Growing the New Michigan –
Natural Resources Economy

BUSINESS LEADERS FOR MICHIGAN

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Developed by McKinsey & Company with support from Business Leaders for Michigan staff

McKinsey&Company

Michigan can leverage its natural resources in agriculture, tourism and gas/wind/minerals/water to drive growth for the state

The asset

- One of the leading states in many agricultural production categories - rank 18th nationally in agricultural exports
- Rank 13th in travel expenditures nationally with strong outdoor product amenities
- Growing convention infrastructure with hotel expansions and new convention facilities
- Leading research hub for manufacturing activities with emerging alternative energy clusters
- Significant natural gas, wind and precious mineral resources that are critical to enabling the growth of alternative energy
- Largest supply of pure freshwater in world

Potential ways to leverage the asset

- Grow agricultural processing and precision agriculture to capture greater share of growing global market demand for food
- Leverage manufacturing strengths to increase growth of agricultural equipment manufacturing to support global demand
- Increase agricultural exports to reflect agricultural production capacity
- Further develop infrastructure to improve Michigan's ability to grow leisure tourism
- Develop strategies to sustainably leverage Michigan's natural resources that can meet increased global demand for alternative energy sources
  - Natural gas
  - Wind power
  - Precious minerals
- Sustainably leverage freshwater to attract key investments

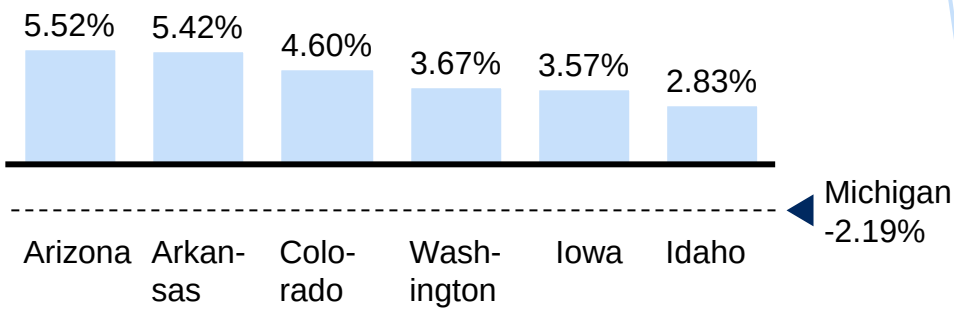
SOURCE: Milken science & technology report, MI department of treasury, McKinsey Global Institute analysis, Engineering Soceity of Detroit, Moody's

2020 Goal: Michigan should be a Top Ten state in natural resource productivity

Top US states outperform Michigan in natural resources

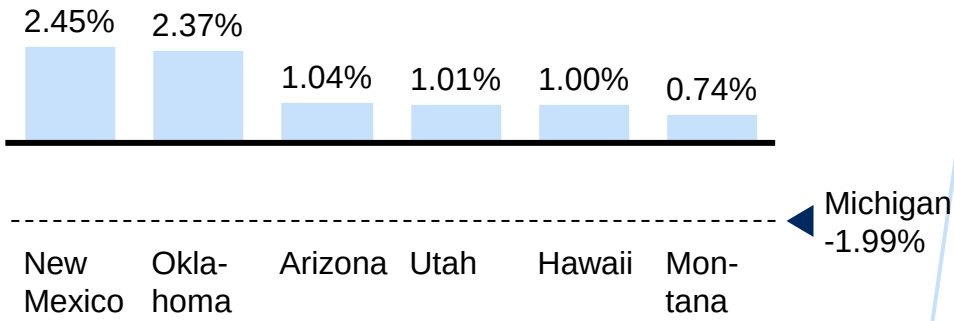
Projected GDP growth in nature resource (US Top 5 - 10)

2010 - 2020



Projected employment growth in nature resource (US Top 5-10)

