DATA CENTERS

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I have hopefully created a 'digestible' primer on data centers (DCs), intended for elected officials, municipal administrators, land use/conservation groups, or others who want to be more informed about the interest and need in the construction and operation of DCs. I am in no way an expert on data centers, nor am I a physicist or any kind of engineer. I am an average citizen in a position of leadership in a township with the responsibility to protect the people and environment in our community and facilitate appropriate business development. I hope to describe the nature and operation of DCs, the reason why the need for DCs is increasing, and potential impacts on both people and the environment in communities, especially communities in rural Michigan.

WHAT IS A DATA CENTER?

A data center (DC) is basically a giant warehouse full of computers, that runs 24-7. They may also be referred to as a HPC (high performance computing). These differ from office computers, as they are powerful servers stacked tightly in rows, processing and storing massive amounts of information. Every time you stream Netflix, use Google, store photos in the Cloud, send emails, use social media, or ask ChatGPT a question, the data is processed and stored in a data center somewhere. They never shut down, and as a result, they generate substantial heat which requires considerable amounts of water for cooling, and they have a constant demand for electricity.

WHAT PROPERTIES ARE SOUGHT FOR DATA CENTERS?

Data center developers seek properties based upon several factors:

- Adequate acreage based upon the footprint of the building (hyperscale DCs house over 5000 servers and have a footprint ranging from 10,000 square feet to several million square feet)
- DCs require sites near electric transmission lines sufficient to provide the substantial amount of electricity necessary to run the operation
- DCs require low-latency fiber optic cable to connect to the internet
- If the DC will be cooled with water (most will) the location must be sited near an adequate water source (river/lake, well/aquafer, public water supply)
- Developers prefer locations that offer tax exemptions or other financial incentives

DO THEY REALLY USE MASSIVE AMOUNTS OF ELECTRICITY?

According to the U.S Department of Energy in 2023, DCs consumed 4.4 % of all electricity generated in the U.S.! I suspect that number has increased significantly by the end of 2025.

The energy and water draw is directly related to the size of the facility. A small to medium facility would be considered 50,000 to 100,000 square feet. Small to medium facilities would use from 5-20 megawatts of power (a megawatt is equal to 1,000,000 watts, or 1,000 kilowatts).

The large DC's are 500,000 square feet and over, some requiring over 900 acres. They use from 100-1,000 megawatts of power, which is equivalent to a medium to large city- for perspective, the average home in the U.S. uses about 30 kilowatt hours per day (1,000 watts), while a large DC can use as much power as 80,000 to 100,000 homes.

Currently, Michigan utilities DTE and Consumers Energy are making deals to produce almost 14 gigawatts to meet the increasing demand for the operation of DCs. I had to look this up, but a gigawatt is 1,000,000,000 (one billion) watts. This is the equivalent to adding six or seven major cities to the grid in just 2-3 years.

This becomes even more interesting when you consider that Michigan **legally mandated** clean energy commitments are 100 % clean energy by 2040; this seems to indicate a colossal collision is looming- the irresistible force of demand for DCs and the subsequent plan to drastically increase current-technology (fossil fuel) energy production vs the immovable force of the government and law. According to the Energy and AI, IEA (International Energy Agency) report in 2025, the current demand for energy for DCs will double by 2040.

WILL MY ELECTRIC BILL GO UP AS THESE DATA CENTERS ARE BUILT?

In Michigan, PA 181 of 2024 was passed, offering DCs sales and use tax exemptions worth millions. In exchange, the new law prohibits DCs from receiving a rate that causes residential customers to subsidize infrastructure and costs required to service the facility. This sounds like a good law, but as with anything, what protections will exist regarding future developments in the industry? For instance, the billions of dollars that are being invested in new DC developments could become 'stranded assets' if DCs don't materialize as predicted, or if they downsize or are obsolete due to new technology, or if the public outcry that we are observing prohibits or greatly restricts the development of new and larger DCs. The Michigan MPSC administrates and applies this law, and the reputation of the MPSC in Michigan seems dubious to many. The MPSC also sets consumer utility rates, and establishes rate-making policy.

