IPRO 345

Fuel Cell/Geothermal Sustainable Energy at the USX Site

Team

- Sponsors: HNTB, Sister Cities International Chicago
- Schools: Tongji University, UIC, Illinois Institute of Technology
- Students: CHE 496, CHE 296, IPRO 345

Team

- Subteams:
  - Environmental
  - Economics
  - Design
  - Ethics
  - Deliverables

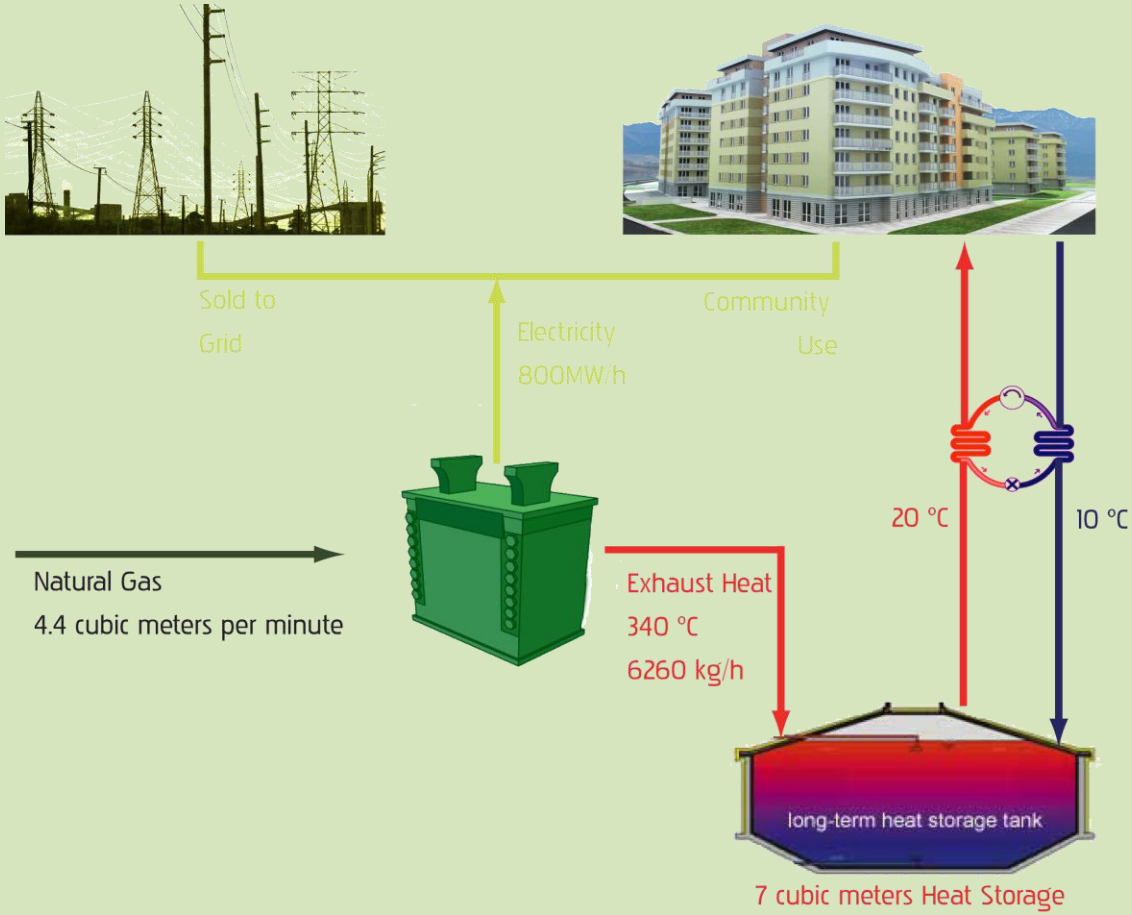
Problem

- There is a need for Clean and Sustainable energy
- There is a need to promote Fuel Cell and Geothermal Heat Pump technology

