To: Professor Forin

From: Aidan Sharpe

Subject: home Evaluation Memo

Date: 2/9/2022

This memo will evaluate the energy efficiency of 2,060 ft^2 ranch-style three-bedroom home. The home is located in Hightstown New Jersey, a small suburb in Mercer County. It was built in 1964 on a 0.7-acre lot and has had several major renovation projects in the last few years.

The front of the house faces West, with several large trees in the front and back yards. While trees certainly keep fend off the sun during the summer, the shade combined with the clamshell roof make solar panels much less viable. Fortunately, windows are plentiful, meaning sunlight keeps the main floor and the basement sufficiently illuminated on clear days.

On the outside, most of the property is lawn with gardens in several locations. The lawn and gardens both require daily watering in the Spring and frequent watering in the Summer. To maintain its heath, the lawn must also be maintained seasonally and fertilized annually. Despite these setbacks, the large bushes and oak trees provide a comfortable place for rabbits and squirrels to live.

Furthermore, being in a suburb, nothing is too far away. Downtown is situated about half-a-mile North, putting many restaurants and shops within ideal walking distance. The lot is an adjacent property to the Peddie School, a local private high school, and the public high school is only about a ten-minute walk. The neighborhood is no more than 1 mile from Route 130, Route 33, and the New Jersey turnpike, making cars an ideal form of transportation. Unfortunately, the nearest train station is a 15-minute drive away, putting it well out of a comfortable walking distance.

Since cars are ideal for the area, three cars are regularly driven. The oldest car is a 2010 Toyota Highlander Hybrid with a combined MPG of 26[1]. Despite being a hybrid, its age combined with the fact that it is an SUV makes it less fuel efficient than the average new car. Second oldest car is a 2013 Hyundai Sonata, which has a combined fuel economy of 27 MPG [2]. The newest car is a 2016 Buick Enclave. It is used most in an average week and has an average efficiency of 17 MPG [3]. It is a large SUV designed mainly with comfort in mind, hence its suboptimal fuel economy. Environmental impact could be improved if one or more of the vehicles were traded in for an electric vehicle, and since the home has a 2-car garage, at-home charging would be a viable option.

The home is insulated with 8in fiberglass insulation on the main floor and in the attic. The windows are double layered, and all exterior doors have both a windowless main and windowed storm door. Both baseboard heat and natural gas heat the home, and cooling is handled by central air. Hot water is provided by a tankless gas water heater. Additionally, apart from the chandelier and the fluorescent tube lighting in the garage, all interior lighting is either LED or CFL bulbs. The kitchen refrigerator is a Samsung RFG298AARS which has an energy star rating. It achieves higher efficiency by placing the refrigerator above the freezer and by making the freezer a pull-out chest design to keep cold air inside as much as possible. The basement refrigerator/freezer and freezer are both energy star rated. The washer and dryer are LG and are both have an energy star rating.

During the summer, the house is regularly unoccupied, making energy consumption significantly lower at about 1360 kWh per month. Energy consumption peaks in January at 2052 kWh for the month, which averages to about 73 kWh per day. For reference, the average American home uses about 893 kWh per month, meaning that this home is quite energy hungry by comparison.[4]

To increase the energy efficiency of this home, several things can be done. First off, baseboard and gas heating are not nearly as efficient as heat pumps, which simply move thermal energy rather than creating it. Second, the basement is not well insulated despite being a finished living space with a bedroom. Both refrigerator and large upright freezer in the basement are both quite old and probably approaching the end of their lifecycles, making them inferior to newer models. Most major energy cost-cutting measures would likely not adequately offset renovation costs, and therefore, higher energy usage is the unfortunate yet better financial option.

References

[1] U.S. Department of Energy. (2022, February 9). *2010 Toyota Highlander Hybrid 4WD* [Online]. Available: https://fueleconomy.gov/feg/Find.do?action=sbs&id=29757

[2] U.S. Department of Energy. (2022, February 9). *2013 Hyundai Sonata* [Online] Available: https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=32341

[3] U.S. Department of Energy. (2022, February 9). *2016 Buick Enclave AWD* [Online] Available: https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=36353

[4] U.S. Energy Information Administration. (2022, February 9). *How much electricity does an American home use?* [Online] Available: https://www.eia.gov/tools/faqs/faq.php?id=97&t=3