UP Demographics: Implications for Energy

UP ENERGY TASK FORCE MEETING: AUGUST 5, 2019

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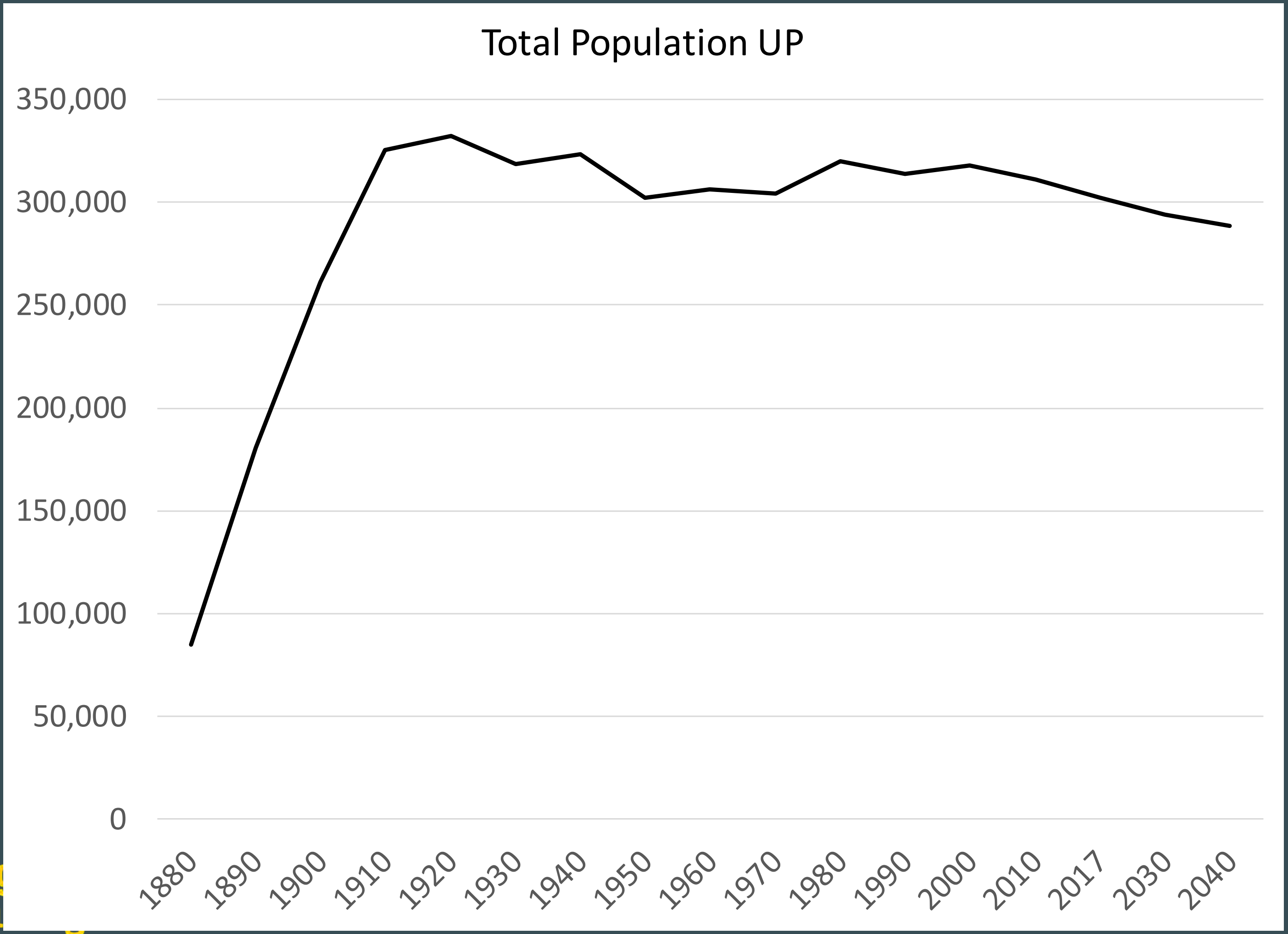
Agenda

- Population & Housing Distribution & Change
- Housing Characteristics
- Residential Energy Demand & Sources
- Energy Poverty & Socioeconomic Dimensions
- Potential for popular, locally-based generation
  - Minewater Geothermal for Heating & Cooling
  - Community Solar

Population: Key Points

- ~ 300,000 people live in the UP. ~ 130,000 Households.
- Slowly declining since peak in 1920 @ 333K
  - **But # of households growing**
- Projected to decline by ~ 13K, 2017-2040
  - **Regions of growth- Houghton & Marquette**
  - **Urban centers suburbanizing/exurbanizing**
- Concentrated in urban centers and along roads
  - ~ 162,000 (52%) live in rural areas/small towns, some of which are not served by natural gas
- Population is old and aging. Growing proportion of elderly (75+)

Population Change



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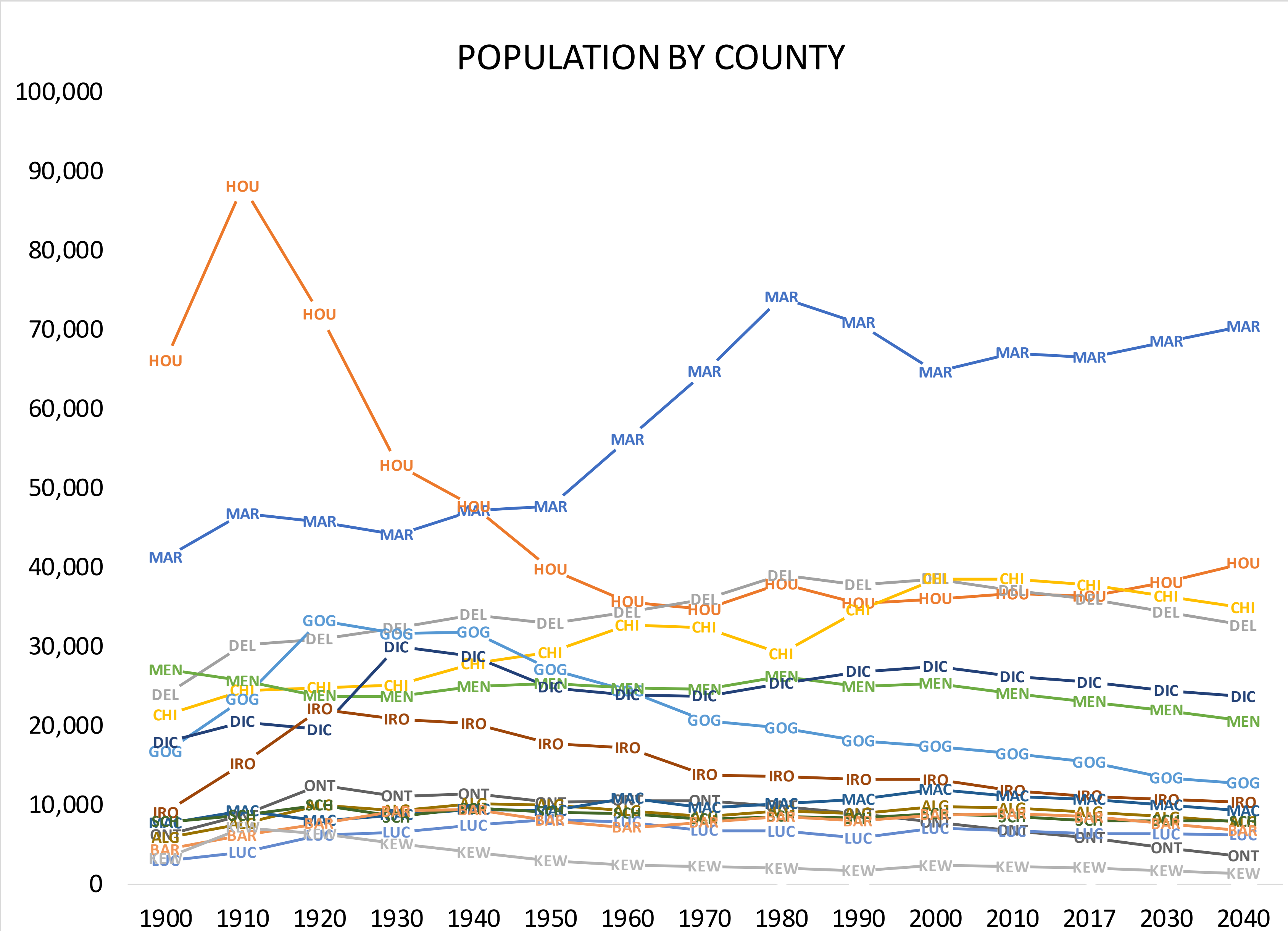

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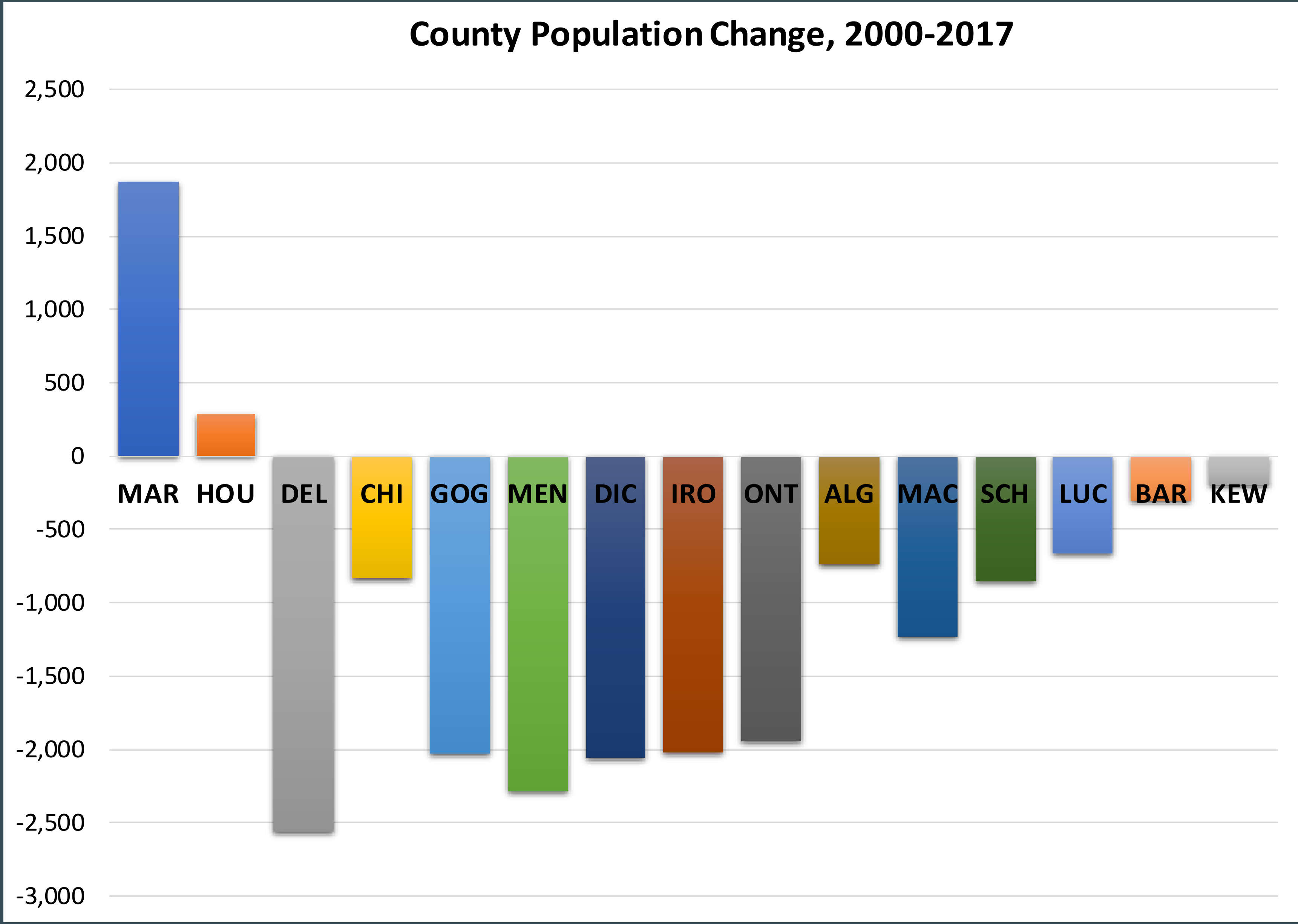

