energy issues in the non-residential sector.

### Profile

In the U.S., the buildings sector accounted for about 41 percent of primary energy consumption in 2010, 44 percent more than the transportation sector and 36 percent more than the industrial sector. Homes account for 54 percent of the energy use in the building sector, with commercial buildings accounting for 46 percent. Currently, 75 percent of energy comes from fossil fuels, and only 9 percent from renewable sources (remainder nuclear).<sup>46</sup>

Primary energy consumption by the U.S. building sector increased by 48 percent between 1980 and 2009. The Energy Information Administration projects this growth will stagnate due to the recession until 2016 when steady growth is predicted through 2035.

<sup>45</sup> U.S. Department of Energy 2011 Buildings Energy Data Book, March 2012. Ibid.

<sup>46</sup> Ibid.

## Risk Assessment

In the Marquette area, most of our electricity is powered by coal. Coal requires oil for mining and transport. Therefore, as the price of oil rises, the price of electricity will rise. As the price of electricity increases, more people will look to other energy sources such as natural gas, if it is available. As more people rely on natural gas, the price will increase. Others may rely on wood burning fuel sources. The increased burning of wood may increase the particulates in the air, cause deforestation, and result in an increased risk of fire. Additionally, local biomass supplies may prove insufficient, and sufficient quantities may not be able to be cut and moved to all destinations.

A significant increase in the cost of fuel will stress the budgets of households who are reliant on personal vehicles, and will have an especially regressive effect on the community's lower wage earners. Disposable income will decline as the price of many products rise (either because oil is a key input in the product or because the cost of transporting the product rises).

The potential impacts of energy scarcity include:

- The personal automobile is a less affordable means of transportation
- There is a much greater need for public transportation
- The cost of food and other critical goods rises due to increases in transportation and production costs
- Commuting is a less affordable lifestyle
- People may look for smaller, more energy efficient homes, and then large or energy inefficient homes will decline in value. Those people who have their net worth tied up in these homes may be negatively impacted.
- Alternative power sources could be needed if there are increasing power disruptions. Without electricity, pumps and toilets won't work. This could include generators that run on multiple fuel sources, or renewable energy sources that are not grid tied.

Businesses that require more energy will be more vulnerable to rising costs. Warehouses, storage facilities, and churches use less energy. Medical buildings and food sales and service businesses are more vulnerable due to energy-intensive end uses and more frequent occupancy.

## Opportunities

*Reducing per capita energy consumption is critical in reducing the impact of shocks or stresses associated with future energy costs or shortages.* Buildings and transportation are the primary focus for savings, with passive strategies providing the highest levels of resilience. Retrofitting is critical given the fact that some 66% of the houses that will exist in 2050 are already standing.<sup>47</sup>

The Marquette BLP and Alger Delta Electric Cooperative offer **energy optimization programs** for both residential and commercial/industrial customers. These include:

- Residential low income programs for energy efficiency and weatherization
- Residential rebates on high efficiency products and appliances (LED fixtures, ceiling fans, power strips, and Energy Star appliances)
- Residential appliance recycling
- Rebates on efficient residential heating, ventilation, and air conditioning
- Online home audit
- Agribusiness rebates for installation of energy efficient products and equipment (waterers, fans, heaters, controls, pumps, refrigeration)
- Commercial and industrial rebates for installation of energy efficient products and equipment (lighting, HVAC, food service equipment, grocery and commercial refrigeration, industrial processes)

<sup>47</sup> 2012. Future Proofing Cities: Strategies to help cities develop capacities to absorb future shocks and stresses, Applegath, Craig.

## PRIVATE ENERGY RESILIENCE



**Michigan Saves** is a public-private partnership which works with private lenders to provide affordable financing to help homes and business save energy and money. This program also supports local construction jobs.

**Methane digesters** transform locally-generated waste into biogas which can be used for power in fixed installations such as power plants or pumping stations. The by-product of this process can be used as fertilizer for local gardens and farms. These systems may benefit private consumers.

## OTHER OPPORTUNITIES FOR PRIVATE RESILIENCE



### Opportunities

Residents should voice support for local regulations that permit them to raise food at their homes and increase their food security.

Residents can increase water supply available for outdoor and non-potable indoor water use by **collecting rainwater** from roofs and other runoff. Avoiding the use of well water for irrigation takes the stress off well pumps and provides less shock to plants from cold water (see *Figure 5-5*). Water storage capacity should be expanded to provide for short-term emergencies in power failures when well pumps won't work.

Consumers should be encouraged to buy products that require **less packaging** that will be thrown away. Less waste means lower costs for transporting them. Household composting also reduces garbage and yields a valuable soil amendment product. Neighborhood scale composting programs can benefit community gardens.

Some neighborhoods are exploring ways to work together through **resilience circles**. These groups provide an opportunity for learning, sharing skills, providing mutual aid, exchanging services, pooling resources, and getting to know each other. It is important that people within the community work together to solve problems, instead of thinking they must stand on their own. Resilience increases when people work together.

Figure 5-5 - Rain barrels at the Chocolay Community Garden warm the well water before use on plants

