Energy Infrastructure Dynamics:

This presentation explores the interaction between **green energy** and **fossil energy** infrastructure in response to growing energy demand. We'll explore how demand is split, infrastructure obsolescence, and efficiency dynamics.

Conceptualization

- **Problem Statement:** How can we balance the growing energy demand with sustainable infrastructure development, while considering the lifecycle and efficiency of both **green** and **fossil energy** infrastructures?
- **Goal:** Analyse how energy demand is allocated between these sources and the effect on infrastructure

Model Overview:

- **KEY COMPONENTS:**
- **Energy Demand.**
- **Green Energy Infrastructure (GEI)**
- **Fossil Energy Infrastructure (FEI)**
- **Efficiency Consideration**

Reference Modes in the Model

- **1. Growth in Green Energy Infrastructure (GEI)**
- **Expected Mode:** Exponential or S-shaped growth.
- **Explanation:** GEI will grow as demand shifts to renewables. Initial growth is slow, then accelerates with investments, eventually plateauing due to capacity limits.
- **2. Decline in Fossil Energy Infrastructure (FEI)**
- **Expected Mode:** Gradual decline.
- **Explanation:** FEI will steadily decrease as demand moves to green energy, driven by obsolescence and market shifts, but its long lifetime causes a slow decline.
- **3. Total Energy Demand Growth**
- **Expected Mode:** Steady growth.
- **Explanation:** Total energy demand increases consistently, driving the need for both GEI and FEI installations.

Model Parameters and Assumptions

Total Demand Growth Rate:

- **Value**: 3% (0.03 per time period)
- Drives the increase in energy demand.

Share of Demand Going to GEI vs. FEI:

- **GEI**: 20%, **FEI**: 80%
- Determines how new demand is split between green and

GEI Efficiency:

- **Value**: 80% (0.8)
- Portion of green infrastructure that is utilized effectively.

FEI Efficiency:

- **Value**: 90% (0.9)
- Portion of fossil infrastructure that is utilized.

Lifetime of GEI:

- **Value**: 100 months
- Average time before green infrastructure becomes obsolete.

Lifetime of FEI:

- **Value**: 500 months
- Average lifespan of fossil energy infrastructure.

Feedback Loops in Energy Infrastructure

- **Loop 1: Green Energy**
- • Demand for energy infrastructure → Increases GEI (Green Energy Infrastructure) installation.
- • More GEI → Increases green energy production.
- • Over time, GEI obsolescence → Reduces efficiency, leading to replacements.
- **Loop 2: Fossil Energy**
- • Demand for energy infrastructure → Increases FEI (Fossil Energy Infrastructure) installation.
- • More FEI → Increases fossil energy production.
- • FEI obsolescence → Reduces efficiency, leading to replacements.
- **Loop 3: Combined Infrastructure**
- • Demand for energy infrastructure → Affects both GEI and FEI installations.
- • Efficiency losses and replacements occur for both infrastructures over time.