Solution

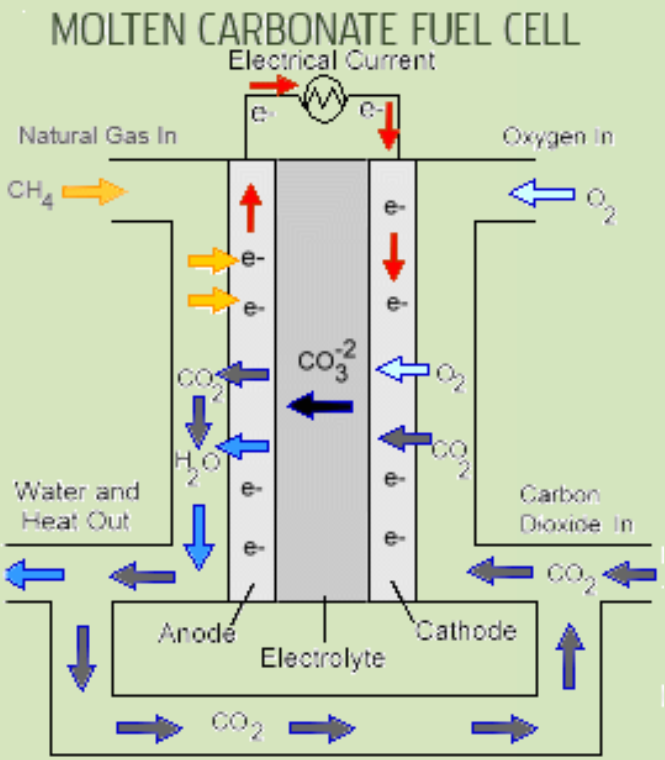
- Software tool
  - User-friendly
  - Easy-Access
    - Design
    - Cost
    - Benefits
- Algorithm
- Database

Conceptual Design



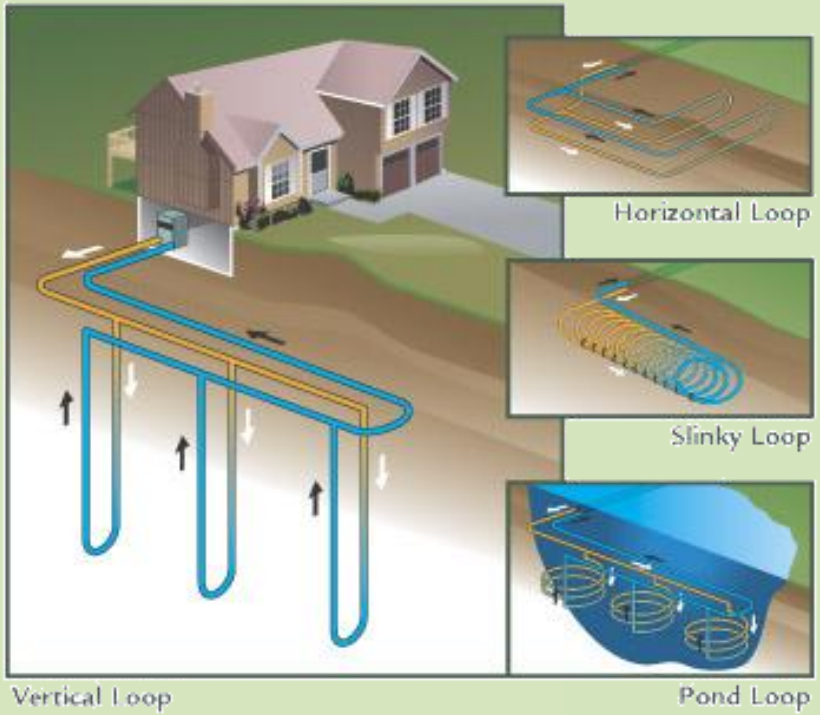
Technology-Fuel Cell

- Electrochemical device
- Converts chemical energy to electricity
- Type: Molten Carbonate
- Fuel: Natural gas



Technology – Geothermal Heat Pump

- Taps stored energy of Earth
- Stores and uses waste heat from Fuel Cell
- Provides heating, cooling and hot water

