

# Using System Modelling to Forecast Housing Demand in Egypt and Assess Sustainability



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## Introduction

- ▶ Egypt is undergoing a housing crisis with a rapidly increasing population and lack of available housing[1].
- ▶ The housing sector has a critical impact on the environment.

20% Greenhouse gas emissions (GHG) is from residential energy [2]      1800 kWh Energy consumed/month in average Egyptian household [3]

As the amount of housing increase, the sectors' impact on the environment increases

- ▶ By projecting Egypt's housing market outcomes under different scenarios we can:
  - gain insight into the dynamics of the housing market.
  - predict future housing demand.
  - forecast the sustainability implications caused by more housing.
- ▶ This creates evidence for strategies and policies to:
  - promote sustainable housing practices.
  - reduce environmental impact.
  - enhance social equity.

## Methods

- ▶ **Simulation:** models a real-system through equations that replicate relationships between variables [4].
  - **System dynamics** is a software-based simulation that changes over time [5] and captures effects of varying factors on one another through cause and effect relationships.
  - Represented in the form of a **stock and flow diagram**.

Elements of stock and flow diagrams:



Entity that accumulates or depletes over time  
- Represents housing and sustainability factors  
- Contains the equation modelling changes in the factor over time

Connector that relates variables to each other  
- Allows factors to affect one another

- ▶ Models can be modified for different scenarios and results, allowing for comparison.
- ▶ Used to analyze complex industrial, economic, social and environmental systems.
- Data and equations:**
  - ▶ Found correlation between data sets for market and social factors to connect them in the model.
  - ▶ A regression with the data for related factors gave an equation and relative error.