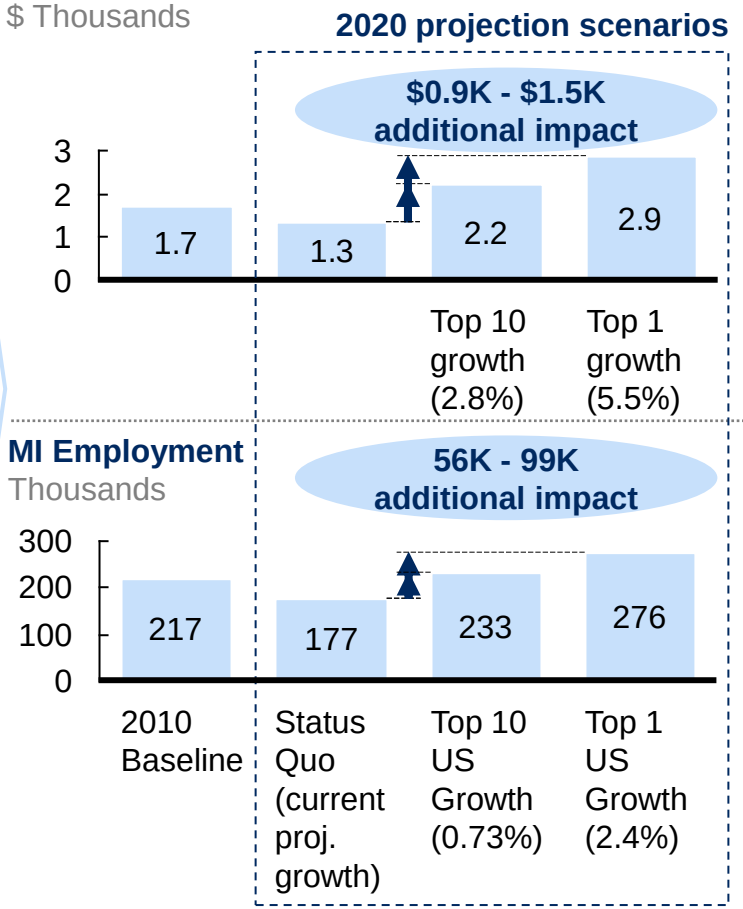
2010 - 2020



Michigan should aspire to reach top US state growth in natural resources

MI GDP per capita

$ Thousands



Source: AEG analysis, MGI analysis

Key considerations for natural resources productivity

A Opportunity & aspiration

- **Agriculture** is an **attractive global market** with **strong growth** in **precision agriculture (19% annually),** combining automation control with sensory and satellite imagery technologies for greater control of seeding, fertilizer application, and yield analytics; Michigan can lead the development of this new field and its application to **agricultural equipment,** for which US sector GDP is expected to increase from $22B to $46B by 2020; Michigan can leverage strengths to become a leader in **agricultural processing**
- **Tourism** in Michigan, largely **leisure** tourism around natural resources (e.g., Great Lakes, skiing), can be a driver for **growth** and **particularly employment**, with typical direct employment rates ~4% of employment and total (including indirect and linked) employment rates of ~10%
- **Growing alternative energy technologies**, including new **shale plays** in **Northern Michigan** may be a driver for growth in the future based on continued **exploration success;** additional opportunities may be found in solar & wind manufacturing, **water innovation**

B Feasibility & case for action

- MI has **strong manufacturing, research** and **high-tech infrastructure**, and **credible local agribusiness** to champion the growth into **agri-tech; GPS** and **satellite** technology is increasingly applied to agriculture with high adoption rates for a variety of technologies (e.g. up to 85% for geo-referenced grid soil sampling), and can be **transferred** from **other Michigan expertise** (e.g., Google, auto OEMs and software providers)
- Michigan's **tourism sector ($15B in 2009)** is already equipped with many **key success factors**, including **ease of access, intrinsic attractiveness**, safety, quality of accommodations, and more
- Gas exploration and mining has a strong history in the state (**Antrim is the 13th largest reserve in the country**), with regulators and businesses familiar with conditions and much infrastructure (e.g., pipelines) largely in place

C Enablers

- **Collaboration** between higher education, private and public sector (e.g., MSU, high-tech)
- Establishing awareness and **targeted brand building** with global markets as well as local markets for both **agricultural leadership** as well as **tourism**
- Incentives to **bring agricultural technology** businesses to Michigan, beginning with **manufacturers** (e.g., tractors) and **including seed, irrigation, satellite** technologies
- **Clear regulations** regarding shale exploration, land leasing, and environmental compliance, and defined strategy for **site development and sustainable land use** for new industry players

A Michigan can leverage its natural resources in agriculture, tourism and gas/wind/minerals/water to drive growth for the state

Opportunities

Innovation in precision agriculture & equipment

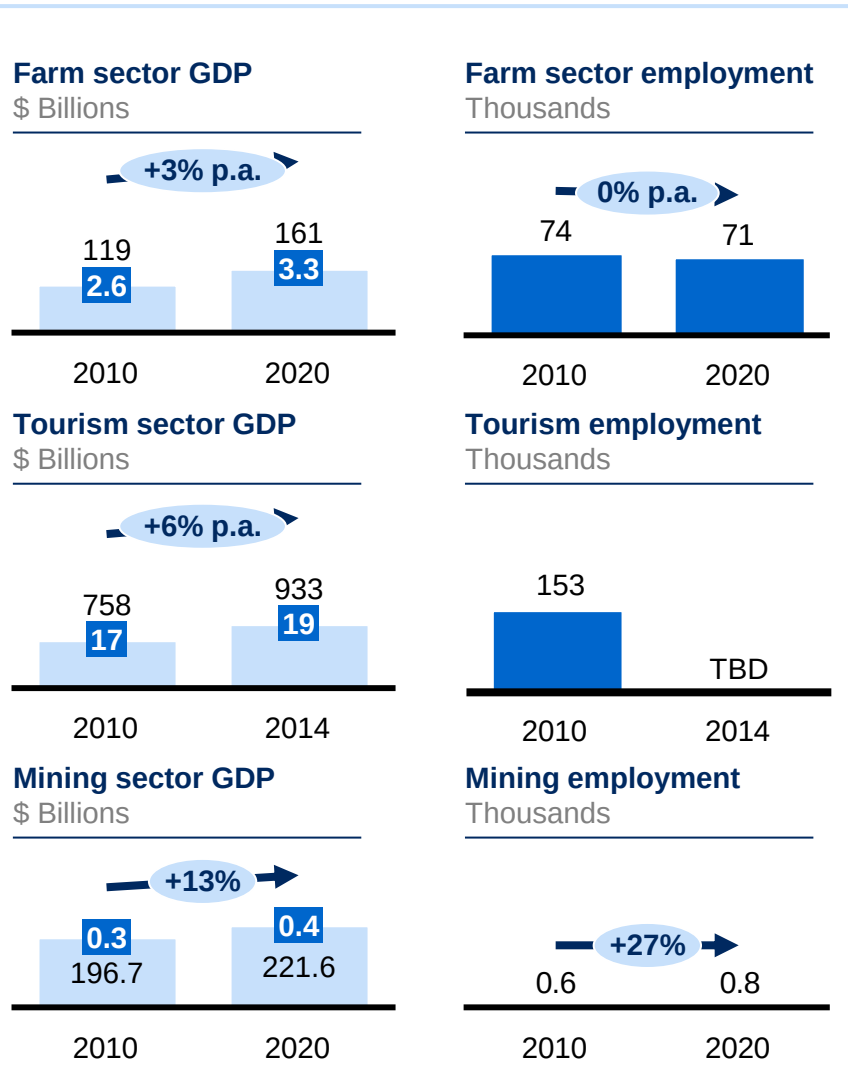
- Global growth in demand for food due to population and wealth expansion will drive growth of the farm sector
- One of the leading states in agricultural diversity and research (e.g., MSU), Michigan can leverage its technology expertise in combination with agricultural background to take an increasing share of value from equipment, services, technology sales

Grow leisure tourism

- $17.2B of tourism in 2010, and less significantly impacted than other US states by the recession, Michigan enjoys significant leisure tourism largely related to natural assets
- Water hub has been attempted by many locales with some success – potential siting factor that could grow in importance

Grow renewable/alternative technologies

- Declining production from Antrim play, but new Collingswood find may prove productive in coming years
- In 2015-2016 timeframe, as other shale plays begin to see declining production, renewed focus may come to Collingswood / Utica or even Antrim