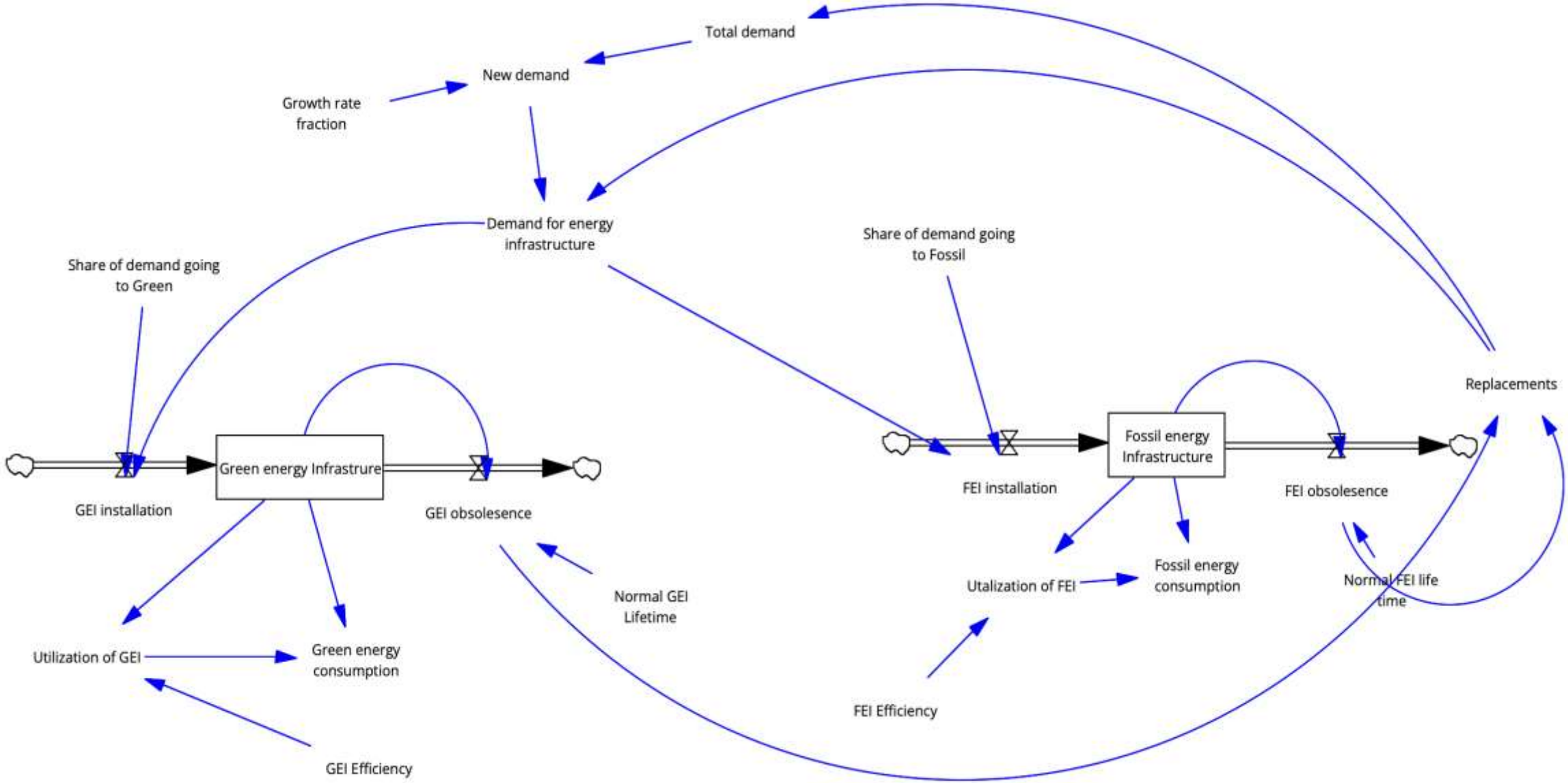
Struggles with the Model:

Understanding Graphs: Difficulty interpreting graphs due to initial values, formulas, and units in Vensim.

Technical Issues: Setting up variables and formulas correctly was challenging.

Modeling Replacements: Capturing the lifecycle and replacements of both fossil and green energy infrastructure was complex.

Efficiency Losses: Struggled to model efficiency losses accurately over time.


Total demand
New demand
Growth rate fraction
Demand for energy infrastructure
Share of demand going to Green
Share of demand going to Fossil
Green energy Infrastrure
Fossil energy Infrastructure
Replacements
GEI installation
GEI obsolesence
FEI installation
FEI obsolesence
Normal GEI Lifetime
Utalization of FEI
Fossil energy consumption
Normal FEI life time
Utilization of GEI
Green energy consumption
FEI Efficiency
GEI Efficiency

Conclusion:

Takeaways:

- This model highlights the importance of **energy efficiency** and **infrastructure planning** for both fossil and green energy.
- Future focus should be on increasing the share of **green energy infrastructure** to ensure long-term sustainability.