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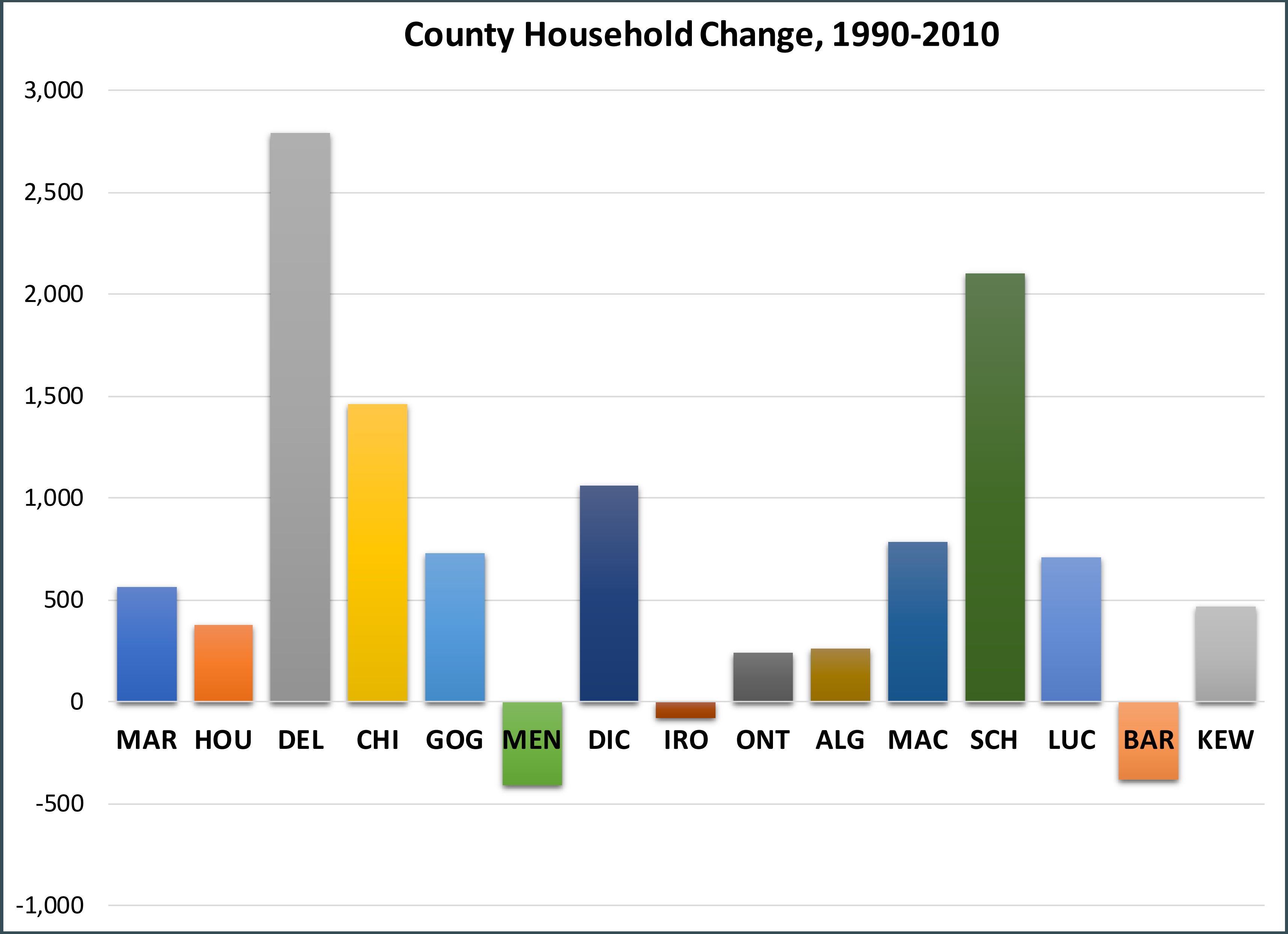

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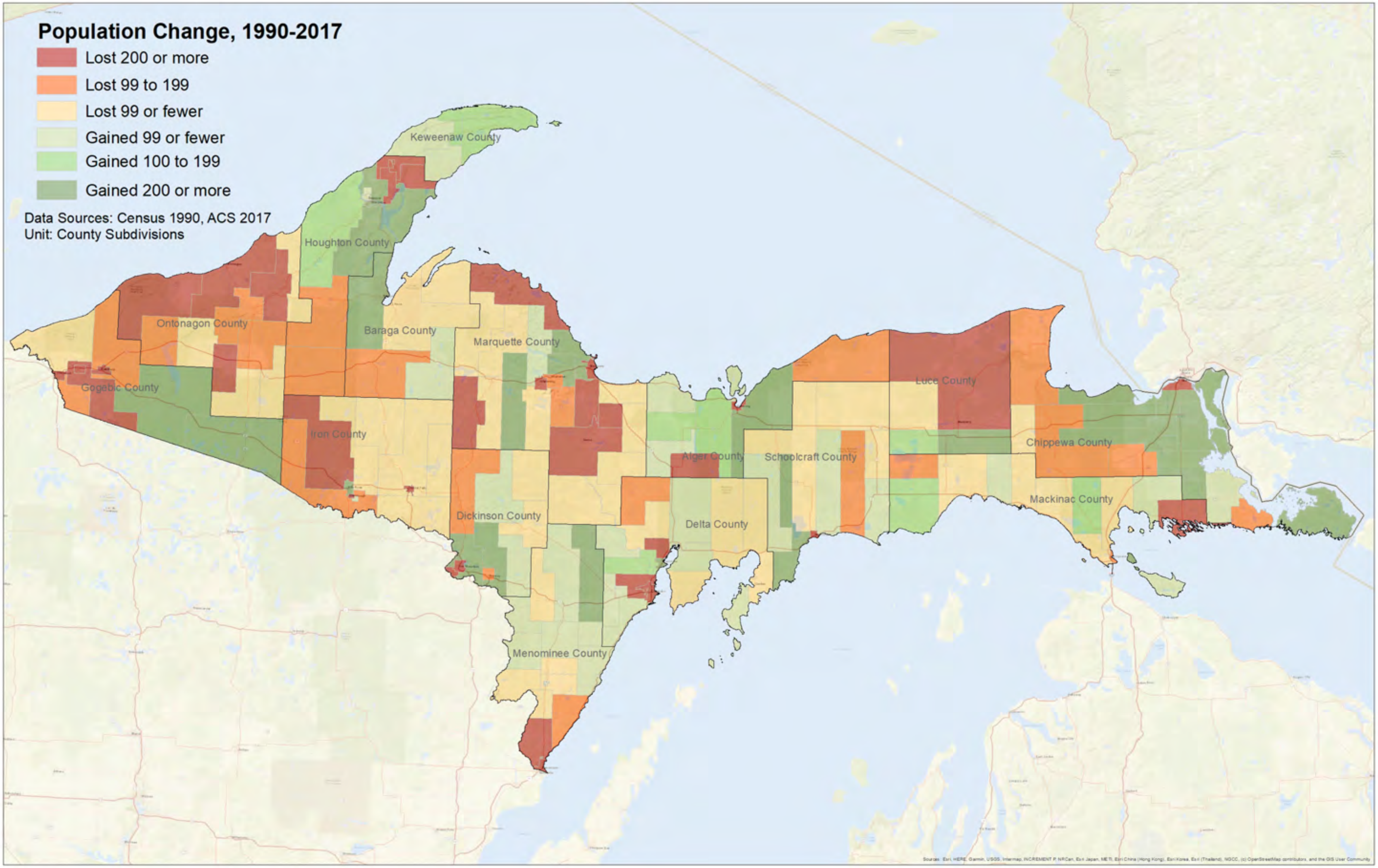
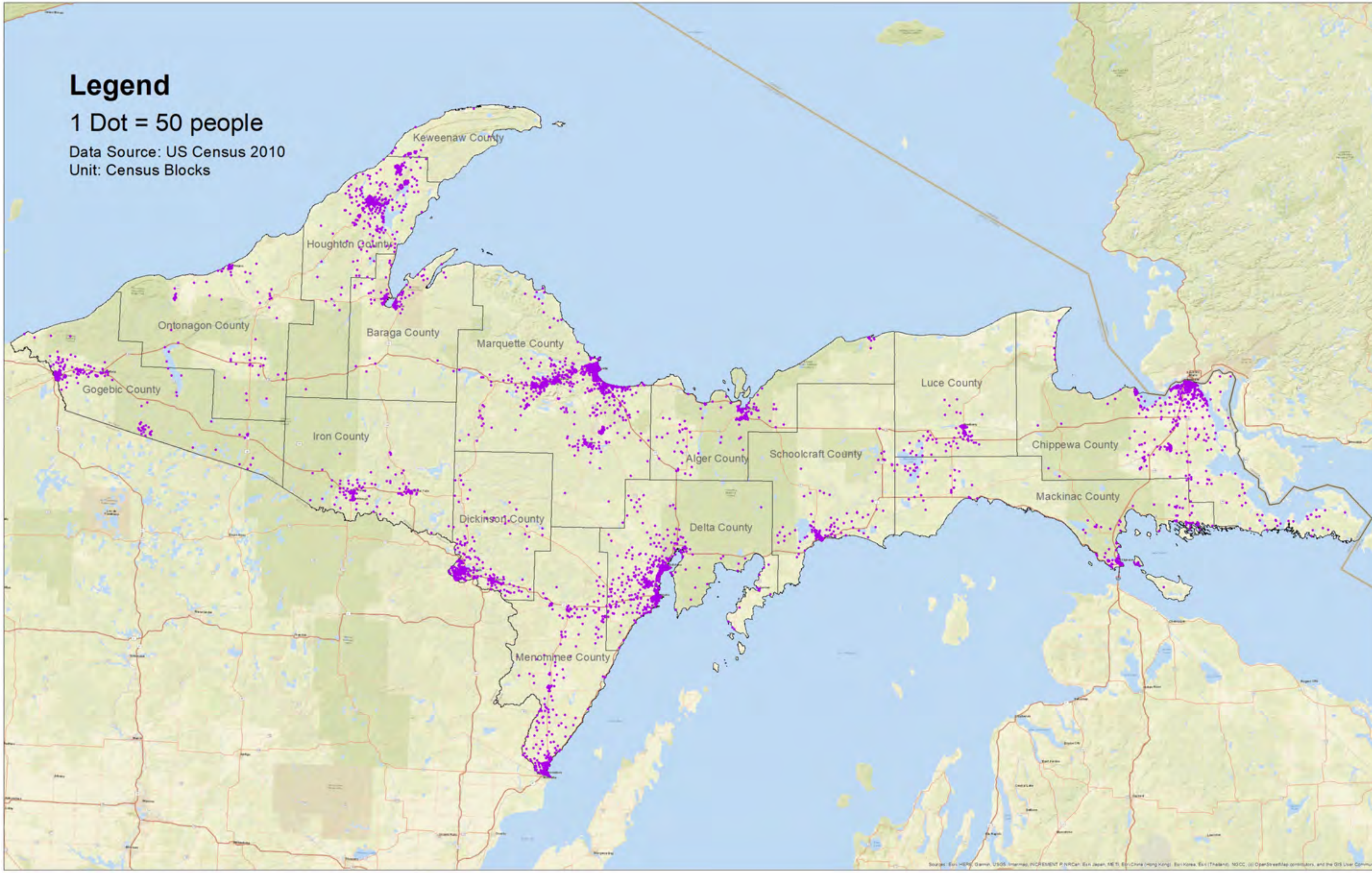
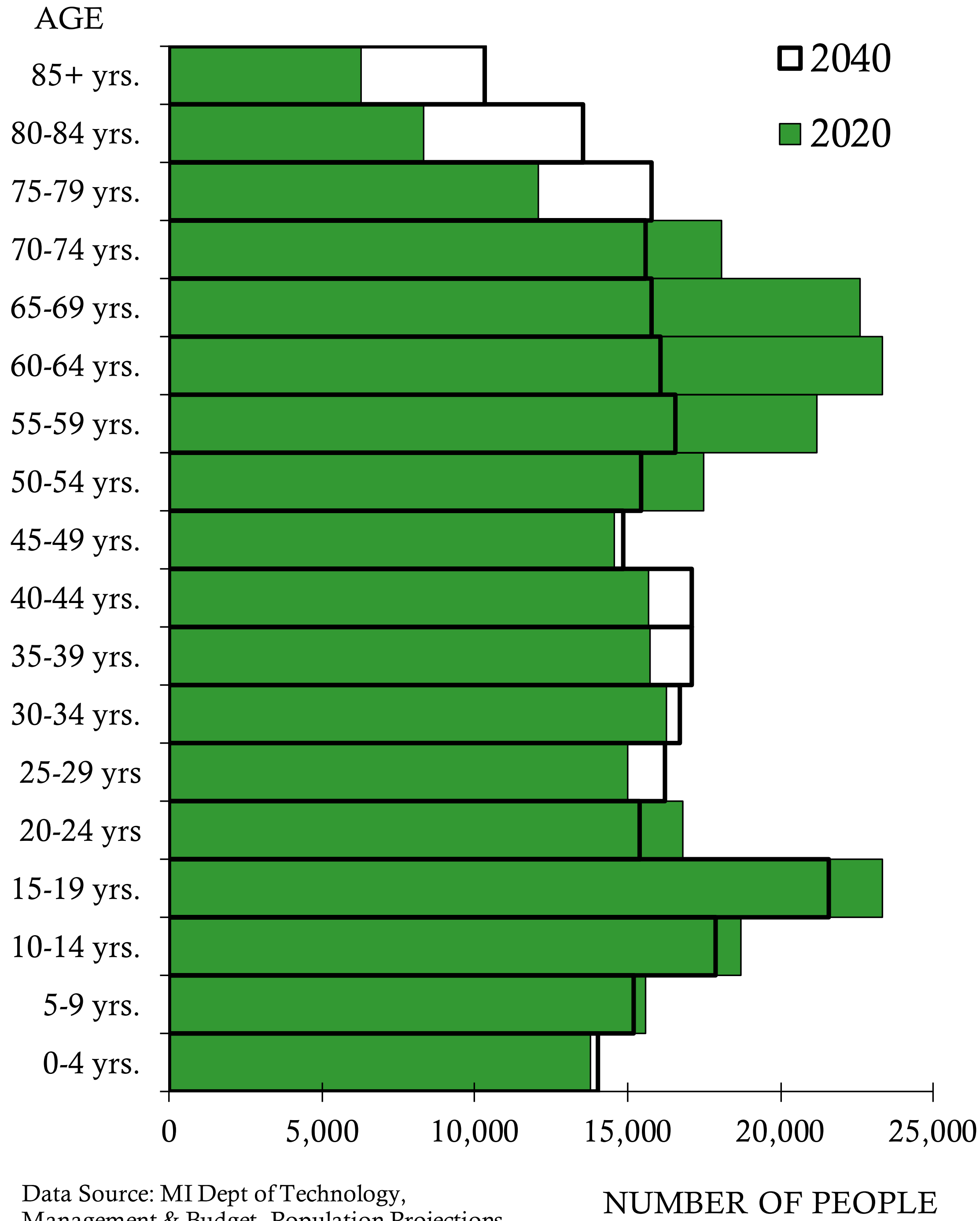