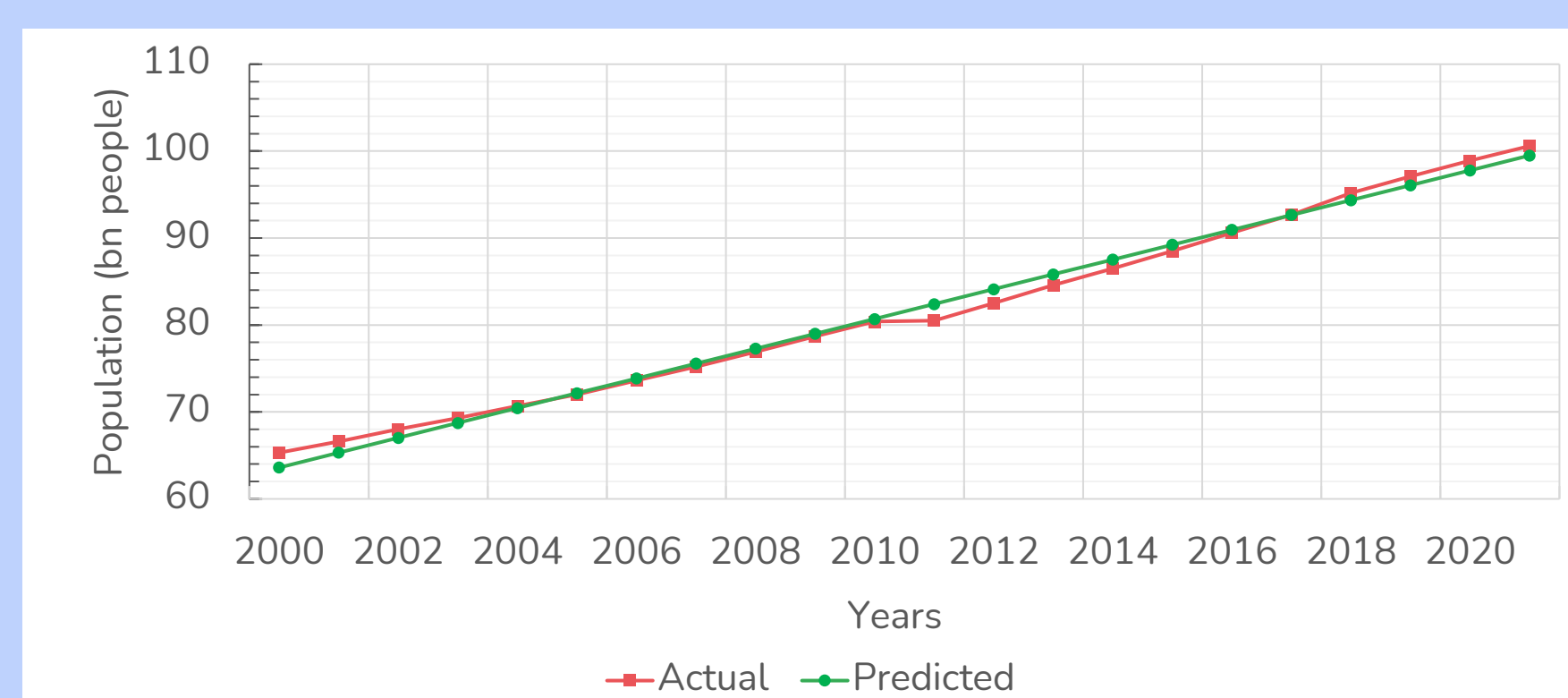


Figure 1. The predicted values for population relative to the actual population values

