Minnesota North College

EV Impact

Isabella Hass, Caleb Bearley, Rodney Kuschel, Dylan Malsed

Why We're Here

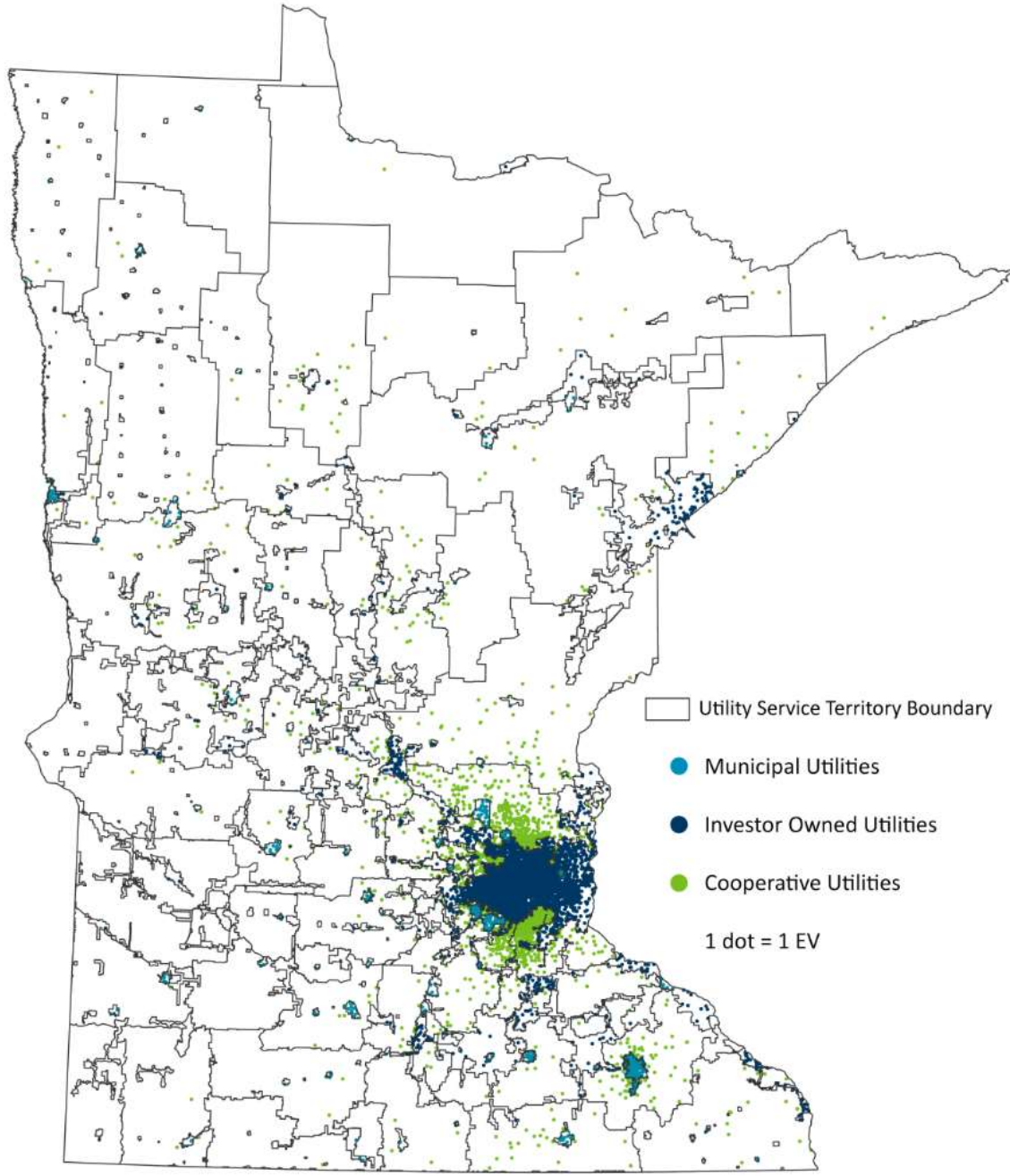
Is the average Grand Rapids neighborhood ready for mass EV adoption?