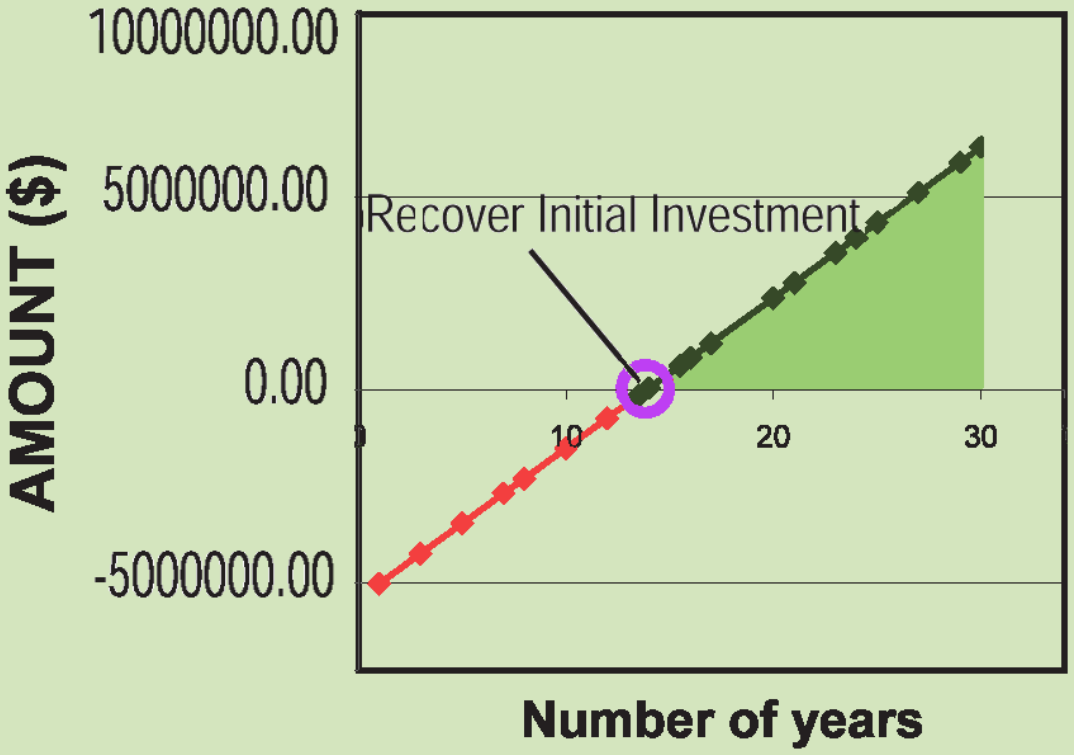


Design Assumptions

- Household demand (2.5 persons/home)
  - Electricity: 1.5 MWh/month
  - Heat: .3MWh/month (assumes heat pump)
- “Off the shelf” units when possible
- Take advantage of government subsidies and grants

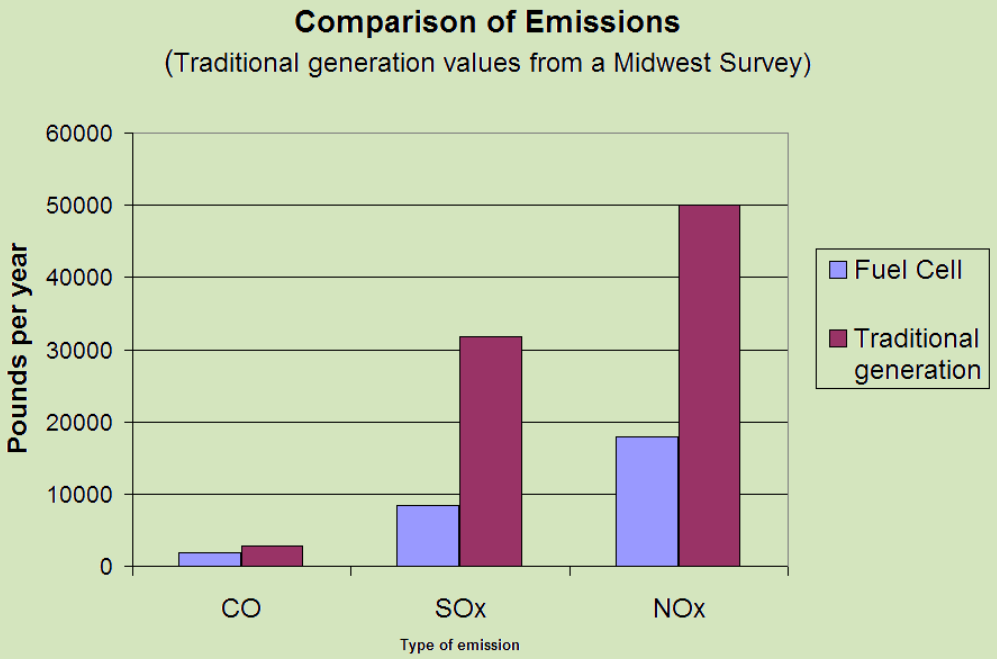
Economics

- Initial Total System Costs: $5,420,000
- Developer cost instead of individua
- Annual Savings: $400,000
- Simple Payback Period: 13.5 years
- Other incentives available