## Results

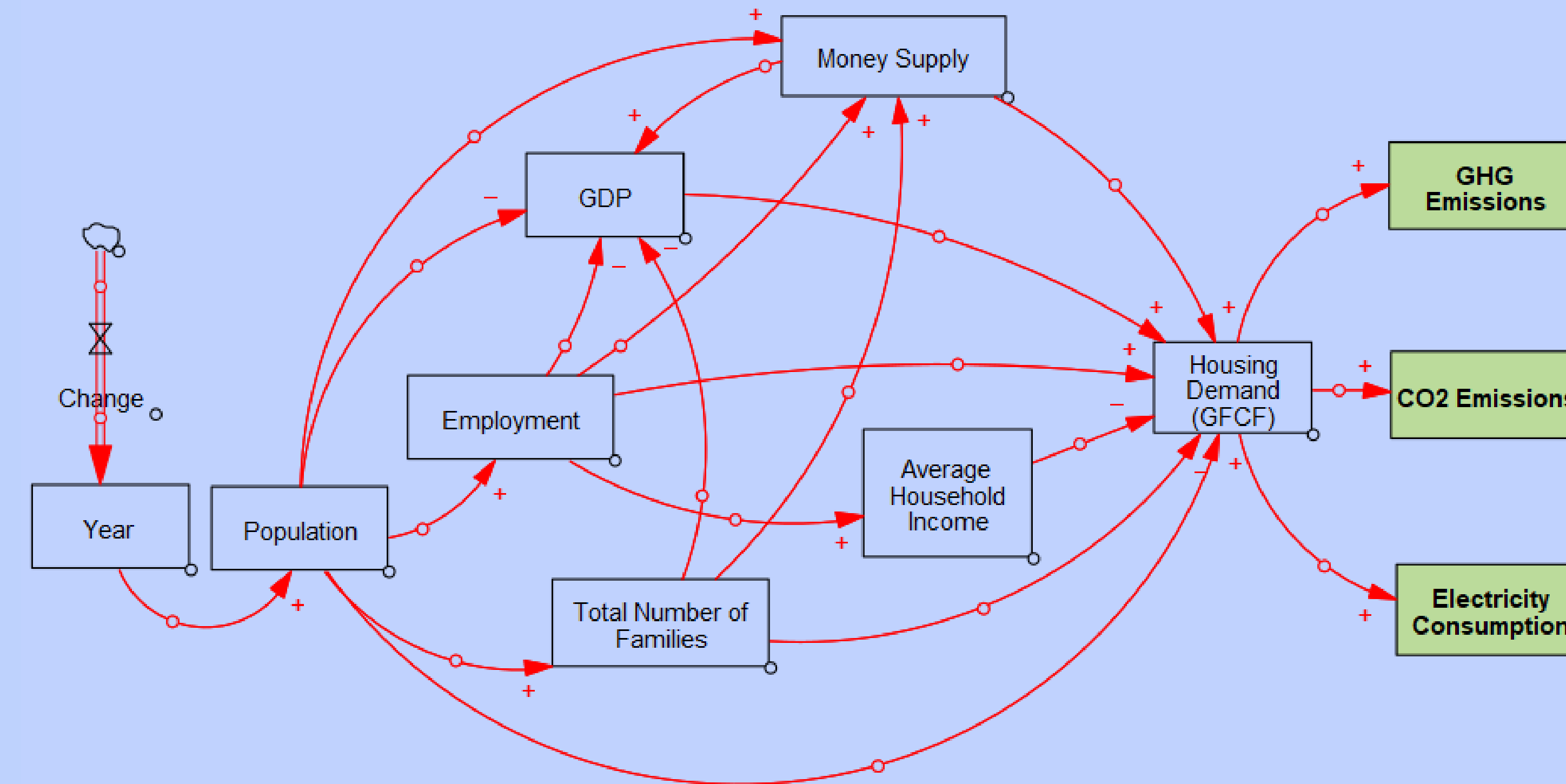


Figure 2. Housing Market and Sustainability Indicators Simulation Model through Vensim PLE

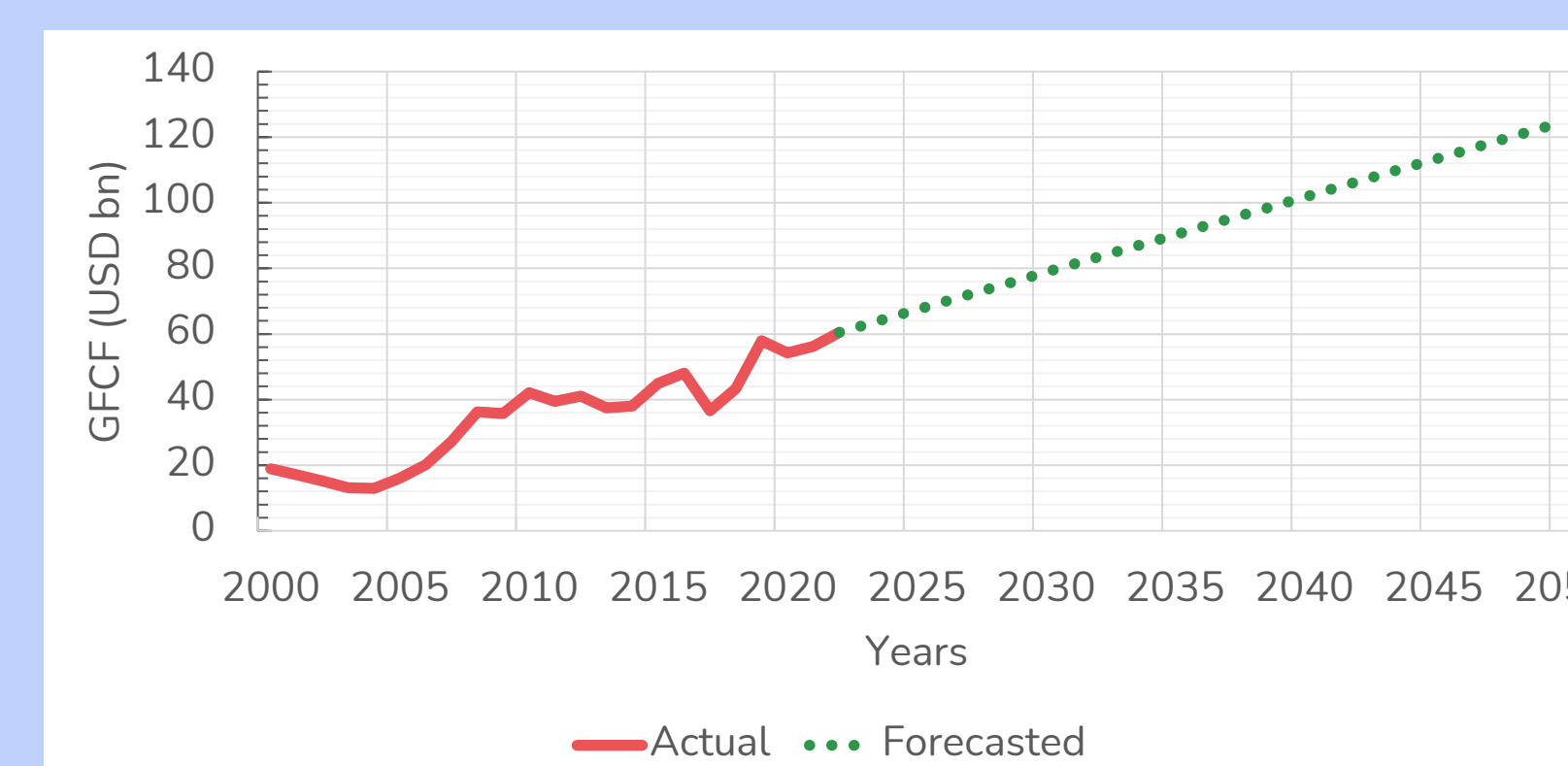


Figure 3 demonstrates the expected effect of housing factors on Gross Fixed Capital Income (GFCF), also known as housing demand.  
▶ Housing demand in Egypt will increase in future years.

