

The Design Challenges: Worksheets

# Your Project Description & Anticipated Energy Demand

Briefly describe your building project, use, location, etc.:

## General

Building Size:  Sq. Ft.

Property Size:  Sq. Ft.

Number of Parking Stalls:

## Electrical

Annual Electrical Usage:  1000 x kWh

Peak Electrical Demand:  kW

## Heating

Peak Heating Demand:  BTU/hr

Peak Winter Day Demand:  BTUs

Average Winter Heat Demand:  BTUs

## Cooling

Peak Cooling Demand:  Tons (BTU/hr)

Average Summer Day:  Tons-hrs/day

## Hot Water

Annual DHW Demand:  Gallons

Swimming Pool Size:  Gallons

# Your Project FLEX Energy Default Calculation Results

## Ground-source Heat-Pump

Vertical Bore Field Area: 10,500 sq feet (102.5' x 102.5')

Peak Electrical Demand: 26.7 kW

## Ice Storage Requirements: XXX Tons

7,500 Gallons, 1013 cu-ft, 6' x 169 sq. ft. (x 4/pi) 14.7' x 14.7'

## Latent Heat Storage for 137,000 BTU

7,500 Gallons, --- 6' x 14.7' x 14.7'

## PV:

Needed for  $6\text{kwh/sqft} * 60,000 = 360,000 \text{ kWhr}$  (178KWp) 9,500 sq. ft. =100'x100'

## Wood Biomass:

Peak systems 2,500,000 BTU/hr, Boiler Area (look-up table based on real examples): 2,500 sq. ft.

Fuel needs 690 ton/year, peak month: 400tons, 1.4 trucks per week.

Storage 250 tons, area @ 6' deep: 3,100 sq feet - 55.6' x 55.6'

## Electric Vehicles:

225 kW peak demand for 45 vehicles.

# Design Challenge: Adding A Centralized Biomass Boiler

- The building design includes a centralized biomass boiler that provides more than 50% of the annual heating demand.

Show:

- The 2.5 MMBTU boiler that typically requires a 2,000 sq. ft. of mechanical space (either attached to your building or a separate building).
- The 150 tons wood chip storage taking 1,800 sq. ft.
- The access route for a 56' deliver truck with a turning radius of 31'. You will need to accept deliveries during normal business hours to keep deliver costs low.

This sheet contains the above designations:



Tell:

Describe how biomass boiler system interface with your building's HVAC system:



Discuss other issues related to retrofitting a Centralized Biomass Boiler.



# Design Challenge: Adding District Energy Connection

- The design includes Electric Vehicle charging stations for more than 50% of the parking spaces.

Show:

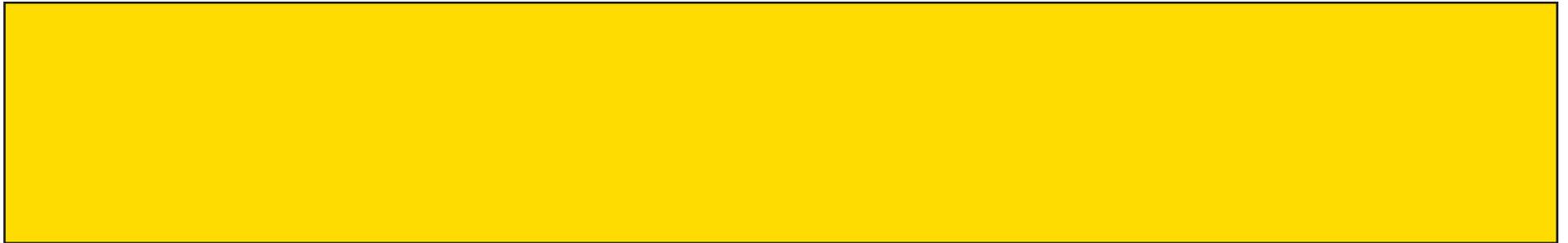
- The connecting point to your building where district energy piped (hot and chilled water) will enter your building.

This sheet contains the above designations:



Tell:

Describe how hot and chilled water from the district energy system interface with your building's HVAC system:



If thermal energy is delivered to your building from the largest adjacent street, how far will the pipe need to travel to get to your designated connecting point?