As mentioned, DCs require 24/7 reliable power. According to the National Electrical Manufacturers Association, U.S. electricity demand is estimated to increase by 50% by 2050, based in great part on the development of DCs. Michigan law includes a 'safety valve' that would keep fossil fuel electricity operational if renewable energy cannot fulfill this increased demand, in spite of the 2040 clean energy mandate.

So, will rates increase? The state may so no, the developers may say no, and the energy producers (Consumers, DTE) may say no…but obviously there are no guarantees, and this type of electrical use, and the expansion necessary to produce the massive energy demands, makes me skeptical.

IS IT TRUE THAT THEY NEED A GREAT VOLUME OF WATER?

Computers, especially high-capacity servers stacked tightly indoors, generate tremendous heat when they are operational, which is 24-7 in a DC. The water demand for cooling ranges from hundreds of thousands of gallons per day to millions of gallons per day. A mid-sized DC (100,000 square feet and up) needs approximately 300,000 gallons of water per day, which is the equivalent to the water used by 1,000 homes. A hyperscale or mega-DC needs from 1-5 million gallons per day, which is equivalent to the needs of a small city.

The water used for cooling evaporates in the cooling process, and obviously is not returned to the watershed in the area. It appears that technology to create 'closed loop' systems (systems that recover water vapor and reduce or eliminate the demand for removing water from the ground), dry-air cooling (which conserves water but demands more energy) and hybrid systems are being developed, and may actually be available, but I have no idea if they are cost prohibitive, or being considered by the operators of DCs.

It seems reasonable that in rural communities, the removal of the water necessary for cooling a DC could result in lower water tables, depleted wells, competition for municipal water supplies, and reduced stream flows that would affect local ecosystems and watersheds.

DOES THE STATE OR FEDERAL GOVERNMENT REGULATE WATER USE FOR DATA CENTERS?

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) regulates water withdrawal, with a goal of protecting the state's environment from significant impacts caused by large-volume water consumers. A DC, using traditional water evaporative cooling, must obtain prior approval before operating pumps capable of removing a minimum of 70 gallons per minute. Further permitting is required in sensitive areas or when large quantity water withdrawal owners seek new or increased withdrawals exceeding 2,000,000 gallons per day. Also, Michigan's Safe Drinking Water Act requires that these facilities maintain adequate capacity and reliability for existing customers.

My experience with the state environmental protection laws and agencies has been dubious; it seems that the pendulum swing in Michigan for the past several years has leaned towards the politicalization of these processes, becoming more and more "friendly" to developers and operators.

For the most part, the federal government does not regulate water use, with a few exceptions (construction/removal near federally designated historical waters/rivers, etc.)

DO DATA CENTERS PRODUCE WASTE WATER?

Typically, yes. Evaporative cooling systems can generate waste water with an altered PH, and other high concentrations of conditioning chemicals and biocides, which are used to minimize the growth bacteria. These changes and chemicals can strain local water treatment operations, and obviously, they should not be returned to the local environment, where they could contaminate aquafers, wetlands, or local water sources. Such discharges would require discharge permits, but confidence in the state and local permit processes is not high.

DO DATA CENTERS PRODUCE EMISSION INTO THE AIR?

Certain DCs may not directly, under normal operations, release emissions into the air, but the electricity required from the grid obviously produces emissions, and the greater the demand, the greater the amount of emissions.

DCs do require generators to guarantee operation during power outages. These generators typically are fueled by natural gas or diesel. Emissions will obviously be determined by the number and size of the generators, but any generator produces noxious emissions. Again, EGLE would regulate these emissions, but they are not eliminated.

DO DATA CENTERS PRODUCE NOISE?

Yes, they produce substantial noise, due to the high number of servers, the use of cooling fans, high-capacity HVAC systems, back-up generators, etc. Hundreds of high-capacity fans are needed to cool densely packed servers which can create up to 90 decibels of noise (similar to a lawnmower or jackhammer).