(GRPU, 2024)

Context

- As of January 2023 – 34k EVs registered in MN
- Minn. Stat 216B.1614 requires each public utility to have a rate specifically designed for EV charging that offers time-of-day or off-peak rates to customers who own EVs

(MN Public Utilities Commission, 2024)



Parameters

GRPU provided data

LVL II Chargers

60 mile commute (based on personal experience and the us census bureau)

Worst case scenario

(GRPU, 2024)

Findings - Chargers

Brand	Voltage	Max Amperage	Max Power Draw (kVA)	Miles per Hour of Charge
Charge Point	240	50	12	37
Tesla	240	48	11.5	35
Emporia	240	48	11.5	N/A
Lectron	240	48	11.52	48
Grizzle-E Classic	240	40	10	30
Grizzle-E Ultimate	240	80	19.2	60
MaxiCharger	240	50	12	38

Findings - Chargers

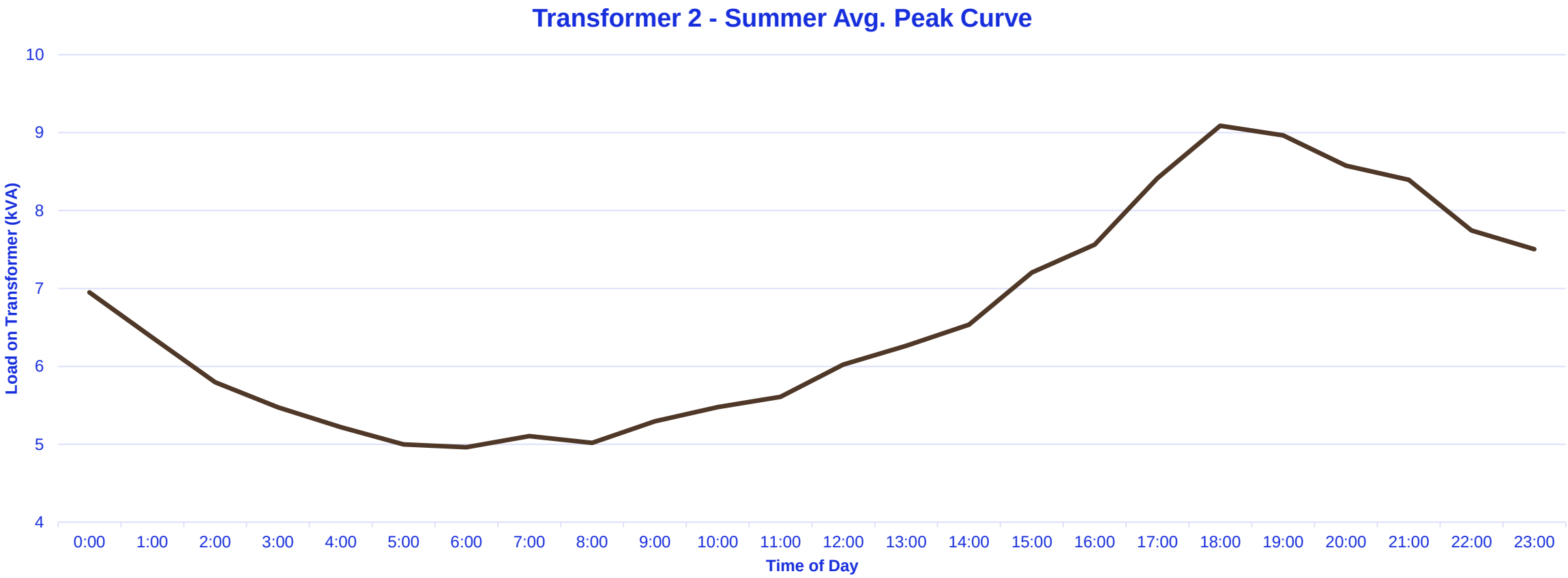
Wall Connector Technical Details			Charge Speed Max Miles of Range per Hour of Charge*			
Circuit breaker (amps)	Maximum output (amps)	Power at 240 volts (kilowatt)	Model S (mph)	Model 3† (mph)	Model X (mph)	Model Y† (mph)
60	48	11.5 kW	41	44	35	44
50	40	9.6 kW	34	37	29	37
40	32	7.7 kW	27	30	23	30
30	24	5.7 kW	21	22	17	22
20	16	3.8 kW	14	15	12	15
15	12	2.8 kW	10	11	9	11