SOURCE: Moody's Analytics, BLS based on NAICS codes 3331, 2111, 111-112; Michigan State Tourism Board, Travel Industry Association of America

A Michigan can leverage its natural resources including agriculture, tourism and gas/wind/minerals/water to drive growth for the state

Natural Resources

Agriculture

Tourism

Alternative energy & technologies

Opportunities	Aspiration
1 Precision agriculture, processing	▪ Lead the application of technology to agriculture through becoming a hub for agricultural technology, research, innovation and application testing, as well as agricultural processing
2 Agricultural equipment	▪ Integrate technology (e.g., GPS, georeferencing, precision guidance, variable application) with agricultural equipment and manufacturing
3 Agricultural exports	▪ Provide exports for developing nations, particularly cereals exports
4 Leisure tourism	▪ Continue growing travel and recreation in MI, in the Great Lakes region, nationally, internationally; grow niche markets (e.g., spas, cruises, golf)
5 Water industries & technologies	▪ Attract water-intensive industries to MI based on availability and security of water resources, and invest in water technologies and becoming a water innovation hub
6 Shale gas	▪ Increase in exploration and production in the Collingwood play

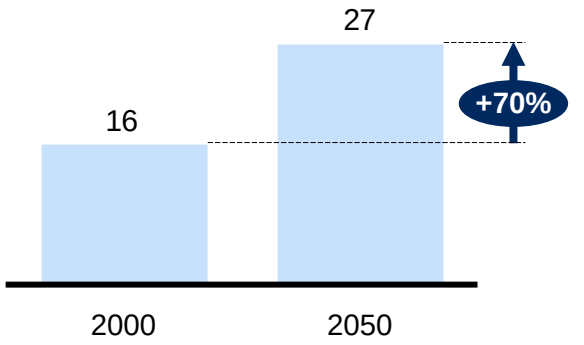
A Agriculture as a growth driver

Megatrends indicate food demand and farm productivity will dramatically increase in the coming years …

- Growing populations, limits in arable land expansion, climate change, water scarcity, and price volatility are driving a new productivity paradigm
- Precision agriculture, borne out of new IT, automation control, sensory and satellite imagery technologies, has the potential to truly transform agriculture
- Growers can improve yields, lower costs and improve the sustainability of agriculture

Global food demand

Kcal consumption, quadrillions



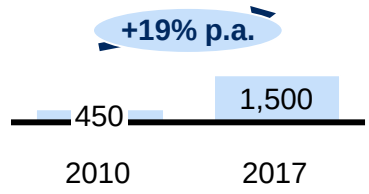
… leading to new market opportunities in precision agriculture, agricultural exports, and agricultural equipment

Agricultural processing and precision agriculture and processing technology & services

High adoption rates for a variety of technologies (e.g. up to 85% for georeferenced grid soil sampling, ~30-50% variable rate application of lime, phosphorus, etc) with growing adoption for more capital intensive technologies (e.g., ~30% adoption of yield monitor in combination with satellite GPS)

Precision ag market

$ Millions (globally)

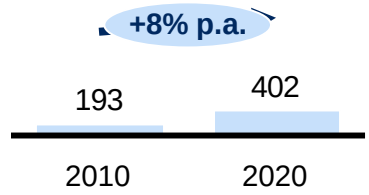


Agricultural equipment manufacturing

As farms expand and technology becomes more important, equipment will become more valuable. Michigan currently employs ~2000 direct employees in this space and can be expected to grow to ~3000 by 2020; US sector GDP will grow from $22B to $46B in this timeframe

Heavy equip. mfctg

$ Millions (Michigan)

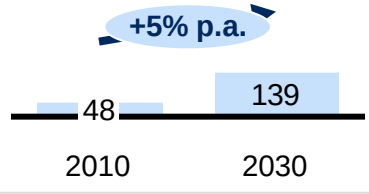


Agricultural exports

US surplus of cereals will continue, with 139 mt m anticipated in 2030; Michigan currently produces 50% more feed-grains than it uses and can grow this share or shift production into high-demand exports

Cereal surplus

Mt m (US)



SOURCE: TopCon, Moody's Analytics, Food and Agriculture Organization (FAO), Ohio State Farm Survey 2007, Farmer Evaluation of Precision Ag Technologies

B Michigan is well positioned to lead the precision agriculture trend to bring technology & smart equipment to farming

Current precision agriculture value chain integrates technology, equipment manufacturers, and services …

Equipment manufacturers of farm machinery (e.g., tractors, chemical applicators) increasingly integrated with guidance technology (e.g., GPS)

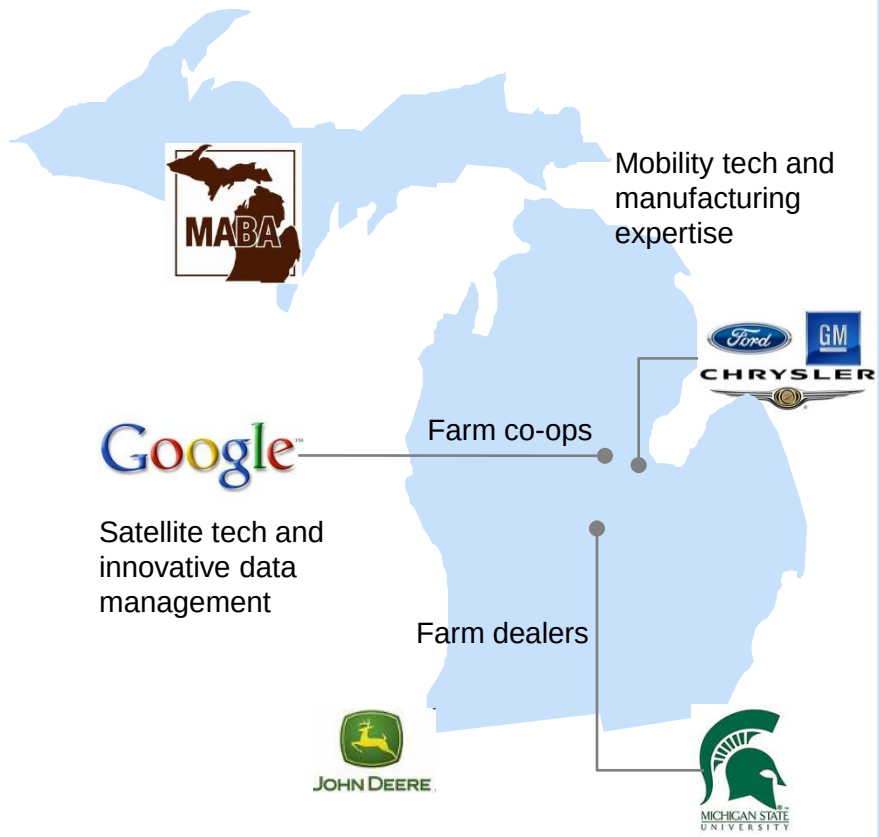
Guidance solutions for intelligent equipment control, increasingly integrated with equipment providers

Data suppliers of raw information that enable precision ag solutions, including remote sensing technology, soil testing, etc.

Software providers of production management solutions, (in-cab or in-office) offer wide array of potential features, including yield mapping and GIS capabilities

Consultants assist producers in making agronomic decisions (e.g., yield management, input application)

… with its expertise in manufacturing, agricultural research, Michigan could become a hub for precision Ag



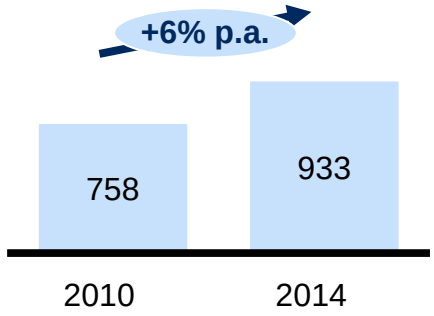
A Tourism has additional growth potential

Megatrends in tourism indicate strong growth, employment trends, and expansion in niche markets …

- Tourism is a **cyclic industry** tied to the overall economy, but has strong multiplier effects and employment benefits (e.g., **152,600 employed** in MI) with **typically ~10% of total employment** directly and indirectly tied to this sector
- Key trends include **increasing demand for niche markets** (e.g., spas, cruise, ecotourism)
- Potential to expand business travel as well as grow niche markets based on intrinsic resources; including

Tourism GDP forecasts

$Billions, US



… and Michigan is well- positioned with a large leisure market

SOURCE: Michigan State Tourism Board, Travel Industry Association of America, team analysis

B Michigan has many factors required to differentiate as a tourist destination, and can expand in niche markets

Very strong
Not strong

Michigan has many of the key success factors for differentiation in tourism markets …

MI current state

External access/airline sector
- Accessibility by mode of transport
- Price and fare scheme

Quality of accommodations
- Right accommodation mix
- Presence of high-quality hotel chains
- Competitive rates, locations

Entertainment
- Amusement/fun parks
- Restaurants, clubs
- Shopping, sports activities

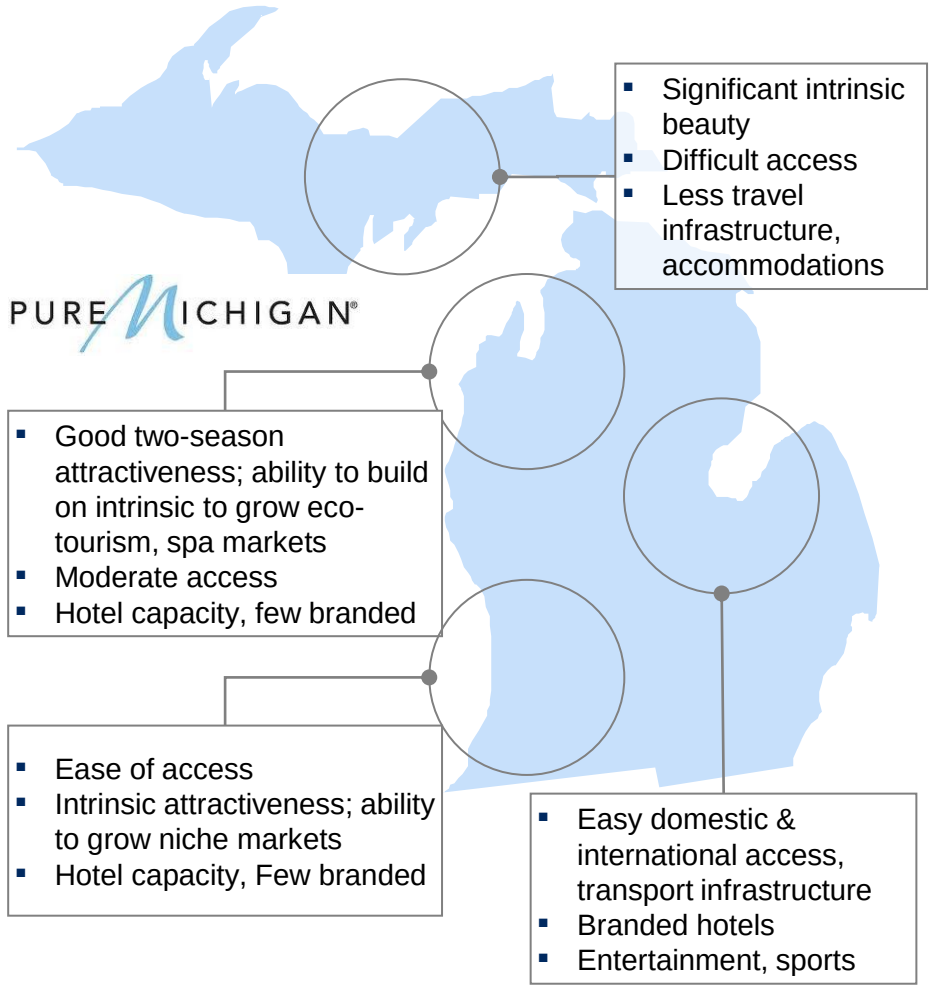
Security
- Safety of infrastructure, events, accommodations

Comprehensive destination marketing
- Marketing spend, strategy
- Brand awareness, reputation, customer segment marketing

Alignment of stakeholders
- Federal/state/local stakeholders

Intrinsic assets
- Local beauty, history, desirability

… and can leverage these assets to grow the domestic and international tourism sector

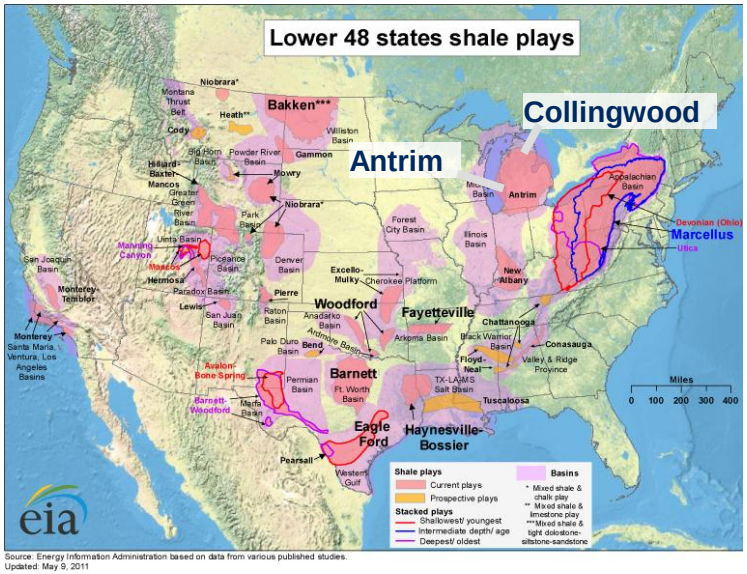


A Natural gas provides growth potential

MI GDP | MI Employment | US Employment

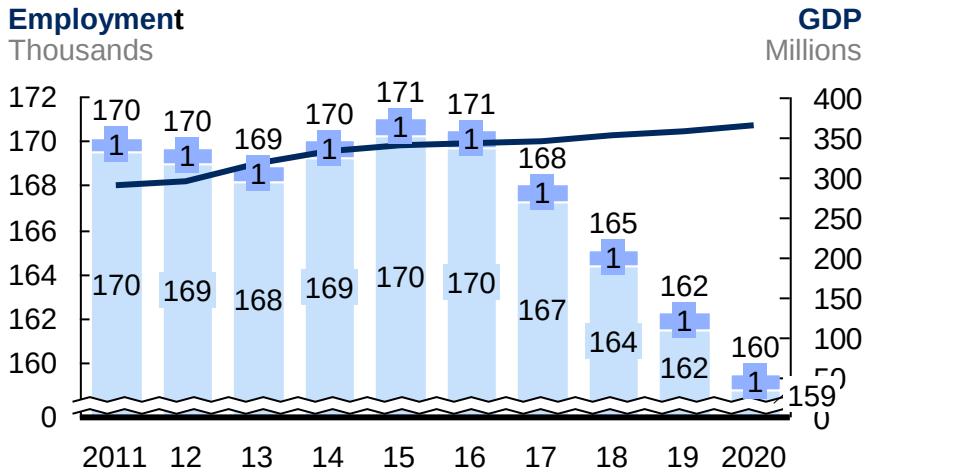
Although production from the Antrim shale play has already peaked …

- Antrim is the 13th largest reserve in the country, with 2% of gas reserves; but total production peaked in the 90s, and horizontal rig production peaked in 2002
- Declines are in part due to shortage of rigs as focus is on the lower cost plays; however dewatering and low volumes make the long term economics challenging
- Additionally, many operators are focusing on shale plays with high liquids contents.



… new finds at Collingwood / Utica, as well as potential declines at Marcellus and other plays may drive growth in the coming years …

Oil & Gas extraction domestic growth projections



- At Collingwood, a successful test well by Encana subsidiary at a depth of ~9,500 ft flowed ~2,500 Mcf/day in 2010, yielding hopes for a new Michigan play overlapping with the Utica
- In 2010, Collingwood auctions totaled $178M for ~118,000 acres of state owned land; this is an average of ~$1,500/acre; comparable new plays (i.e., Eagle Ford with high liquids and oil content) drew ~$7,200/acre
- Although the Collingwood is deeper and more expensive to extract, it appears to have high liquids content which may improve the economics

SOURCE: HPDI database, EIA, DowJones Gas Daily, BLS, Moodys based on NAICS code XXXX

A Water and other renewable technologies have potential as future growth drivers

Alternative energy demand will increase the potential of leveraging Michigan's natural resources for growth, provided sustainable and environmental best practices are adopted

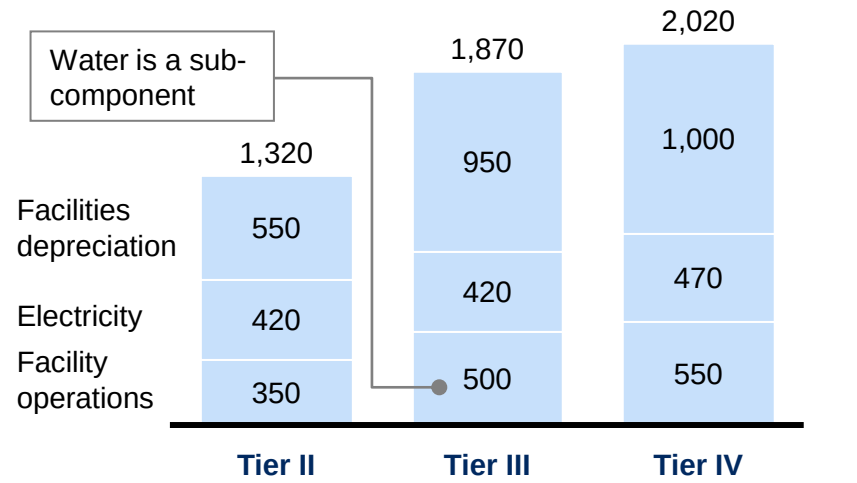
- Michigan has several wind corridors that could prove viable for export energy production
- The state's abundant deposits of precious minerals could prove to be a vital resource in supporting the growth of alternative energy systems
- The state's emerging cluster of advanced battery manufacturers demonstrates the viability of becoming an alternative energy hub
- The use of natural resources as a growth driver will depend on the ability to implement sustainable and environmentally sound practices

While water availability has the potential to become a major site location factor, other costs drive current market decisions – Example: electricity is the single biggest driver of operational costs for data centers

- Improvements in technology have enabled air cooling as a more environmentally friendly and energy efficient cooling mechanism
- Air cooling has lower O&M costs compared to chilled water systems, and if just pure fresh air systems are used, then capital costs are also reduced

Annual operating expense for a mid-tier ($2500) server

$Millions



SOURCE: EPA 2009 NPDES Majors Report – Compilation of Inspection, Violation and Enforcement Data, New York Times, Uptime Institute, APC – "Different types of Air conditioning equipment for IT environment"

C Potential enablers – What needs to happen to successfully pursue the opportunity?

	Potential stakeholders	Requirements	Potential enablers	Facts/case examples
Agri-culture	Technology companies	▪ Attract small technology companies to Michigan ▪ Develop partnerships with large technology companies	▪ Attract more agri-business & ag-sector graduates to the state ▪ Enable MI farmers to test new technologies and services	▪ The Environmental Business Cluster (EBC) is a cleantech incubator in San Jose that provides commercialization support for emerging clean technology companies – Founded in 1994 by the City of San Jose and the San Jose State University Research Foundation – Has assisted over 150 companies, and has received $1.4 million in grants from the California Energy Commission – Services include expert coaching and strategic counsel, focused educational and networking programs, access to investors, strategic partners and industry networks, office space, equipment, conference rooms
	Equipment manufacturers	▪ Attract farm equipment manufacturers	▪ Access to talent ▪ Tax incentives	
	Universities	▪ Attract federal grants ▪ Attract private funding	▪ Public-private partnerships for experimental technology ▪ Attractive opportunities for agsector graduates & access to talent	
Tourism	Hospitality & accommoda-tions	▪ Attractive tourist profile, volumes, and growth trends ▪ Access to talent ▪ Low-cost properties	▪ Access to talent ▪ Tax incentives ▪ Travel infrastructure	▪ Bulgaria invested in tourism – marketing, combined with increased safety and inte-gration to the Euro zone – has enabled 50% employment growth in tourism 2000-2008
	Out-of-state tourists	▪ Ease of access, quality accommodations ▪ Intrinsic attractiveness	▪ Brand / marketing awareness ▪ Travel infrastructure ▪ Attractive rates	
Alter-native energy	E&P companies	▪ Successful, economic production of gas ▪ Natural gas processing ▪ Transmission pipeline access	▪ Hydraulic fracturing regulations	

C Potential enablers – What needs to happen to successfully pursue the opportunity?

Potential Enablers	Potential actions	Case Example
1 Enhanced infrastructure for transit and accommodations	▪ Accommodations, transit, and infrastructure to enable tourism ▪ Innovation around year-round business models	
2 Marketing & branding efforts	▪ Continue effort to brand Michigan as a prime vacation location domestically and in targeted international locations ▪ Increasing volume of visitors could have potential ancillary benefits of incenting brand name accommodation development , real estate development and/or driving air travel cost down	▪ Greater Speyside, Scotland
3 Tax reform	▪ Tax reform to remove penalty for second- home owners	
4 Immigration reform	▪ Streamline the visa process to enable global talent to visit, work; attracting locals to stay ▪ Incentivize small businesses with offices elsewhere in Midwest to move to Michigan	▪ “Four National Taps”, Singapore
5 Competitive business climate for technology & manufacturing innovation	▪ Facilitate innovation with MSU and other university centers in collaboration with private sector (e.g., Google, Monsanto, Ford) ▪ Attract current out-of-state manufacturers to the state with competitive talent pool, wages, tax structures, and regulations	▪ Economic Business Cluster, Silicon Valley