Depending on the size of the DC, the noise escaping the DC can be from 50-90 decibels, or higher. Typical "quiet neighborhood" standards limit noise to a maximum of 40-50 decibels. Based upon locations and individual township, city, or county standards, an average seems to be 50-65 decibels during the day, and 45-55 at night.

I am uncertain if technology is being developed to use quieter equipment, or the ability to sound-proof the building.

WILL DATA CENTERS PRIOVIDE EMPLOYMENT OPPORTUNITIES? WILL THEY PROVIDE TAX REVENUE?

Promises have been and will be made about the employment opportunities that DCs will provide. But according to one report (not substantiated by me), the Switch DC near Grand Rapids originally pledged 1,000 jobs at the operation. By 2022, that DC provided just 26 jobs, yet continues to receive $1,000,000 annually in tax breaks.

Excluding temporary jobs during the construction of a DC, the number of permanent, direct jobs is relatively small compared to the substantial capital investment.

Based upon the size of the DC, and the value of the equipment within, DC's can significantly increase the property tax base. DCs are classified as a commercial use, and the equipment within the building would be taxed as commercial personal property.

COULD DATA CENTERS BE A TARGET FOR TERRORIST ATTACKS?

It's hard to say. As a former law enforcement official, it seems logical that attacking data centers would certainly disrupt what many of us consider our way of life, which depends on the availability of functioning data centers. If terrorists attacked strategic data centers, could we all get by without so much of the technology that we are accustomed, or addicted to?

ARE THERE ENVIRONMENTALLY FRIENDLY DATA CENTERS?

Generally speaking, the most environmentally friendly DCs do the following:

- Use water and energy efficient equipment practices that are confined inside of the DC
- Use electricity sources that require low water use and emissions that do not threaten or damage the environment
- Construct a facility that minimizes exterior sound
- Target thoughtful site locations that are tolerable to the local community, and that avoid sensitive lands/habitat
- Commit to a decommissioning plan that not only removes the facility at the end of facility life, but restores the property to the original state, or incompliance with a mitigation plan designed by the local government

CAN ANYTHING BE DONE TO PROTECT OUR COMMUNITIES, ESPECIALLY OUR RURAL COMMUNITIES?

Contrary to what many people think, a local government, for example, a township, cannot arbitrarily deny a company from purchasing property and building a business. This is a question for the local unit of government to be answered by legal counsel. If a local government cannot prohibit DCs, zoning efforts may need to consider restricting and controlling DCs, rather than trying to simply 'outlaw' them. For example:

- Require that DC developers specifically state the electrical and cooling demands (water), and anticipated noise levels of the proposed project
- Require an environmental impact study to be completed, considered, and approved by the board
- Require the developer to provide information regarding fire and explosion risks, or other potential safety concerns, to determine if existing emergency response capabilities can adequately respond to and mitigate an emergency
- Require that DC developers produce their own, clean energy (as established by the Michigan mandate for 2040)
- Require that DC developers use a "closed loop" water recovery system, or other system that does not threaten the local water supply whether from existing ground water or municipal water systems
- Require "noise deadening" technology to be installed in the operation that will comply with established or acceptable noise standards for the community; and that the noise emitted will not be unreasonable, unnatural, or unusual
- Require that DC developers post significant bonds to be recovered by local residents and/or governments in the event of unforeseen negative environmental impacts, including but not limited to ground water or municipal water supply issues, and to include site remediation and restoration

- Require that the DC developer pay for an assessment of nearby residential water delivery systems, including but not limited to the volume of water supplied to the residence prior to construction, and a contaminant baseline test prior to construction

This list of restrictions should not be considered exhaustive. Based upon each location of a proposed DC site, and upon local ordinances, and perhaps most importantly, the interest of your community members, restrictions can be added or deleted.

I am hopeful that this summary is helpful as you consider the future of data centers in your own communities. I encourage you to act now- do not wait until property is purchased, and plans are submitted for consideration. Good luck!