45.1% increase in 28 years

Figure 3. Future housing demand (GFCF) forecasted by the model based on actual values

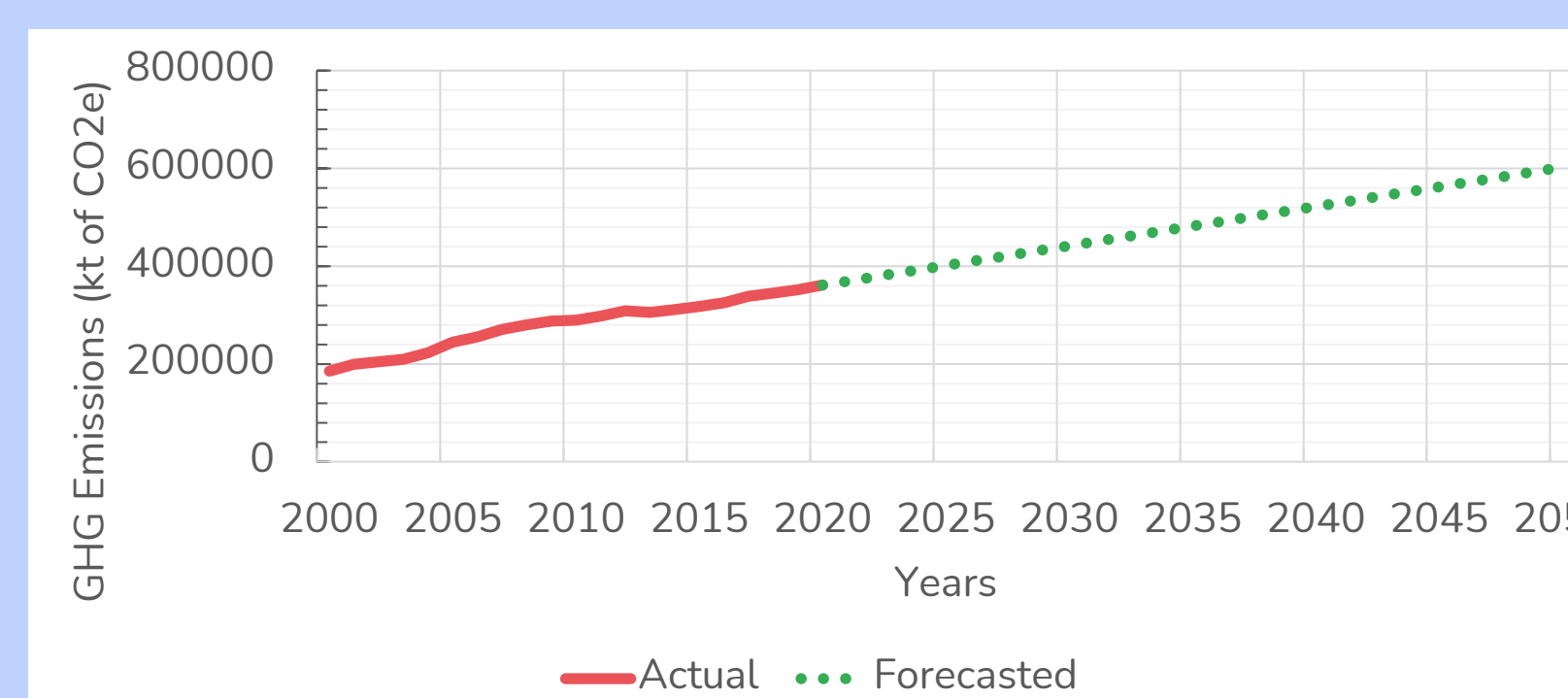


Figure 4 shows the predicted impact of an increase in the amount of housing on GHG emissions.  
▶ GHG emissions will continue increase significantly every year.