*All charge speeds are approximate.

†Maximum charge rate for Model 3 Rear-Wheel Drive and Model Y Rear-Wheel Drive is 32A (7.7kW) - up to 30 miles of range per hour.

(Tesla, 2024)

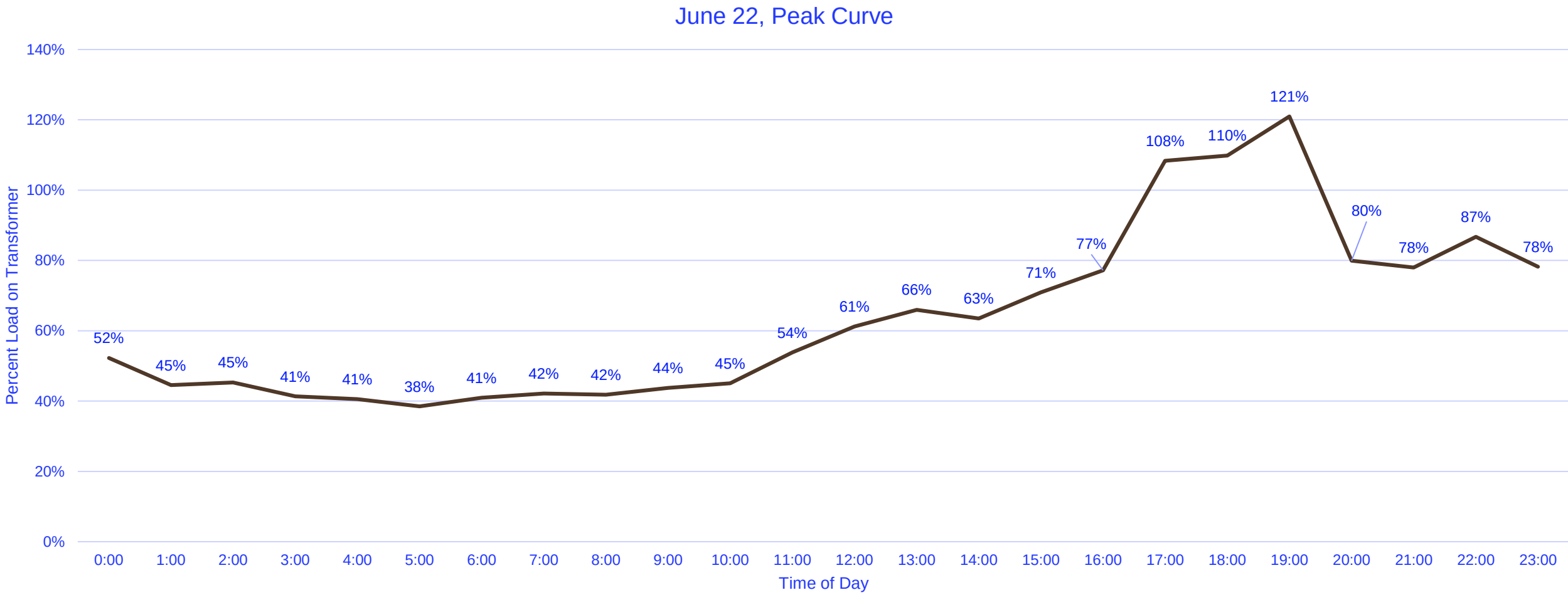
Findings No EVs



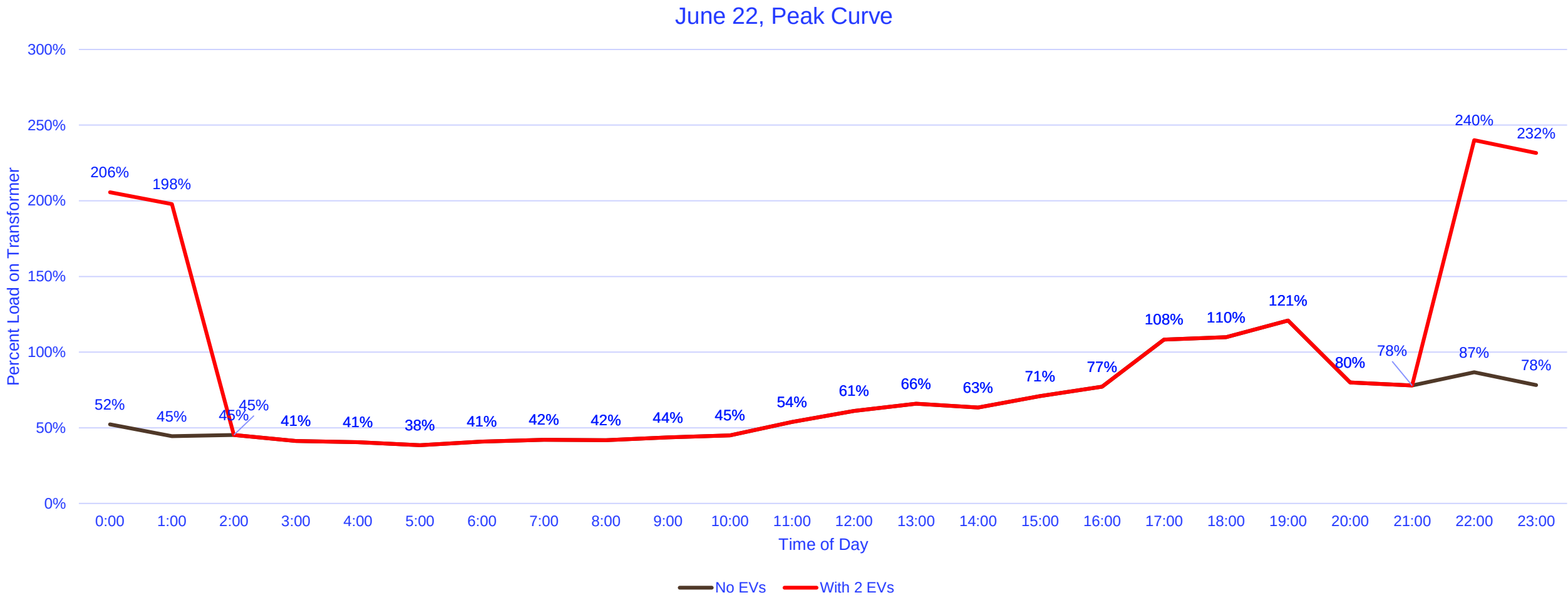
Findings – Extreme No EVs

Date	Transformer	Peak Value	Percent Load
6/1/2023	1	11.5	76.67%
6/2/2023	1	10.5	70.00%
6/4/2023	1	11.09	73.93%
6/5/2023	1	12.27	81.80%
8/2/2023	1	11.72	78.13%
6/4/2023	2	17.48	116.53%
6/22/2023	2	18.14	120.93%
7/2/2023	2	17.32	115.47%
7/20/2023	2	19	126.67%
7/25/2023	2	17.74	118.27%
9/4/2023	2	16.17	107.80%
11/23/2023	2	17.48	116.53%
6/20/2023	3	15.6	104.00%
6/21/2023	3	19.5	130.00%
7/26/2023	3	19.68	131.20%
7/28/2023	3	16.05	107.00%