Population Change, 1990-2017
Lost 200 or more
Lost 99 to 199
Lost 99 or fewer
Gained 99 or fewer
Gained 100 to 199
Gained 200 or more
Data Sources: Census 1990, ACS 2017
Unit: County Subdivisions
Keweenaw County
Houghton County
Ontonagon County
Baraga County
Marquette County
Gogebic County
Iron County
Luce County
Chippewa County
Alger County
Schoolcraft County
Mackinac County
Dickinson County
Delta County
Menominee County



Legend
1 Dot = 50 people
Data Source: US Census 2010
Unit: Census Blocks
Keweenaw County
Houghton County
Ontonagon County
Baraga County
Marquette County
Gogebic County
Iron County
Alger County
Schoolcraft County
Luce County
Chippewa County
Mackinac County
Dickinson County
Delta County
Menominee County

UP population is already relative old.

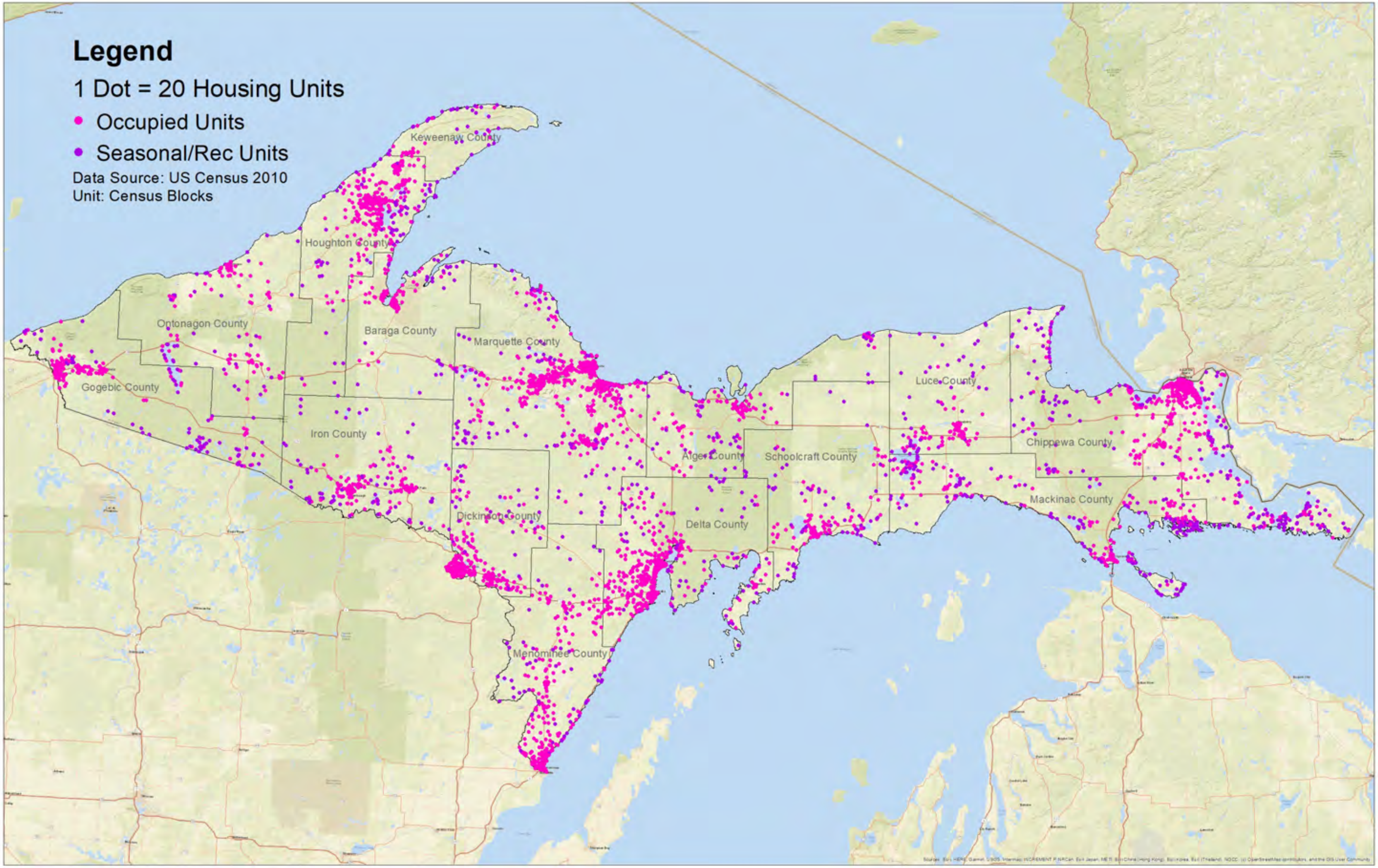
Elderly (75+) projected to almost double in coming years



Data Source: MI Dept of Technology, Management & Budget, Population Projections

Housing

- Seasonal/Rec housing is important: 22% of housing units
  - Especially Keweenaw & Mackinac Counties (~ 50%)
  - Number of seasonal units increasing across UP.
  - Energy demands for seasonals are different
- Characteristics of housing matter for efficiency and to understand trends in development



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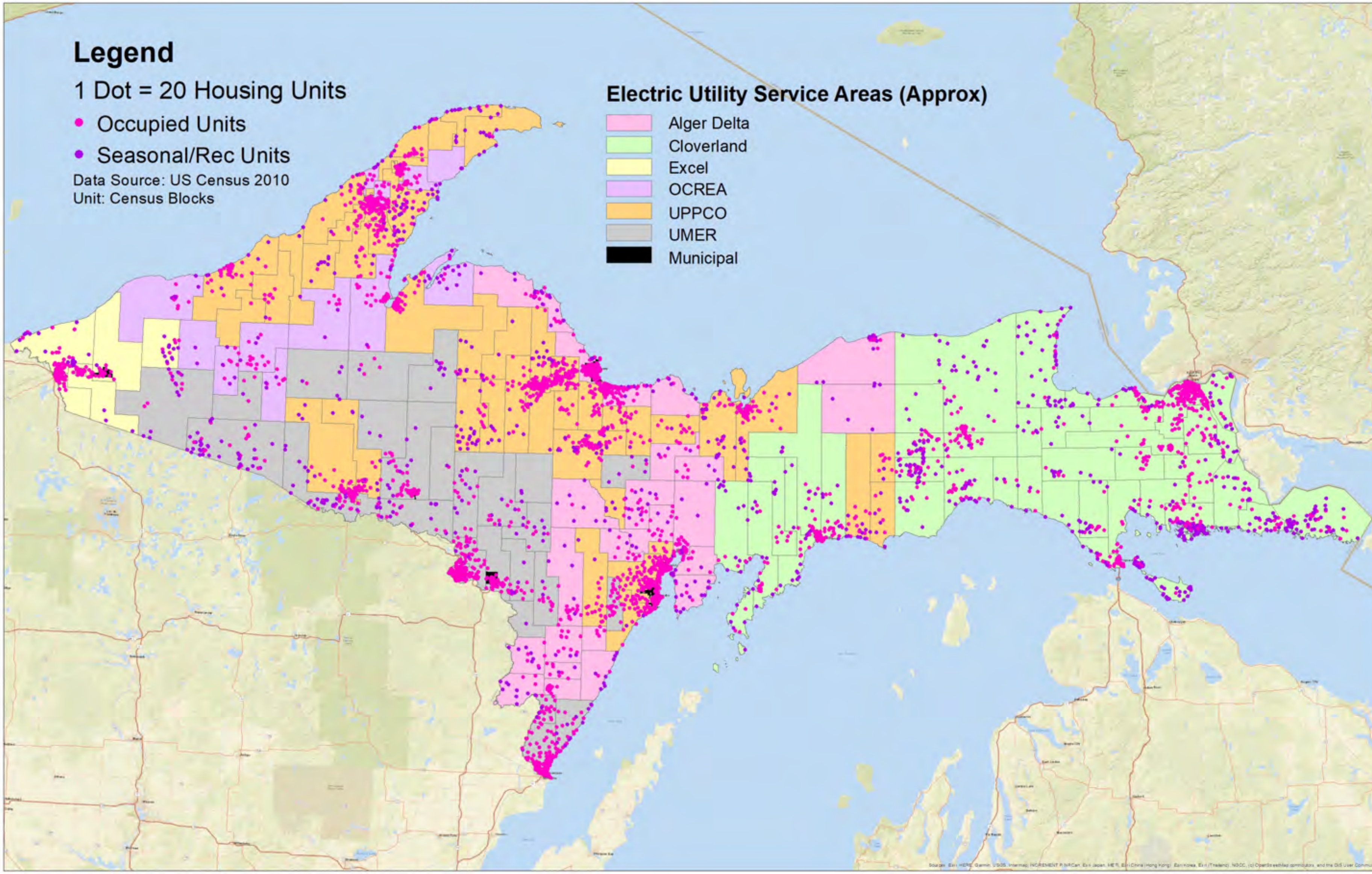
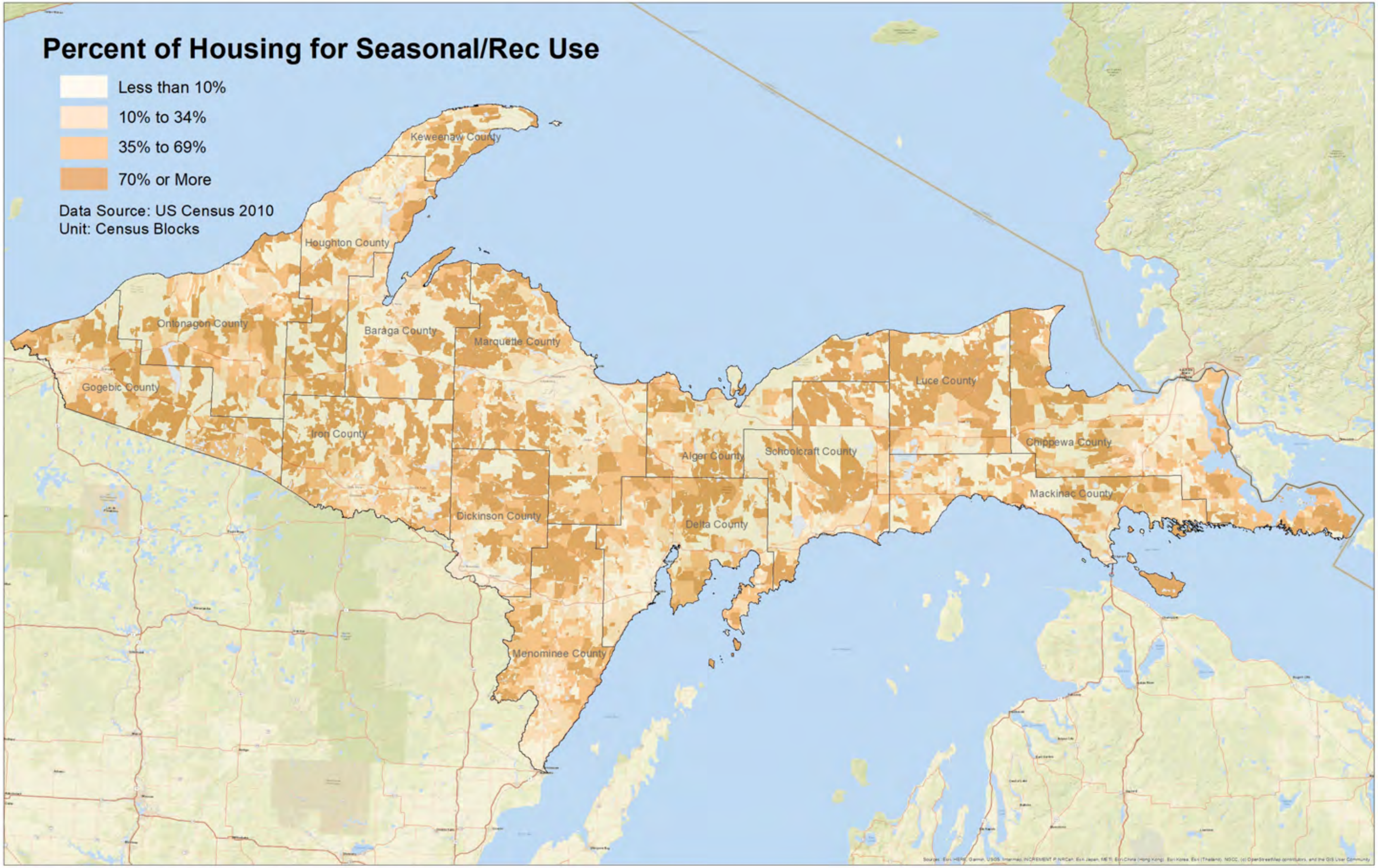