60.0% increase in 30 years

Figure 4. Forecasted GHG emissions resulting from impacts on housing demand

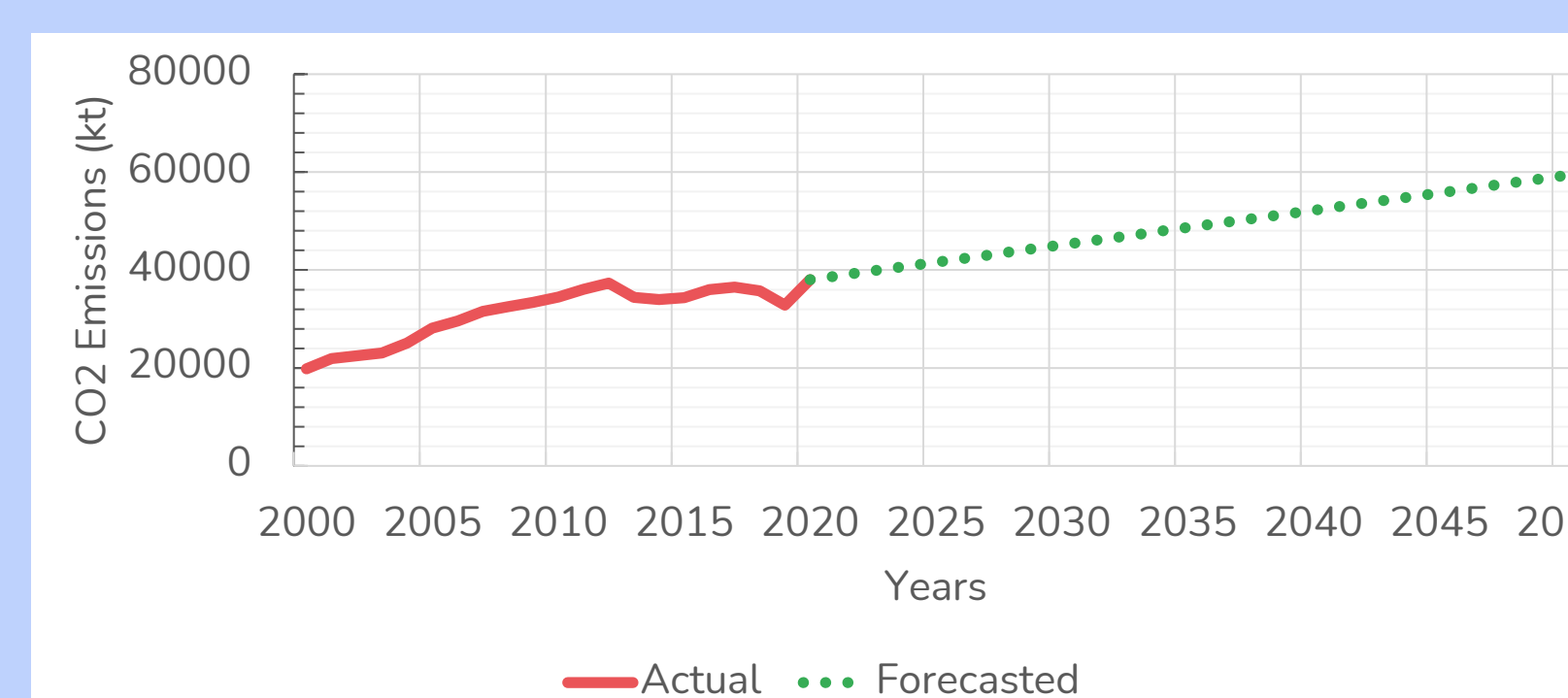


Figure 5 reveals the resulting CO<sub>2</sub> emissions from an increase in housing amount.  
▶ The amount of CO<sub>2</sub> emissions from housing will rise.