Environmental

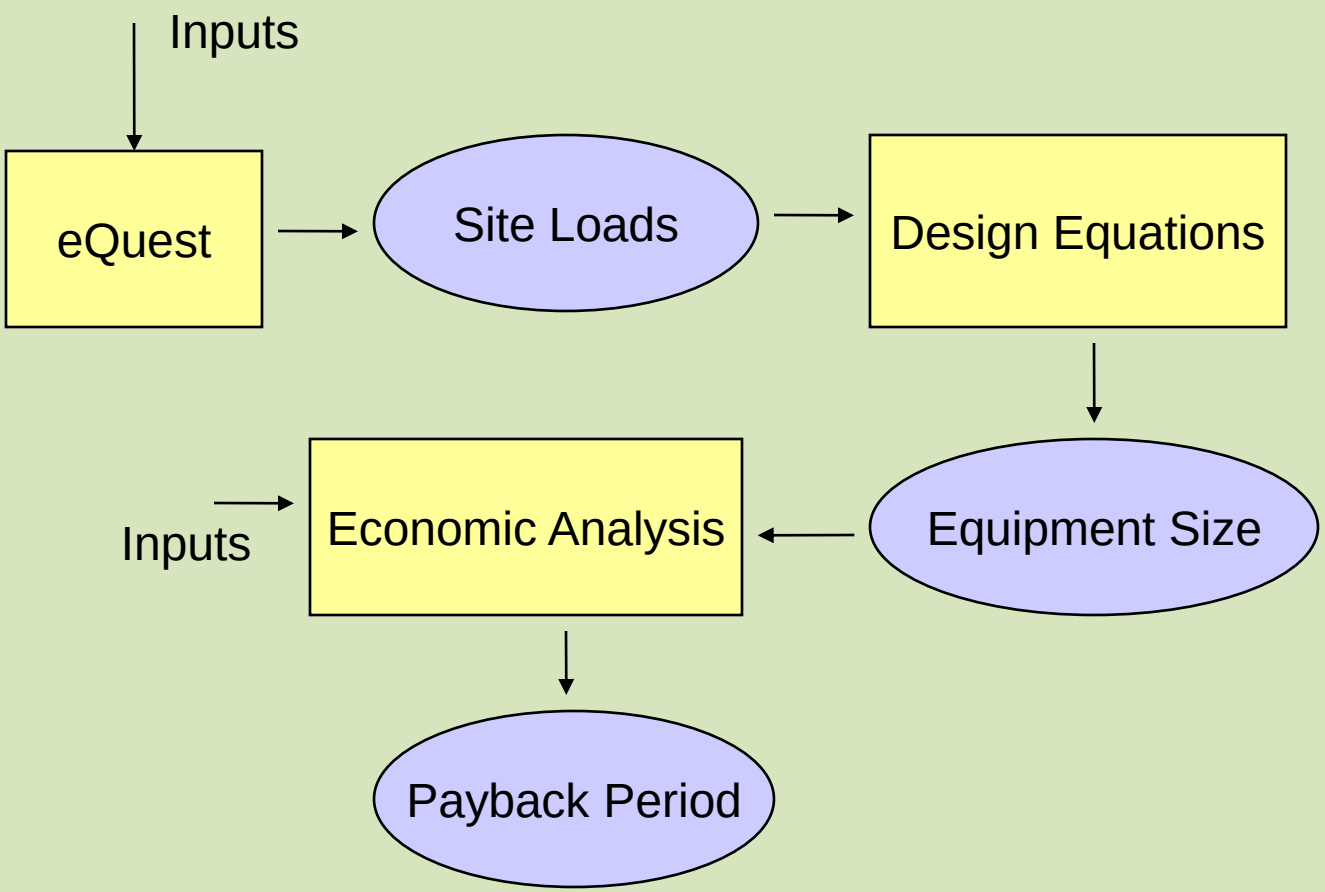
- Low emissions
- Low or negligible emission of SOx and NOx
- Carbon trading potential
- Methane can be used as a power source



Software Design

- If specific data is unknown, the user imports the area of surfaces
- If specific data is known, the program takes the following values:
  - Location of project
  - Types of Buildings
  - Number of Buildings
- Compare with eQuest

Algorithm Layout



Obstacles

- Software Design
- Scope of Project
- Remaining Objective
- Communication

Summary

- Fuel cell/Geothermal technology
- Environmentally friendly
- Potentially economically feasible
- Software design

Recommendations

- Enhance the database for wider implementation
- Increase thoroughness of economic analysis
- Minimize assumptions of design equations
- Develop optimization protocols
- Test the results against a real world case study
- Determine degree of marketability

Questions?