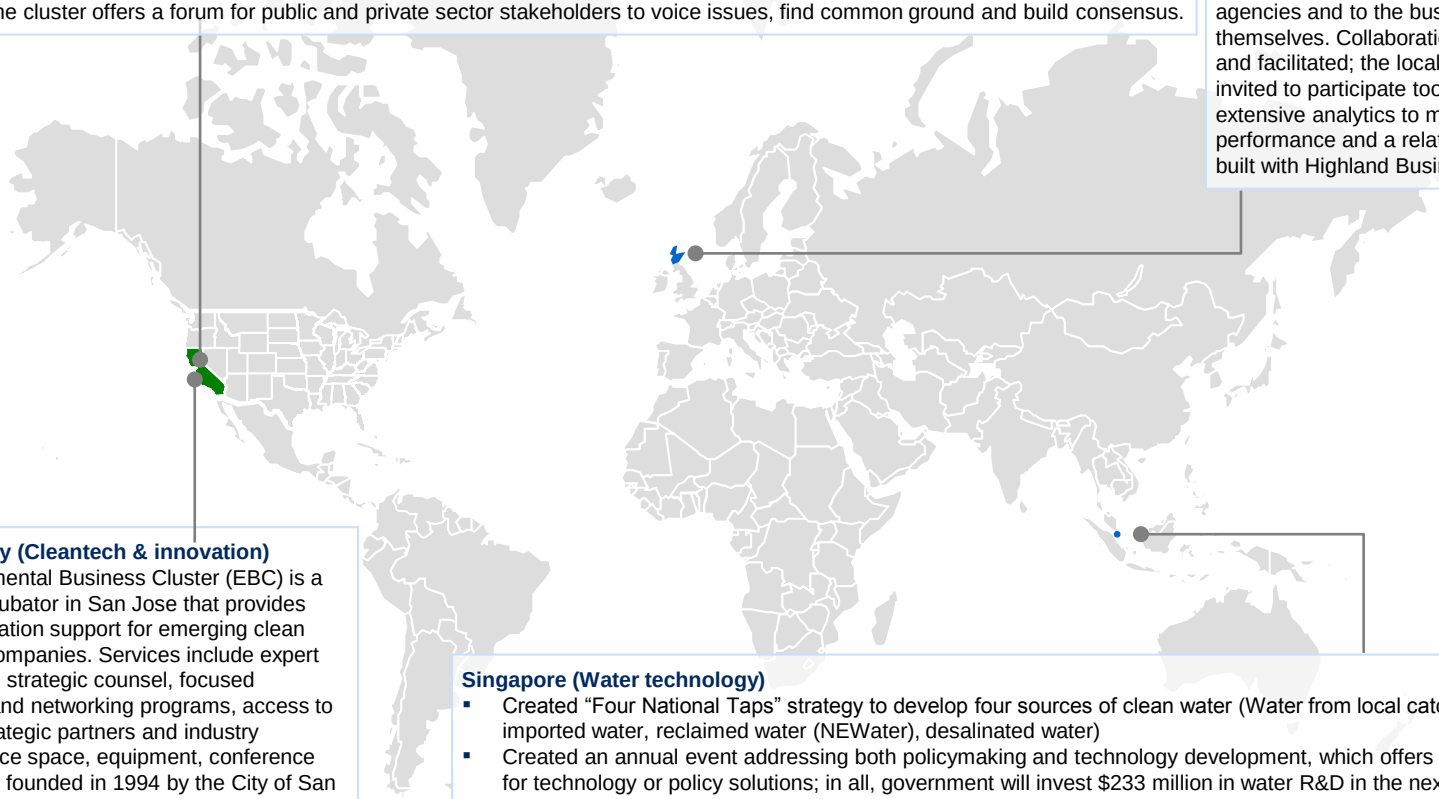
C Case studies

NOT EXHAUSTIVE

Monterey, CA (Agriculture, and others)
Launched in 2003, C2 is a joint effort between the Monterey County Business Council and the County of Monterey, with funding from the Board of Supervisors. C2 is a designed to implement near-term economic development action as well as provide economic development vision. The effort is directed by a Leadership Council, comprised of private and public sector leaders. The agriculture cluster is defined very broadly to include crop production and services, livestock, food processing, agricultural machinery and equipment, as well as agricultural-related transportation and distribution. Cluster initiatives include:

- Optimizing resources through collaborating on pre-competitive areas such as market intelligence, supplier development and joint policy advocacy; strengthening collaborations (e.g. Growers Association) in relations with regulatory and public policy agencies;
- Building specialized county economic infrastructure including education institutions to provide the special skills and training; emerging technology and sources for research and development; and finance tools and financiers sensitive to this market.
- Finally, the cluster offers a forum for public and private sector stakeholders to voice issues, find common ground and build consensus.

Scotland (Tourism)
Greater Speyside is a "bottom up" project to develop the tourism cluster in the Moray and Nairn area of Scotland. All local businesses are eligible to join. The "on the ground" initiative is backed by an innovative portal which gathers information from the cluster, allows participants to maintain their own data then distributes it to visitors, partner web sites, economic development agencies and to the businesses themselves. Collaboration is encouraged and facilitated; the local community is invited to participate too. There are extensive analytics to measure performance and a relationship has been built with Highland Business Research.



Silicon Valley (Cleantech & innovation)
The Environmental Business Cluster (EBC) is a cleantech incubator in San Jose that provides commercialization support for emerging clean technology companies. Services include expert coaching and strategic counsel, focused educational and networking programs, access to investors, strategic partners and industry networks, office space, equipment, conference rooms. It was founded in 1994 by the City of San Jose and the San Jose State University Research Foundation, has assisted over 150 companies, and has received $1.4 million in grants from the California Energy Commission.

Singapore (Water technology)

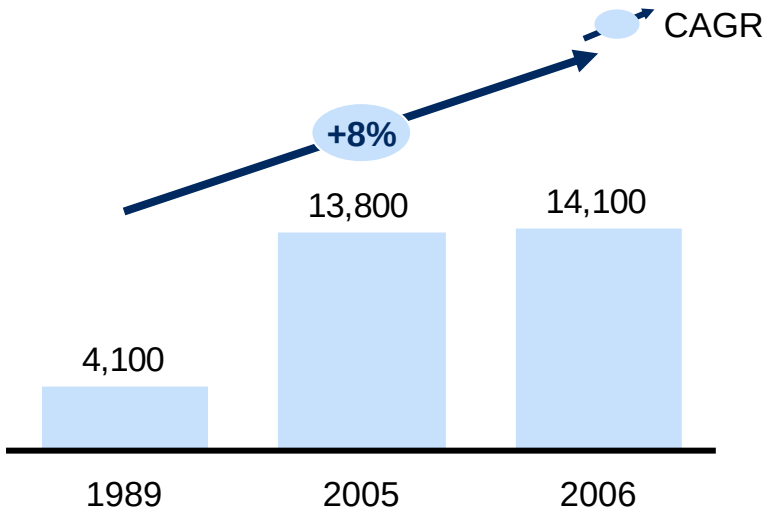
- Created “Four National Taps” strategy to develop four sources of clean water (Water from local catchment areas, imported water, reclaimed water (NEWater), desalinated water)
- Created an annual event addressing both policymaking and technology development, which offers $200K annual prize for technology or policy solutions; in all, government will invest $233 million in water R&D in the next 5 years
- Created Singapore Water Technology Centre, jointly funded by General Electric & the National University of Singapore; to focus on desalination, reclamation and reuse technologies
- Created WaterHub, an R&D facility created for in-house experts, local and international academic and industry players. Partners include Siemens, Nitto Denko, Konzen

Tourism niches appear to be gaining importance – Example: Wellness tourism

The spa sector attracts many customers …

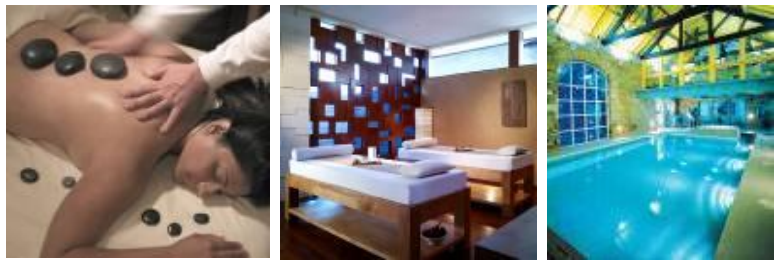
- At the end of 2006, more than one quarter of adults in the United States, or 57 million people, had visited a spa in their lifetime
- The U.S. spa industry generated an estimated $9.4bn in 2006
- Interest in spas is growing, as it appears from data about the number of spas in the U.S.