64.2% increase in 30 years

Figure 5. Forecasted carbon dioxide (CO<sub>2</sub>) emissions resulting from impacts on housing demand

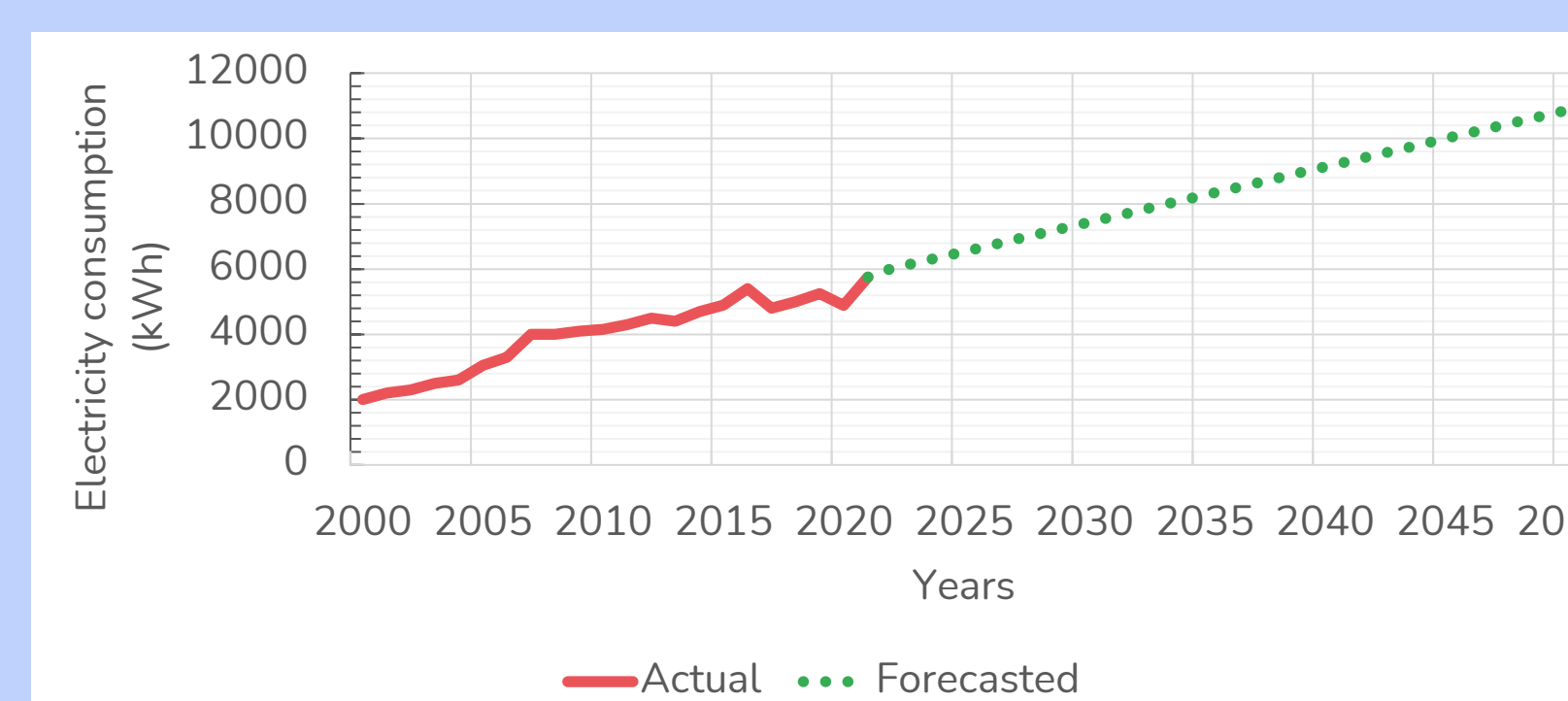


Figure 6 displays the forecasted electricity consumption that will result from rising amounts of housing.  
▶ There will be increased household electricity consumption.

53.0% increase in 32 years

Figure 6. Forecasted electricity consumption based on impacts on housing demand

## Conclusion

- ▶ As various housing factors impact the housing market, the demand for housing increases dramatically .
  - Affected sustainability indicators grow with the amount of housing.

The environment is harshly impacted

- CO<sub>2</sub> and GHG emissions contribute to global warming[6].
- Electricity consumption impacts climate change, air pollution, waste disposal, etc.
- ▶ Widely available and affordable housing is necessary in Egypt because of the growing population.
  - A balance between creating enough housing and improving sustainability is necessary.

### Further studies:

Sensitivity analysis to evaluate the impact of various policies on sustainability indicators.

- Subsidy programs
- Energy efficiency
- Regulatory framework

Employing a points system to evaluate sustainability in the housing market.

- Advise policy makers
- Balance sustainability with affordability.
- Prioritize social and environmental welfare

## References

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