Legend
1 Dot = 20 Housing Units
Occupied Units
Seasonal/Rec Units
Data Source: US Census 2010
Unit: Census Blocks
Electric Utility Service Areas (Approx)
Alger Delta
Cloverland
Excel
OCREA
UPPCO
UMER
Municipal



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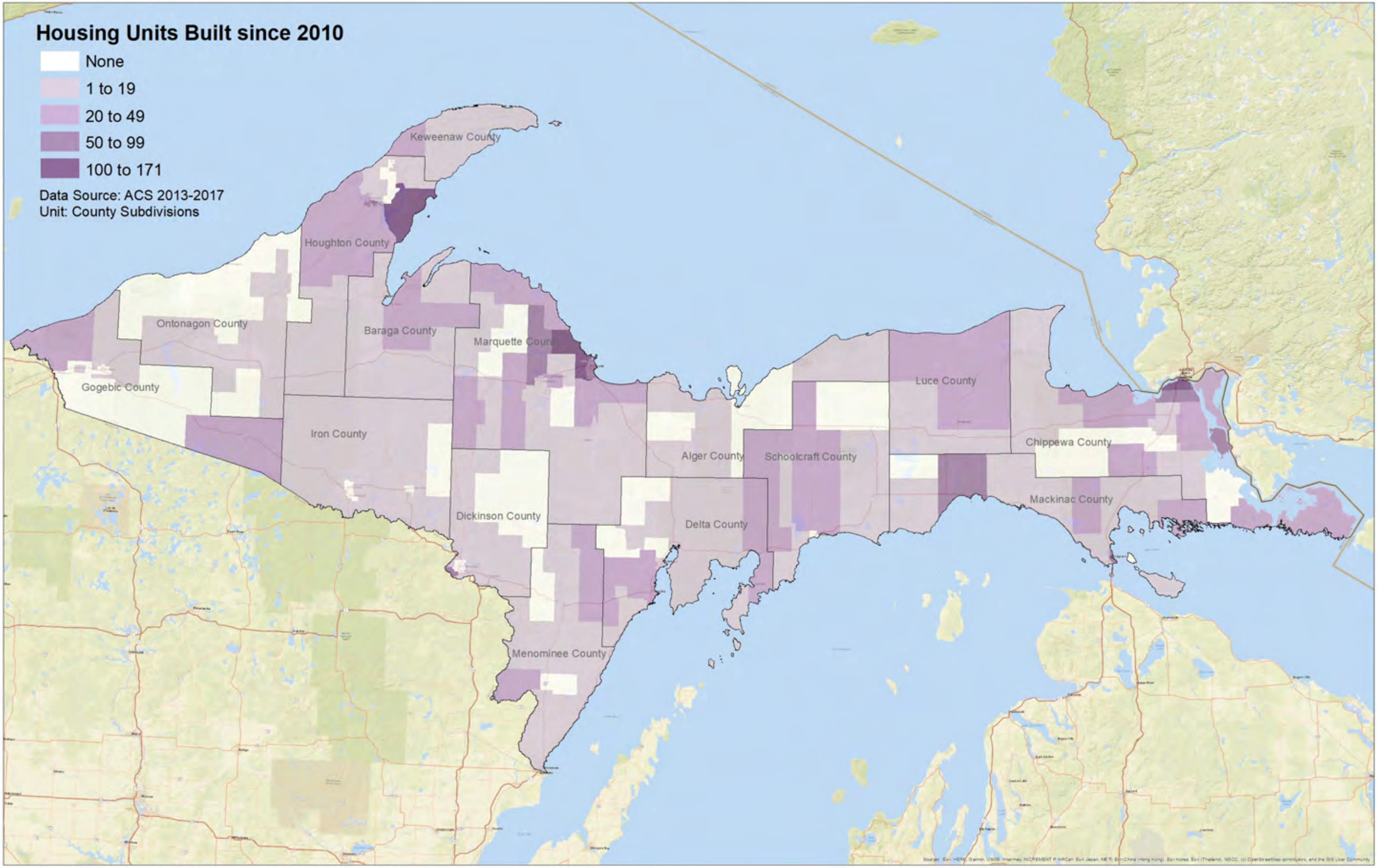
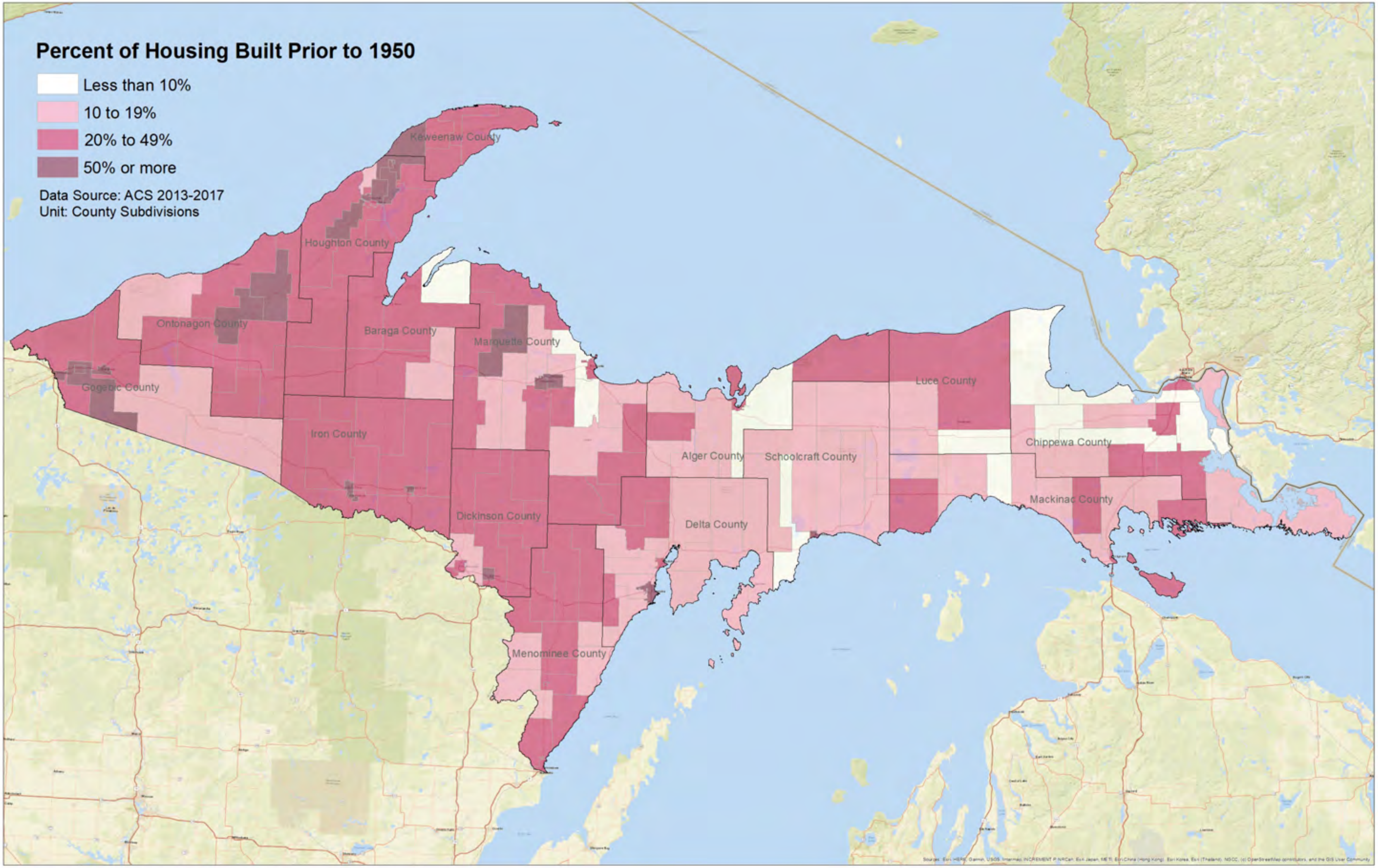

Housing Units Built since 2010
None
1 to 19
20 to 49
50 to 99
100 to 171
Data Source: ACS 2013-2017
Unit: County Subdivisions
Keweenaw County
Houghton County
Ontonagon County
Baraga County
Marquette County
Gogebic County
Iron County
Luce County
Alger County
Schoolcraft County
Chippewa County
Mackinac County
Dickinson County
Delta County
Menominee County



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Residential Energy Demand

- ~22,600 households (18%) heat with propane
- Most (58%) use Natural Gas, but not available everywhere
- Electric heating poses issues for affordability and energy poverty