# Design Challenge: Add Electric Vehicle Friendly Parking Lot

- The design includes Electric Vehicle charging stations for more than 50% of the parking spaces.

Show:

- The location underground wiring from 50% of your 45 stalls to your site transformers, and the location of an additional transformer capable of providing 225 kW of additional service.

This sheet contains the above designations:



Tell:

If 50% of your parking lot of 90 is filled with electric vehicles need to be charged in 6 hours with enough energy for a 10 mile drive, You will need to provide an additional 225 kW of electrical service to your project. How will you meet this need?



How will you install charging stations for at least 45 parking stalls?



# Design Challenge: Adding a Ground-Source Heat Pump (GSHP)

- The building design includes a GSHP system.

Show:

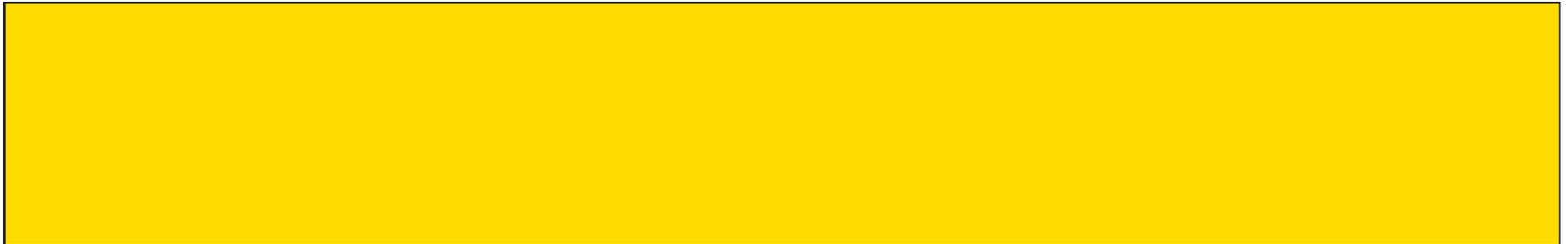
- The location of a 20,000 sq. ft. vertical bore hole field that meets the heating load of XXXXX.
- The location of the piping between the ground loop field and the MER.

This sheet contains the above designations:



Tell:

Describe how a GSHP will be integrated with your existing HVAC system and what changes will be needed in the mechanical equipment room and distribution system:



Changes needed in the occupied space (heat-pumps in the ceiling space of each rooms, etc.):



# Design Challenge: Adding Photovoltaic Roofs

- The building design includes sufficient PV to provide more than 50% of the annual electrical demand.

Show:

- The locations of 12,500 sq. ft. of unshaded roof area suitable for PV. The annual energy demand of 320,000 kWh requires a 172kWp PV system.

This sheet contains the above designation:

Tell:

Will the roof support 2 lbs per square foot on the designated areas?

How will the panels be connected to your electrical system? Where will the inverters be located? Have you added any conduit to your build-plan?

What aesthetic considerations have you made for adding PV? Do you think your building with PV added with be acceptable to your community?

# Design Challenge: Adding Solar Thermal for Swimming Pool

- There is no swimming pool or large demand of domestic hot water in this project.
- A solar thermal heating system capable of providing more than 50% of the annual heating needs of the pool.

Show:

- The location of a 5,000 sq. ft. solar thermal system need to heat your swimming pool is 20,000 gallons, with a surface area of 2,000 sq. ft. It will require 300,000 BTU/hr heater.

This sheet contains the above designation:



Tell:

Describe how a solar thermal hot water heater will interface and inter-operate with you existing system:



# Design Challenge: Adding Thermal Energy Storage

■ A thermal energy storage system capable of storing XXX MMBTUs is part of the buildings design.

Show:

■ The peak daily heat demand of 15 MMBTU. The default area needed to store 5 MMBTU in a  $\Delta 30^\circ\text{F}$  hot water system requires 20,000 gallons of water. At a height of 6', this requires a 24' diameter tank.

This sheet contains the above designation:

Tell:

How will the TES system be integrated into your existing design?

Additional comments and ideas: