DEVELOPMENT OF A SOFTWARE DESIGN TOOL FOR HYBRID SOLAR-GEOTHERMAL HEAT PUMP SYSTEMS IN HEATING- AND COOLING-DOMINATED BUILDINGS

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Presentation Outline

- Project Motivation
- Project Scope
- Project Objectives
- Approach and Methodology
- Current Status and Progress
- Future Work

Project Motivation

- Development of a Sophisticated and Reliable Design Tool for Hybrid GHP Systems
- Optimal System Design
- Sustainable Design by Using Solar Thermal Collectors for Heat Rejection and Extraction
- Reduction of System Costs
- Easy-to-Use Software Tool

Project Scope

- **This project focuses on the development of a stand-alone software tool for the design and economic analysis of hybrid geothermal heat pump systems for heating- and cooling dominated buildings using solar collectors in both operating modes**

Project Objectives

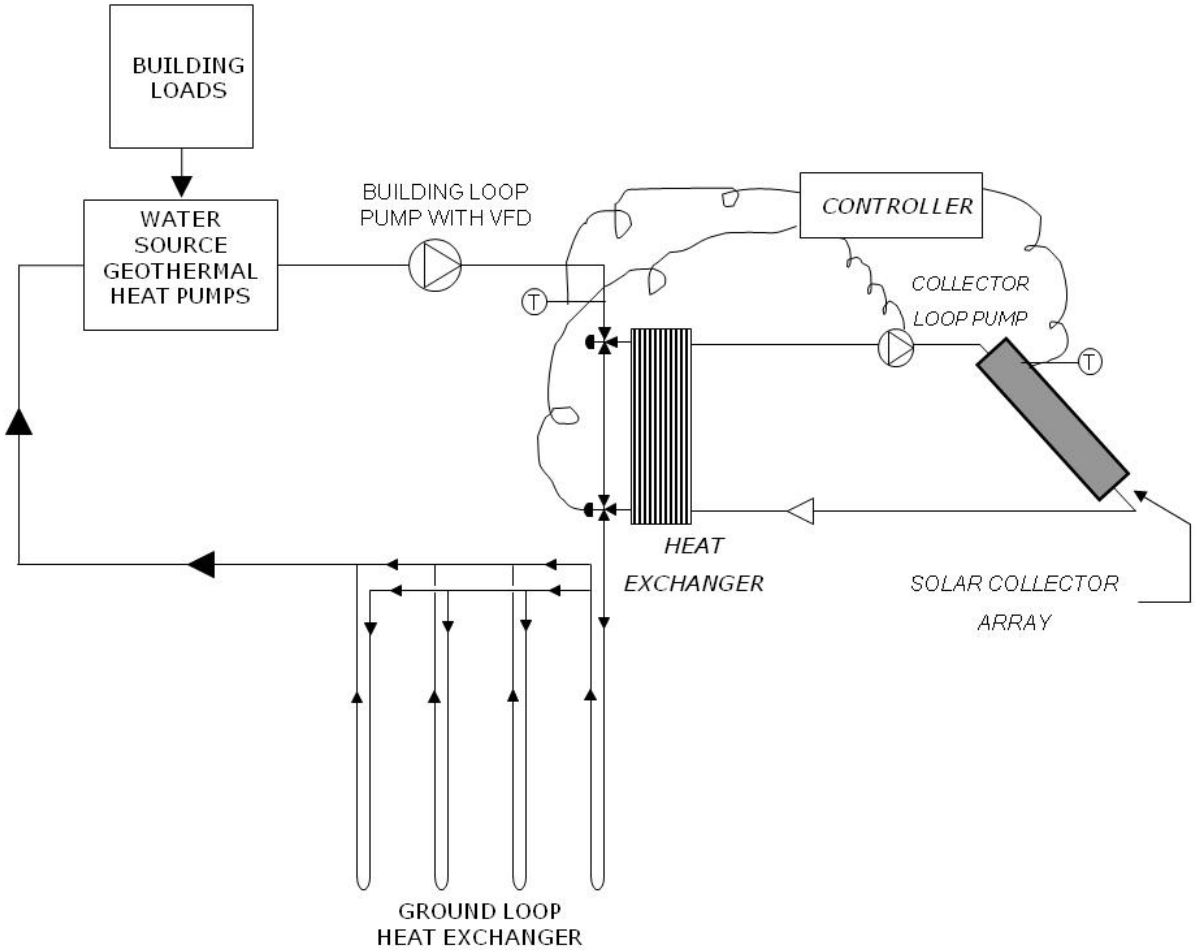
- Identify mathematical simulation models for system components of solar hybrid GHPs.
- Implement the simulation models as TRNSYS component models.
- Identify, select and integrate appropriate optimization algorithms with the component simulation models for overall system simulation of solar hybrid GHPs.
- Develop and integrate a synthetic load generator.