Findings – Extremes No EVs



Findings – Extremes With 2 EVs



Findings – Known Houses with EVs

Minnesota North College

Date	Power Used
2/28/2024	0.048 kWH
2/29/2024	2.584 kWH
3/1/2024	0.044 kWH
3/2/2024	62.267 kWH
3/3/2024	0.044 kWH
3/4/2024	0.047 kWH
3/5/2024	19.357 kWH
3/6/2024	29.786 kWH
3/7/2024	0.047 kWH
3/8/2024	5.902 kWH
3/9/2024	21.398 kWH
3/10/2024	44.631 kWH
3/11/2024	2.956 kWH
3/12/2024	0.042 kWH
3/13/2024	11.232 kWH

Date	Power Used
11/21/2023	13.817 kWH
11/22/2023	59.859 kWH
11/23/2023	55.600 kWH
11/24/2023	0.105 kWH
11/25/2023	0.054 kWH
11/26/2023	14.113 kWH
11/27/2023	0.055 kWH
11/28/2023	25.987 kWH
11/29/2023	20.641 kWH
11/30/2023	43.192 kWH
12/1/2023	0.056 kWH
12/2/2023	6.231 kWH
12/3/2023	12.955 kWH
12/4/2023	14.483 kWH
12/5/2023	0.056 kWH

Proposals

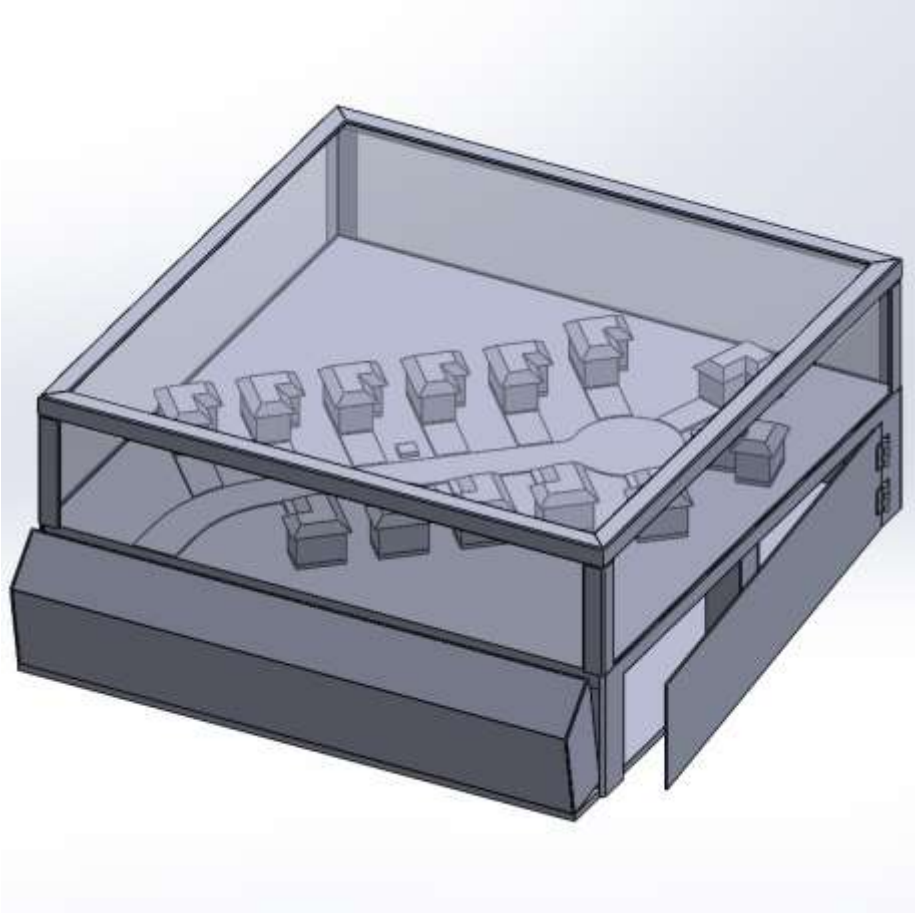
Short Term:

- Upgrade all 15KVA transformer
- Move EV off-peak to 2 AM

Long Term:

- Do a cost analysis between upgrading all components and dedicated EV charging transformer
- Increase of Supercharging Stations

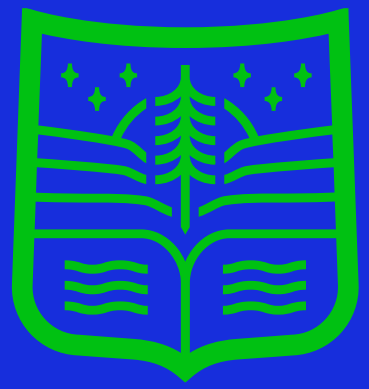
Physical Model – CAD Model



Physical Model - Lighting

Citations

- *Grand Rapids Public Utilities. (2024, February 26). Transformer Data. Grand Rapids, MN.*
- *Grand Rapids Public Utilities. (2024, March 28). Ev Power Consumption Data. Grand Rapids, MN.*
- *U.S. Census Bureau quickfacts: Grand Rapids City, Minnesota. (n.d.).* https://www.census.gov/quickfacts/grandrapidscityminnesota
- *Wall connector: Tesla support*. Tesla. (n.d.). https://www.tesla.com/support/charging/wall-connector#vehicle-charging-speeds
- *Electric vehicles. Public Utilities Commission. (2024, January 12).* https://mn.gov/puc/activities/economic-analysis/electric-vehicles/
- *The best home EV Chargers by Grizzl-E in 2024 for the USA. (n.d.-a).* https://grizzl-e.com/products/grizzl-e-ultimate/
- *The best home EV chargers by Grizzl-E in 2024 for the USA. (n.d.-b).* https://grizzl-e.com/products-specs/grizzl-e-classic/
- *Emporia EV Charger: NACS (tesla) or CCS (J1772): Energy star: UL listed: 48 amp: 24' cable*. Emporia Energy. (n.d.). https://shop.emporiaenergy.com/products/emporia-ev-charger
- *Lectron Home Level 2 J1772 V-box EV charging station: 240V: 48 amp: NEMA 14-50 / hardwired*. Lectron EV. (n.d.). https://ev-lectron.com/products/lectron-240v-48a-electric-vehicle-ev-charging-station
- *Maxicharger AC Elite Home 50A - EV charger with in-body holster*. Autel Energy. (n.d.). https://autelenergy.us/products/maxicharger-ac-hardwired-wallbox
- *Meet Home Flex, the level 2 home EV Charger*. ChargePoint. (n.d.). https://www.chargepoint.com/drivers/home?utm_source=google&utm_medium=cpc&utm_campaign=CP-Brand-Search-B2C&utm_term=chargepoint+home+flex&utm_matchtype=p&ad_content=680890508615&gad_source=1&gclid=Cj0KCQjwltKxBhDMARIsAG8KnqXlgdAM8YAqnn03xqBYEa6Vt4E4SluNJa6ygMZpKoOFHdvQvi8EUooaAmVnEALw_wcB
- *Performance measure dashboard*. Electric Vehicles - Performance Measure Dashboard - MnDOT. (n.d.). https://www.dot.state.mn.us/measures/electric-vehicles.htm l



Minnesota North College

A Member of Minnesota State