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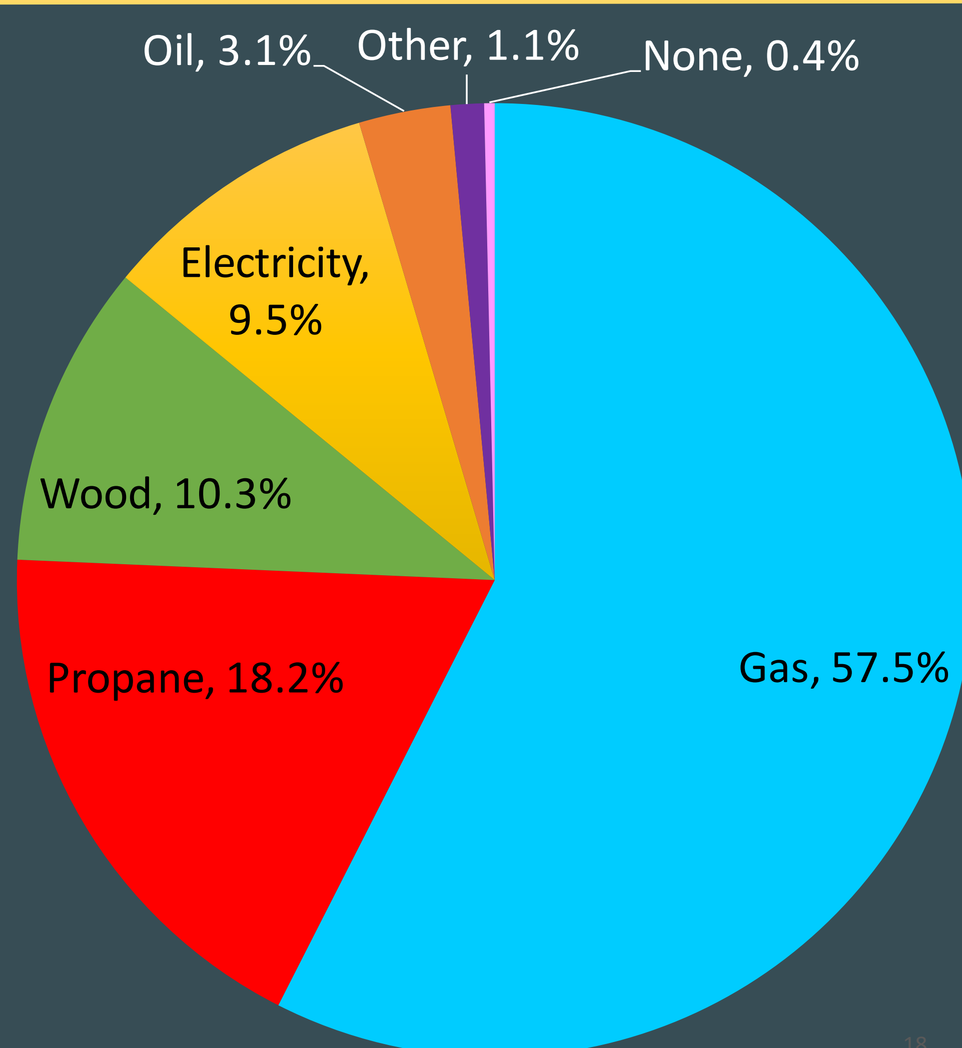
UP Residential Heating Sources

- ~22,600 households (18%) heat with propane
- With seasonals, maybe as many as 60K



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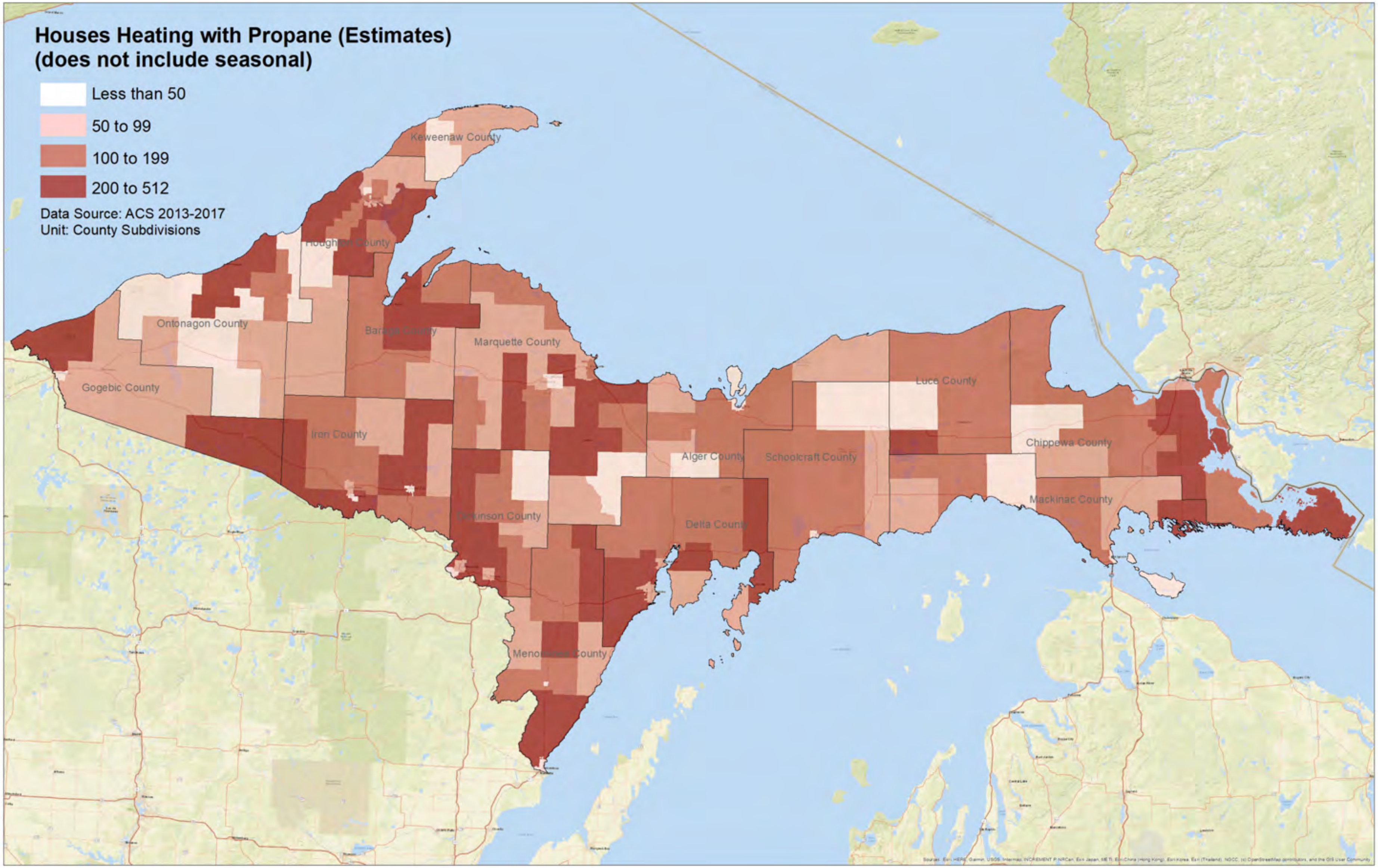

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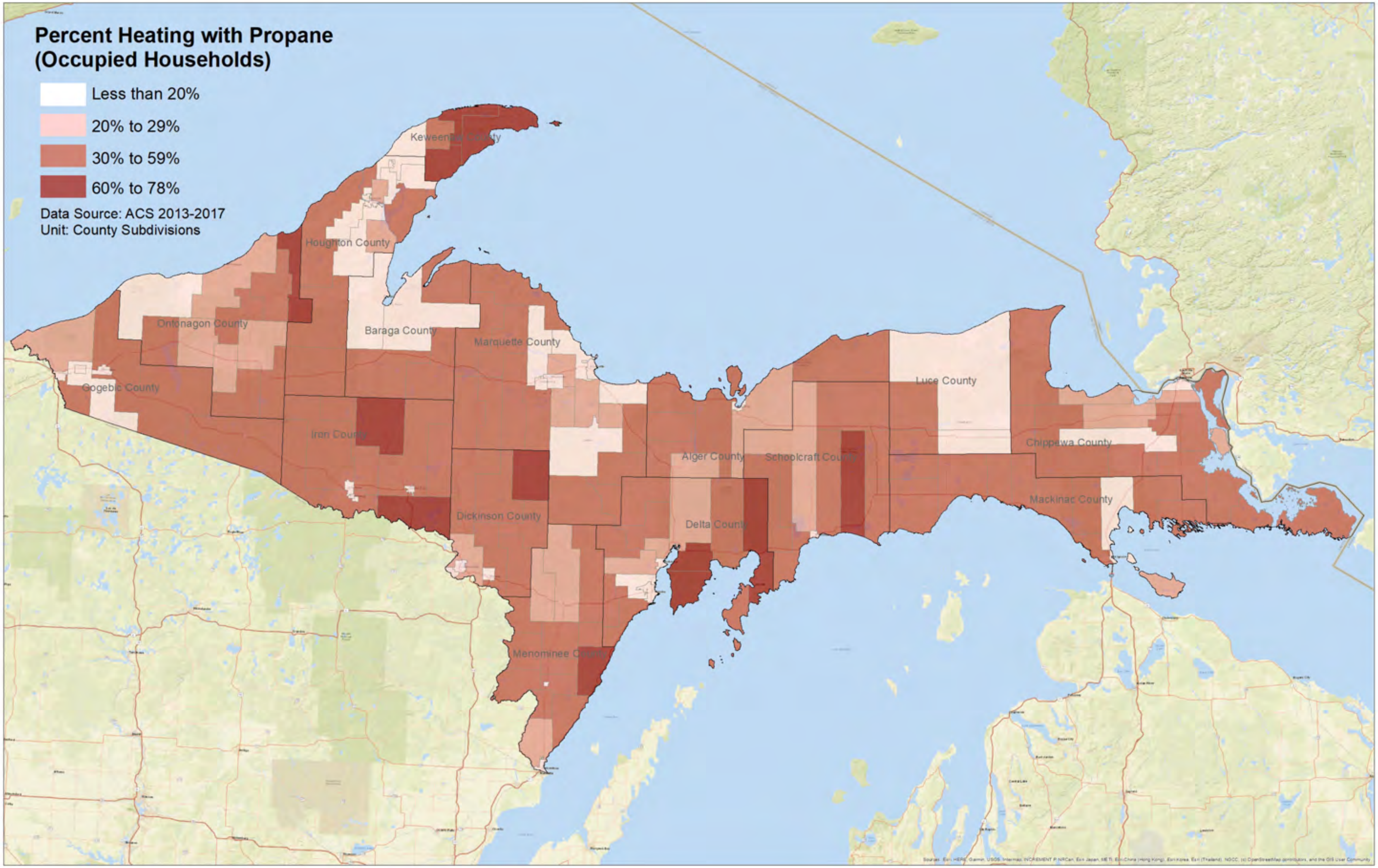

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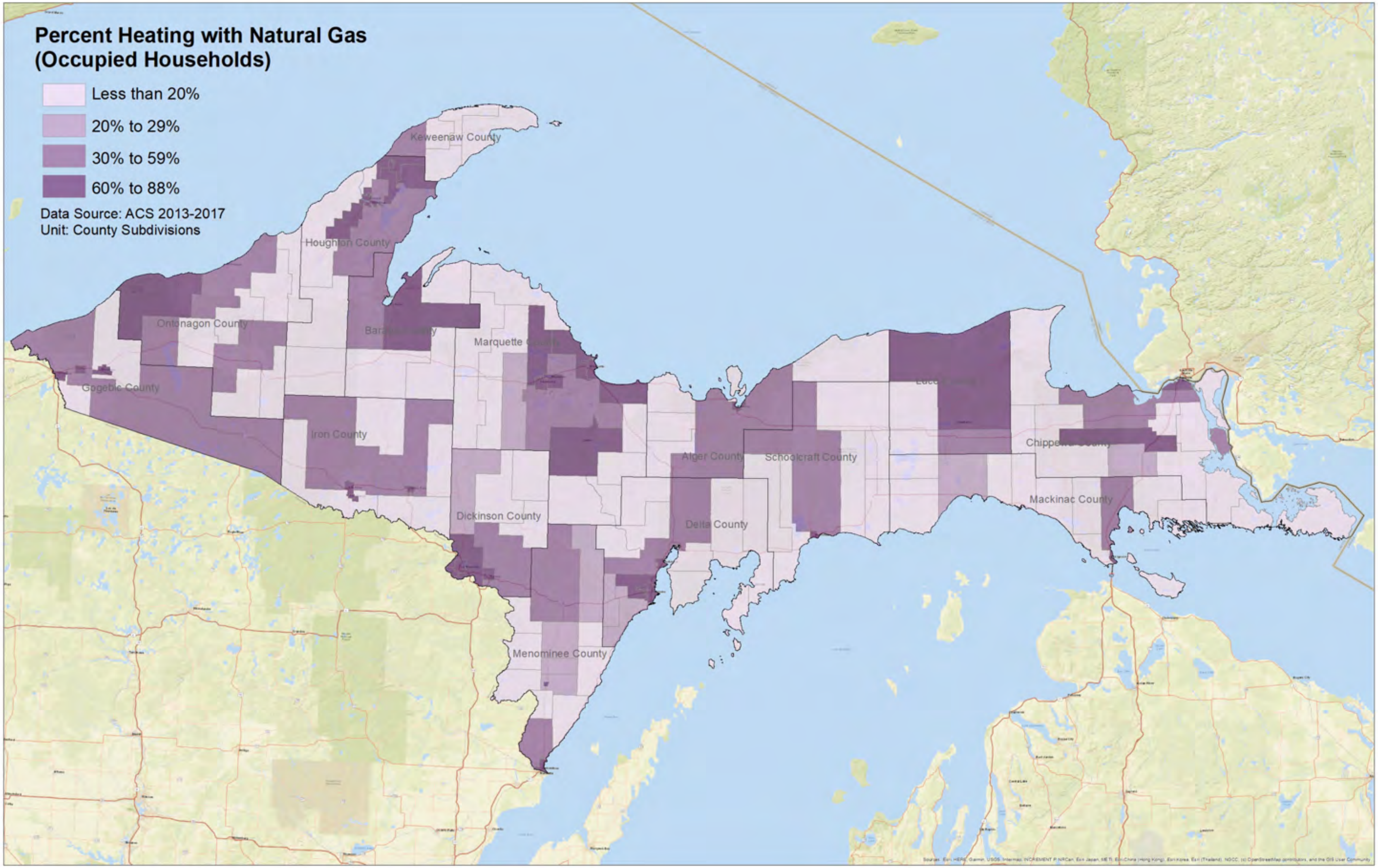