Project Objectives

- Develop and integrate capability of user-selected weather and solar data into TRNSYS.
- Identify, develop and integrate a comprehensive solar collector database into TRNSYS.
- Develop a menu-driven, user-friendly graphical user interface for the software tool.

Approach and Methodology

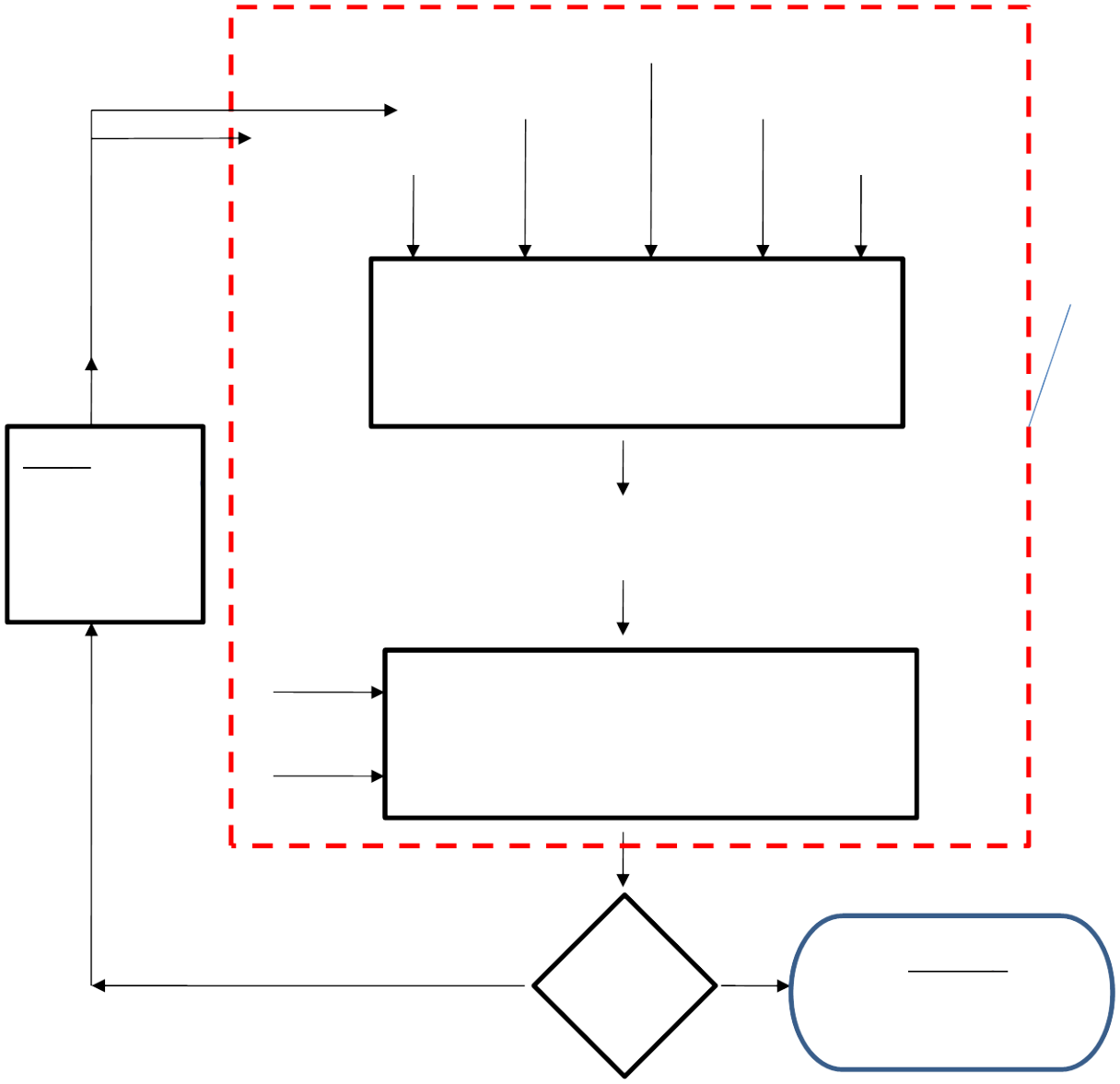
- Hybrid System Configuration in TRNSYS



Approach and Methodology

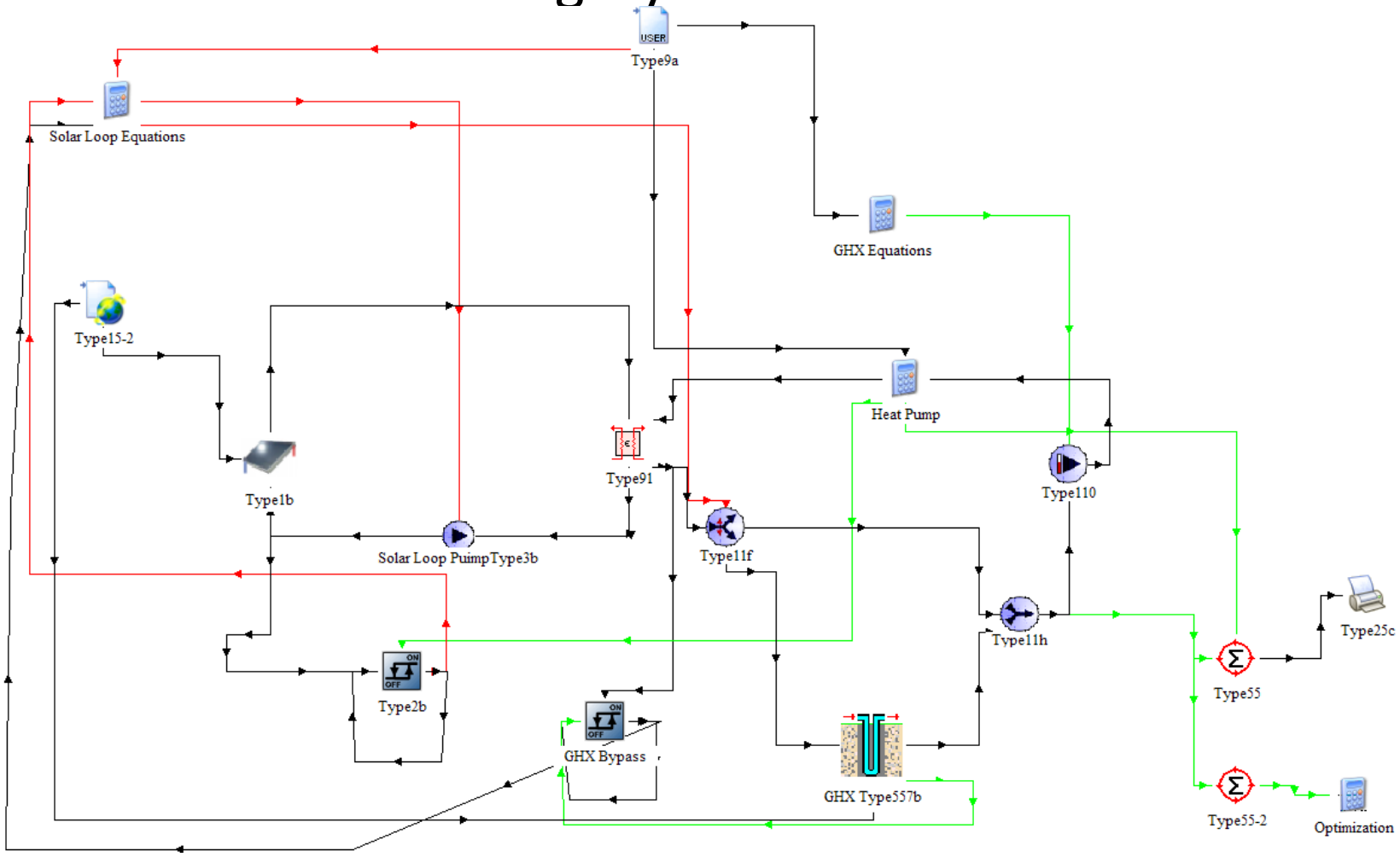
- The Objective Function for Optimization:
  - Z = Sum of the Squares between Annual Minimum Heat Pump Entering Fluid Temperatures AND The Heat Pump Design Entering Fluid Temperatures.
  - Minimize Z to Balance Ground Thermal Loads

Approach and Methodology



Current Status and Progress

- Constructed a Working Hybrid Solar-Geothermal Heat



Future Work

- On-going and immediate future work:
  - Implement a more user-friendly heat pump model (currently implemented heat pump model in TRNSYS requires user to have manufacturer's catalog data in a data file)
  - Implement a FORTRAN model to seek and store maximum and minimum heat pump entering fluid temperatures
  - Implement improved unglazed solar collector model to account for nocturnal radiation

QUESTIONS?