Number of spas



… with a well-defined profile

- 69% of U.S. spa-goers are female, while 31% are male
- On average, male spa-goers are between 35-54, while female spa customers are younger, between 25-54
- The full body massage is the most requested service (84% of customers), followed by manicure/pedicure (48%), and facial (46%)
- The most visited types of spa are the day spa (77% of customers), followed by resort/hotel spas (64%)
- The U.S. is the top preferred destination for future spa vacations (68% of spa-goers), followed by Mexico/Caribbean (31%), Europe (25%), Canada (15%), and Asia



SOURCE: International SPA association (ISPA); hospitalitymrny; team analysis

The Milwaukee Water Council is a regional public-private partnership working to attract water technology companies

Purpose

- To make the Milwaukee region the world's hub for water research, development and education
- Aiming to create a "Silicon Valley" for water and to challenge Singapore's water development dominance

- Membership:
  - 75 companies, universities & organizations
  - Fees range from $250 (individual) to $5,000 (Corporate Level 1)
- Funding 2009
  - Grants from private foundations and government agencies $84,920
  - Membership dues $114,945
- Expenses 2009
  - Publications $58,236
  - Travel expense $40,462
  - Water Summit conference $36,435
  - Professional fees $15,020
  - UN Global Water Initiative $13,024
  - Miscellaneous $9,168

History

2007:

- "Milwaukee 7" regional economic development group looked for ways to replace shrinking manufacturing jobs; identified local cluster of water technology companies
- CEOs of A.O. Smith and Badger Meter co-sponsored first Water Symposium
- Great Lakes Water Compact was in the news: 8 regional states agreed to stop large-scale diversions and promote conservation

2008:

- University of Wisconsin created School of Freshwater Sciences
- Milwaukee 7 hired water industry specialist: Claus Dunkelberg, former consultant & engineer; now Business Development Director for the MWC

2009:

- Industry leaders officially created new agency, to be funded by grants and memberships
- Rich Meeusen, CEO of Badger Meter, frequently cited as "founder"

SOURCE: Milwaukee Journal Sentinel; Milwaukee Water Council; Foundation Center Directory

The Milwaukee Water Council raises awareness of the region's capabilities through events, publications and sponsorships

	Description	MWC involvement
Annual Water Summit	▪ 5th annual event in September 2011; topic was "Achieving Harmony with Water" ▪ Previous themes: Blue Footprint, Our Water Innovation Economy; The True Costs and Opportunities of Water	▪ MWC originated event in 2007; remains sponsor and convener ▪ Attendance has grown from 80 in 2007 to 250+ in 2010
Blue Footprint™ Index	▪ Indicator of impact of human activity on water resources ▪ Corresponds with the Water Impact Index developed by Veolia Water: assesses impact of human activity on water resources	▪ Featured topic of Water Summit IV, held in July 2010
Collaborative Research Center	▪ Cooperative university/industry research effort; announced May 2010 ▪ Links 2 universities and 6 local water businesses ▪ Expected cost $2.75 million	▪ MWC provided leadership; selection of projects to be funded ▪ Garnered funding from National Science Foundation

SOURCE: Milwaukee Water Council; Alliance for Water Stewardship; United Nations; The Greater Milwaukee Committee

For water technologies, consolidating efforts under a central authority enabled Israel to become one of the world's leaders

The government of Israel, recognizing the international need for innovative water solutions and Israel's proven expertise, launched in 2006 the National Program for Promoting Water Technologies -NEWTech. This program aims to build on Israel's experience, while advancing its water technology capability at an international level through strategic investments and allocation of substantial resources

- **Centralized authority with highly coordinated inter-ministerial governance –** NEWTech is led by the Ministry of Industry, Trade, and Labour, which oversees a multiministerial steering committee. The committee is comprised of members from the Prime Minister's Office and the Ministries of Foreign Affairs, Finance, Science, National Infrastructure, and Environmental Protection, as well as the Israel Water Authority, water and sewage program
- **Substantial resources –** the government has invested heavily in the program and allocated substantial resources towards strengthening the foundation of Israel's water tech cluster. NEWTech's annual budget is approximately US$300 million
- **Facilitates and connects –** NEWTech has established 24 private and government-funded water technology incubators that assist entrepreneurs in commercializing new technologies. These incubators have helped attract around US$772 million in private investment to date. NEWTech also connects companies with potential partners overseas
- **Promotes the industry in the global market –** NEWTech has also invested in promoting Israel's water technologies globally, supporting coverage in the global media, participating in water related events and creating marketing tools for the benefit of the entire sector. It developed WATEC, an international exhibition and conference showcasing technologies, products and services to support a sustainable economy

SOURCE: NEWTech website; The water opportunity for Ontario, March 2010

In its effort to ensure a sufficient water supply, Singapore's 3-pronged approach made it a world water technology hub

Creating policy

- Created "Four National Taps" strategy to identify 4 main sources of clean water:
  - Water from local catchment areas
  - Imported water
  - Reclaimed water (NEWater)
  - Desalinated water
- Sponsors Singapore International Water Week: annual event addressing both policymaking and technology development
  - Offers $200K annual prize for technology or policy solutions

Encouraging research

- Singapore Water Technology Centre: jointly funded by General Electric & the National University of Singapore; focuses desalination, reclamation and reuse technologies
- WaterHub: R&D facility created for in-house experts, local and international academic and industry players. Partners include Siemens, Nitto Denko, Konzen
- Government will invest $233 million in water R&D in the next 5 years

Implementing technology

- NEWater initiative uses state-of-the-art microfiltration, reverse osmosis technology and ultraviolet disinfection to convert wastewater to potable; supplies 15% of the country's water
- SingSpring desalination plant uses reverse osmosis and remineralization; produces 30 million gallons/day

SOURCE: Public Utilities Board of Singapore, General Electric, Government of Singapore, Siemens