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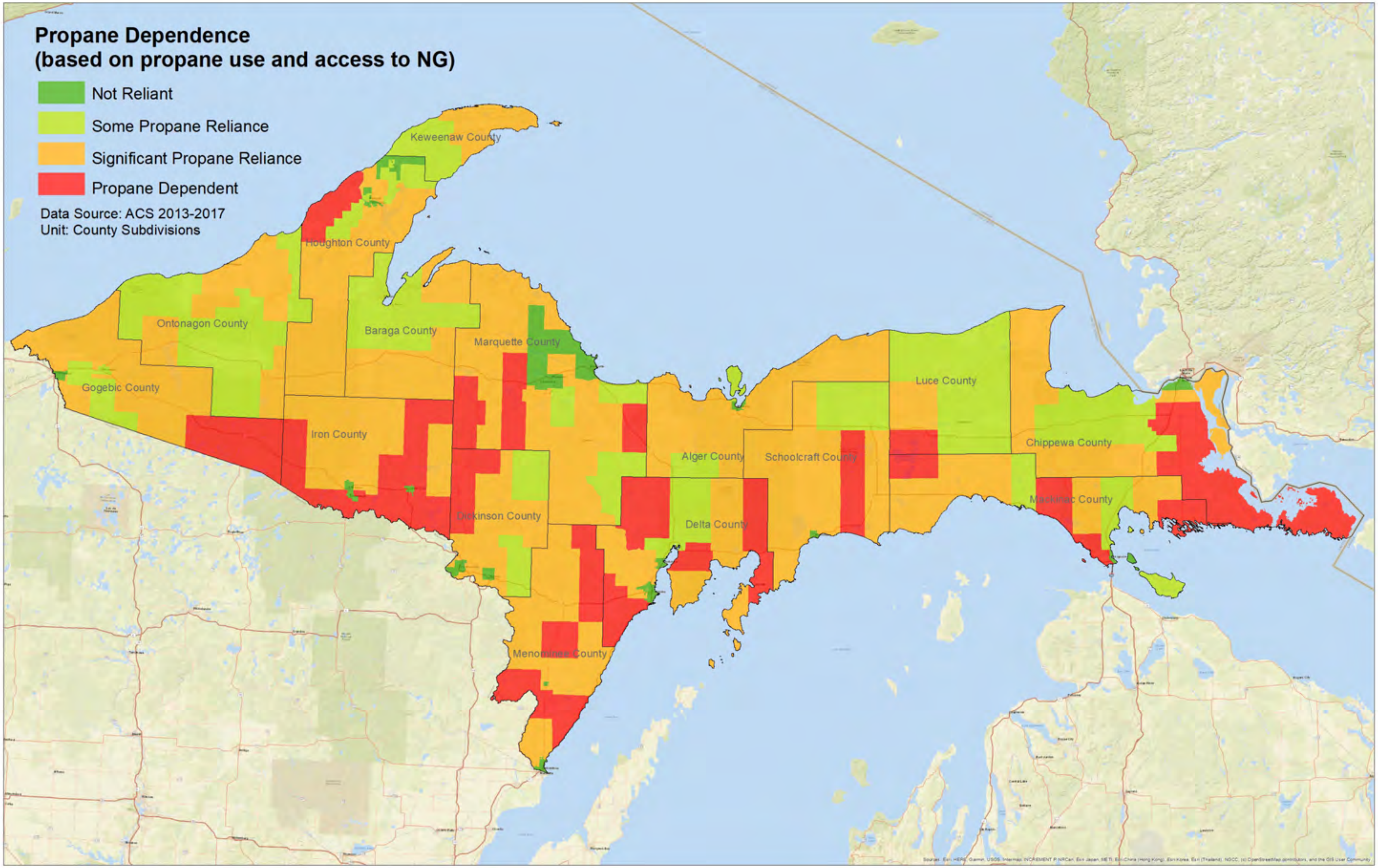
Propane Dependence
(based on propane use and access to NG)
Not Reliant
Some Propane Reliance
Significant Propane Reliance
Propane Dependent
Data Source: ACS 2013-2017
Unit: County Subdivisions
Keweenaw County
Houghton County
Ontonagon County
Baraga County
Marquette County
Gogebic County
Iron County
Luce County
Chippewa County
Alger County
Schoolcraft County
Dickinson County
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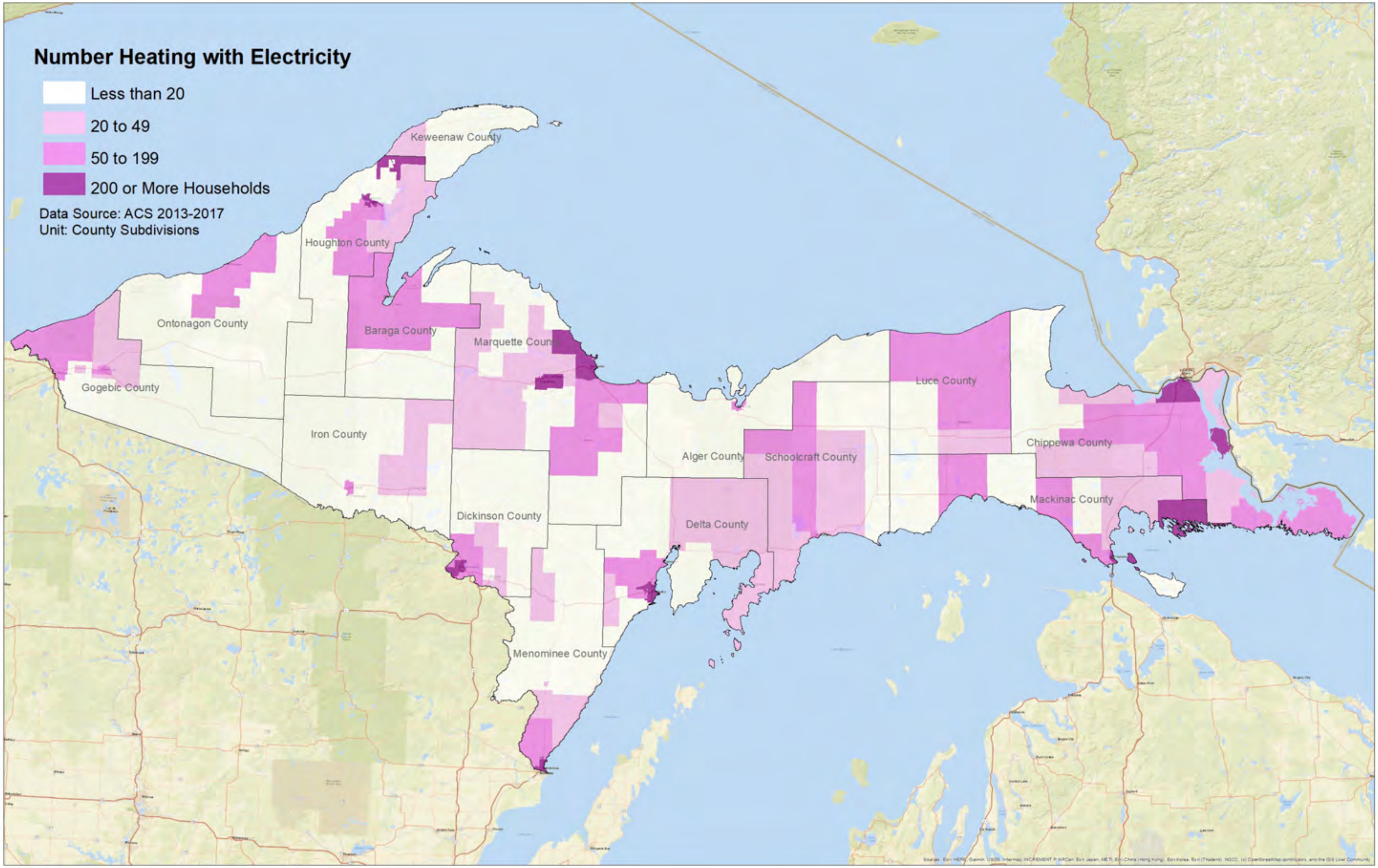
Mackinac County
Menominee County



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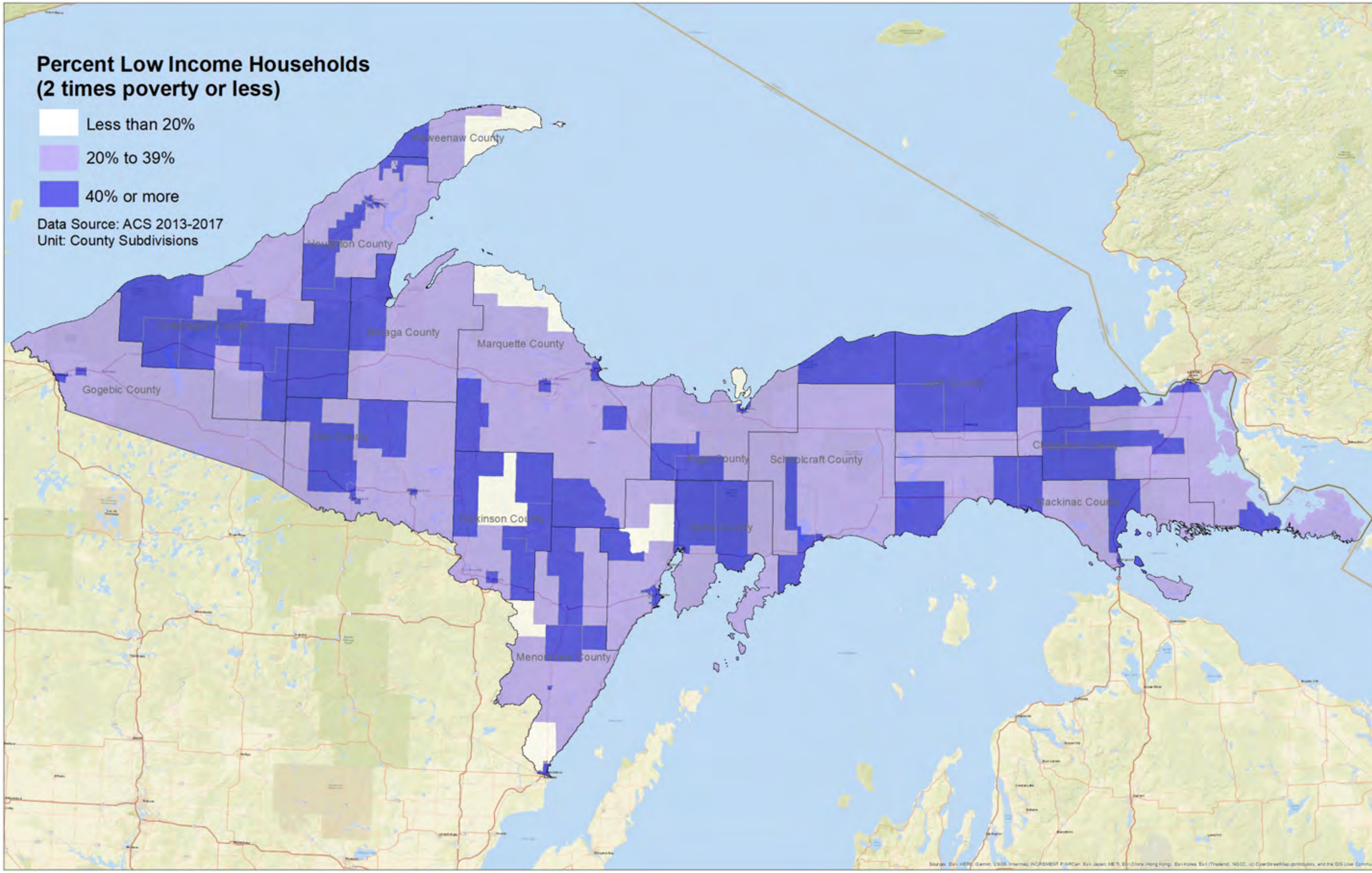
Energy Poverty

- FACTORS: Housing conditions; income; rates; age; alternatives; education; support; policies
- Old housing stock – years of disinvestment
- Income- ~38% of households are low income
- Electricity Rates- are high in western UP
- Population is old and aging. Elderly population concerns.
- Alternatives: Wood
- Educational attainment rates fairly low
- Support- CAC, Little Brothers, churches
- Policy- natural gas shut offs


Percent Low Income Households
(2 times poverty or less)
Less than 20%
20% to 39%
40% or more
Data Source: ACS 2013-2017
Unit: County Subdivisions
Keweenaw County
Houghton County
Baraga County
Marquette County
Gogebic County
Schoolcraft County
Dickinson County
Mackinac County
Menominee County

Some Interesting Alternatives

- Community-Engaged Technical and Socioeconomic Feasibility Studies in Houghton/Baraga Counties
  - Minewater Geothermal for heating/cooling
  - Community Solar
- Widespread community support
  - Connect to heritage & community values
  - Community centered/controlled
  - Environmentally responsible
  - Economic advantages

Community Solar:
An Opportunity for Clean Local Energy

KIWANIS CLUB OF THE COPPER COUNTRY: JULY 24, 2019

Richelle Winkler, Associate Professor of Sociology & Demography, Dept of Social Sciences
Chelsea Schelly, Associate Professor of Sociology, Dept of Social Sciences
Emily Prehoda, PhD Candidate, Environmental and Energy Policy
Jay Meldrum, Executive Director of Sustainability/Director Keweenaw Research Center/AEE Faculty Advisor
Brett Niemi, Senior Energy Services Representative, WPPI Energy
Brad Barnett, Senior Planner, Western Upper Peninsula Planning and Development Region
Robert LaFave, Village Manager, L'Anse, Michigan
LeAnn LeClaire, Village Manager, Baraga, Michigan

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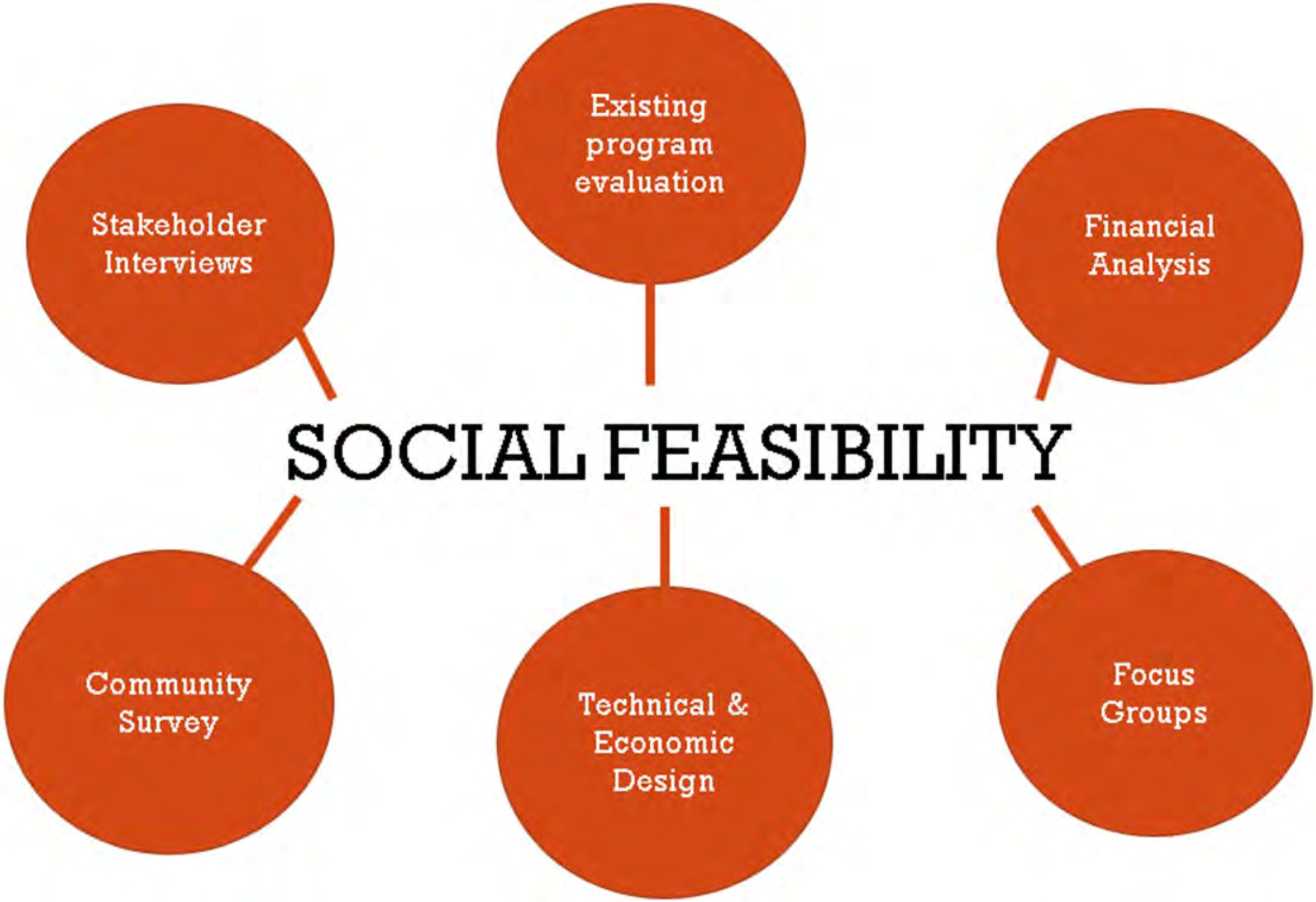
BENEFITS & CHALLENGES

- Increased access: renters/site
- Increased affordability
- Money saving potential
- Lower emissions
- Local energy source & local control
- Community-building
- Easy- No individual installation

- Lack of institutional and policy support
- Lack of resources/expertise
- Complicated program design
- Community skepticism/lack knowledge
- Low participation
- Affordability

Image: https://www.carbontracker.org/the-new-energy-transition-history-is-bunk-renewables-growth-rates-fossil-fuels/


Existing program evaluation
Stakeholder Interviews
Financial Analysis
SOCIAL FEASIBILITY
Community Survey
Technical & Economic Design
Focus Groups

RESEARCH & ENGAGEMENT

Do people in L'Anse & Baraga want community solar, and if so, how should it be designed to meet community interests and needs?

- 15 key informant interviews
- 3 community meetings
- 2 community surveys: mail and door-to-door
- Financial analysis: NPV
- Press features & presentations

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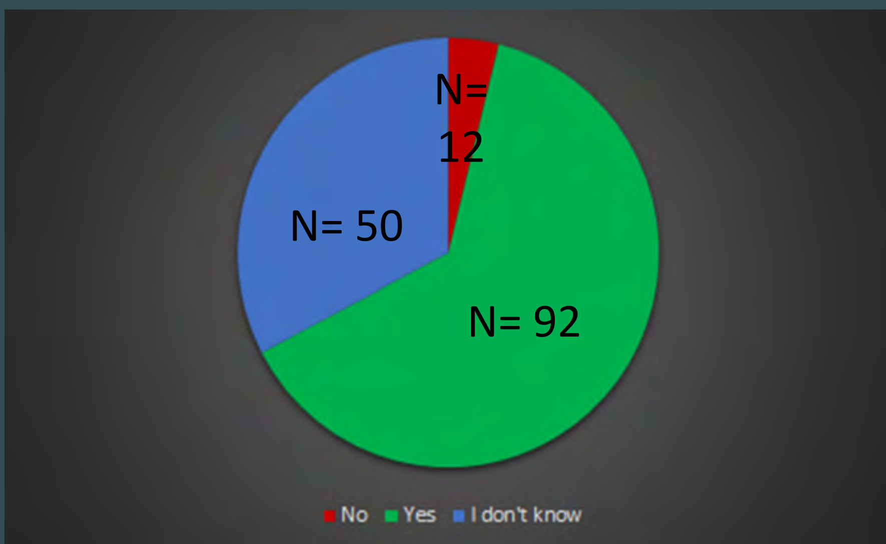
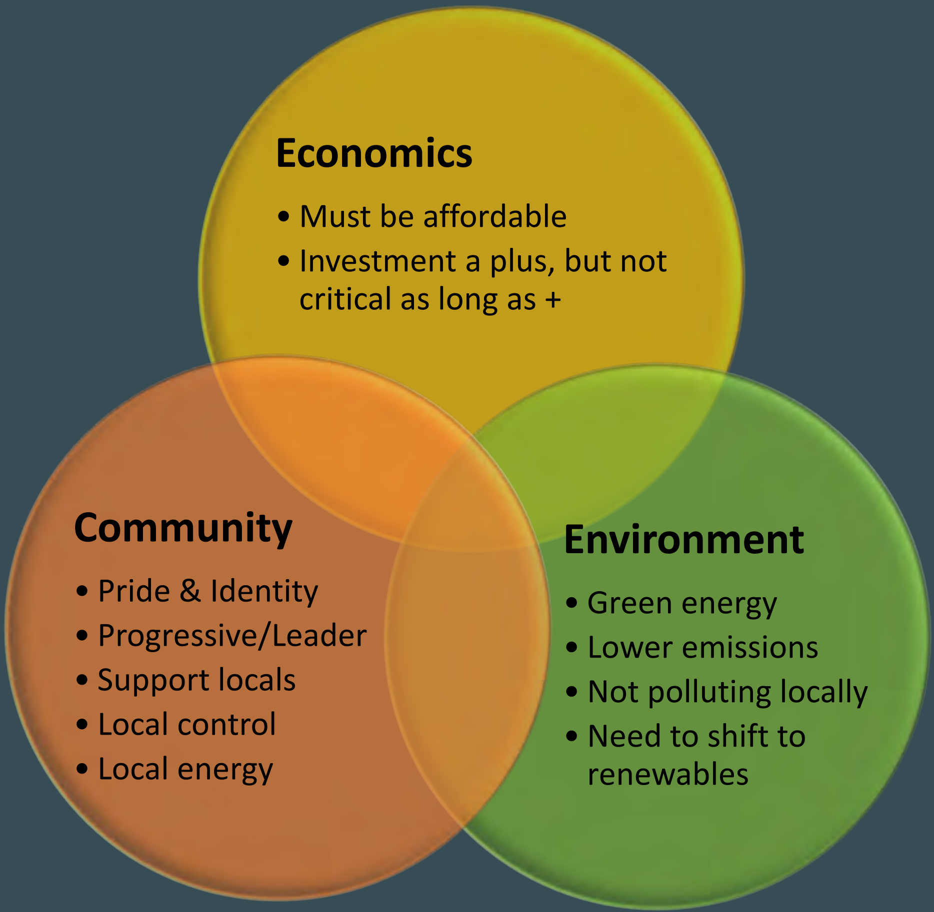
FINDINGS

- Yes- people are interested!



- Concerns, but can design around them



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MAKING IT REAL

- L'Anse system under construction. Selling shares.

L'ANSE COMMUNITY SOLAR SUBSCRIPTION OPTIONS AND SAVINGS ESTIMATES*

Payment Plans (per panel)	Upfront Payment	Monthly Payment	Monthly Savings	Net Lifetime Savings	Payback Length (years)
MI Energy Options: Low-to-Moderate Income Plan (250 shares reserved)					
Supported LMI	$0 (MEO)	$2.00/month for 10 years	$3	$660	0
Short Term Payment Plan	$ 250	$ 2.00/month for 10 years	$ 3	$ 410	14
Upfront Payment Plan	$ 450	$ —	$ 3	$ 450	13

* Savings will vary depending on actual system performance.

** Income qualifications apply to this payment plan.

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Using Minewater for Geothermal Energy in the Keweenaw

Richelle Winkler, Department of Social Sciences
Jay Meldrum, Keweenaw Research Center

Green Lecture Series
Michigan Tech University
November 20, 2014

Michigan Tech

Source: Keweenaw National Historic Park

CALUMET MAIN MICHIGAN MAIN STREET

Keweenaw Research Center

- System cost approximately $100K to install for new building
  - 11,000 sq ft heat/cool with 12 heat pumps
  - Recently added 4,000 sq ft & 4 heat pumps
- Save approximately 30% over natural gas.
- Estimated pay back period 3-5 years.

Results

Source: Amanda Kreuze

Energy Costs Comparison - KRC Updated with Actual Prices 2013

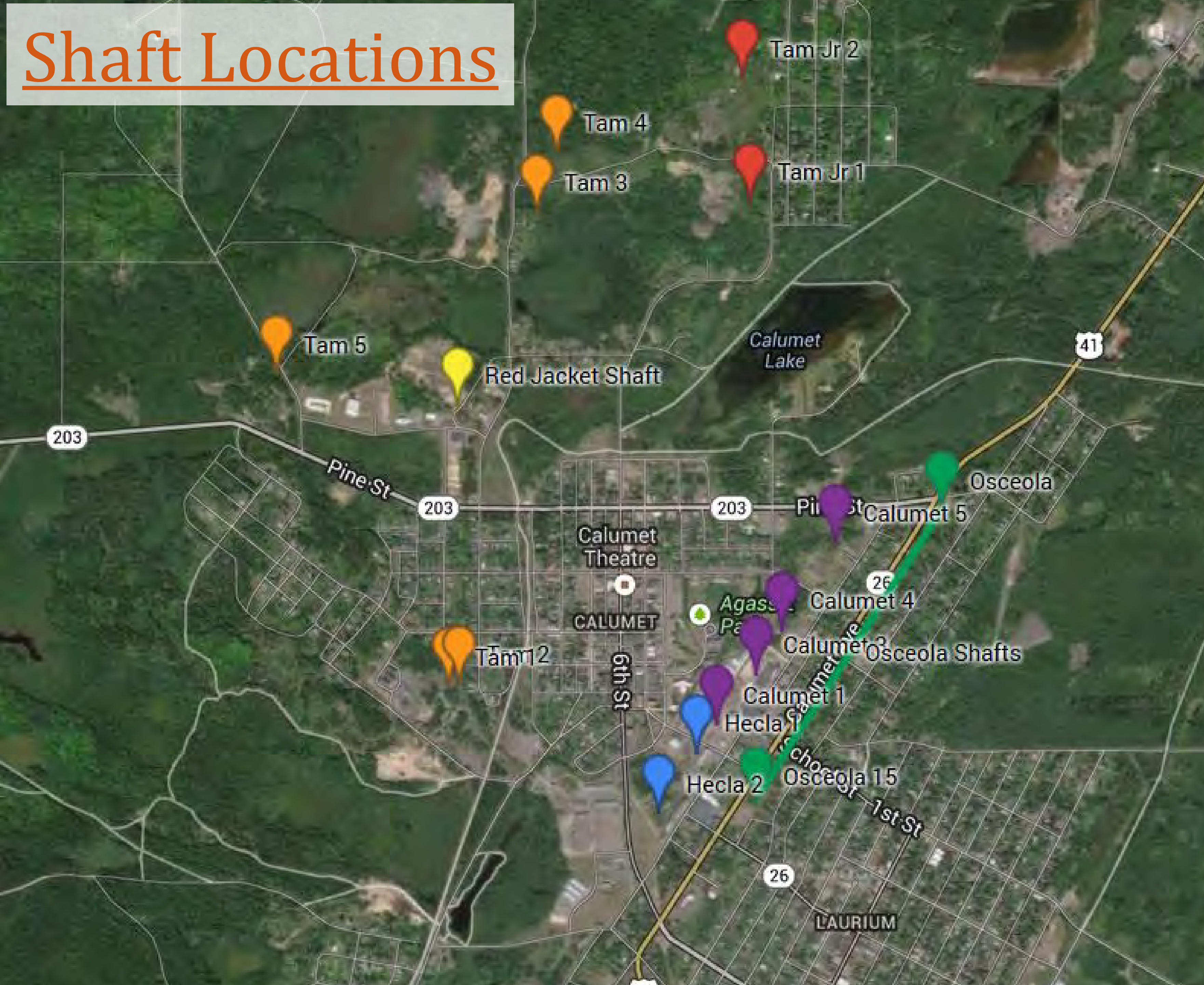
Energy Source	Efficiency	Price	$ per Million BTU
Electrical Resistance (REA)	100%	$0.109/kWh	$31.94
Heating Oil (state average)	85%	$3.54/gal	$30.19
Propane (state average)	85%	$2.25/gal	$25.75
Natural Gas (SEMCO)	87%	$0.65/Therm	$7.53
Geothermal Heat Pump (large)	COP=5.2	$0.109/kWh	$6.10
Geothermal Heat Pump (small)	COP=5.2	$0.109/kWh	$8.85
Geothermal Heat Pump (combined)	COP=4.7	$0.109/kWh	$6.81
Geothermal Well Pump (250 –ft Head)		$0.109/kWh	$1.41
Total Geothermal System			$8.22

Calumet- Technical Infrastructure

- 37 Shafts in and around Village of Calumet
- Temperature ~ 55 ° F
- Billions of gallons of water
- Close proximity to downtown, residences, industrial park
- Heating demand is substantial, cooling a plus

Source: http://www.coppercountryexplorer.com/scrapbook/wp-content/uploads/paulpetosky/petosky-shaft1.jpg

Shaft Locations



Enviromental: Renewable/sustainable energy source, reduce dependence on fossil fuels and carbon dioxide emissions. Turns a negative into a positive.

Cultural: Reinforces community identity and celebrates cultural connections to mining. People feel the community owns the water and the legacy. Much interest. >50 people attended meeting. 29 of 30 on survey supportive. 16 said would adopt in their home.

Human: Some opportunity for training and cultivating interest in renewable energy systems.

Political: Would require political will and coordination between several political entities: Village, Township, NPS, School District, etc. Concerns about who benefits/who pays/who controls. Up front cost and leadership.

Social: Could reinforce and build social relationships and connections between organizations depending on how organized.

Financial: Currently more expensive than natural gas in western UP (high electric/low gas prices). How initial costs would be financed is major issue. Could save money in long term and encourage job creation/new industry/tourism.

Built: Would be a source of new infrastructure, but would need to be maintained and questions about who benefits and who pays.

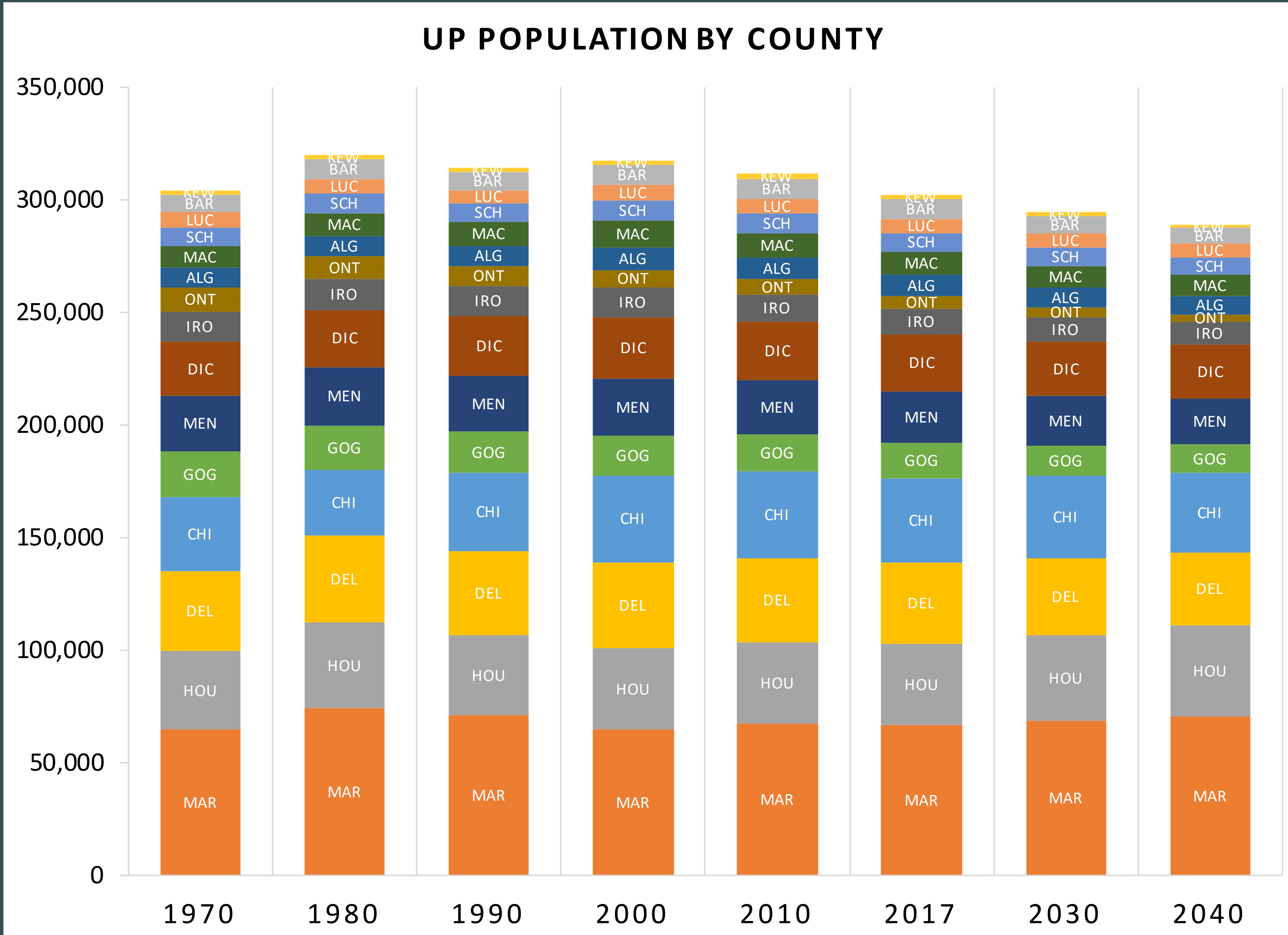
Summary Points

1. Population stable, concentrated, and aging.
   - Some areas of growth (Houghton/Marquette). Moderate decline projected others.
2. Housing type matters: old & inefficient; seasonal
   - Western UP has particularly old housing stock
   - Seasonal is remote/rural – lakes, rivers, forests/hills- hard to service
3. Propane dependence is real. Numbers fairly small, but hard to serve population. Widely distributed across space.
4. Efficiency a big issue with old housing stock, particularly in western UP
5. Energy poverty/justice issues are real-- mix of old stock, electric heat, high electric rates, elderly population, and low incomes
6. Some alternatives are widely popular, but depends on community involvement/control, source, environmental impact, and distribution of cost/benefit.
7. Residential analysis- other energy demands!

References & Data Sources

- IPUMS NHGIS, University of Minnesota, www.nhgis.org
- US Census 1990, 2000, 2010
- American Community Survey, 2013-2017
- Michigan Dept of Technology, Management, and Budget-Population Projections

Questions?


UP POPULATION BY COUNTY
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
KEW
BAR
LUC
SCH
MAC
ALG
ONT
IRO
DIC
MEN
GOG
CHI
DEL
HOU
MAR
1970
1980
1990
2000
2010
2017
2030
2040