HOMER Energy

Foundations of HOMER Pro

Economic Optimization of Hybrid Renewable Microgrids with HOMER® Pro

Objectives / Agenda

- Introductions

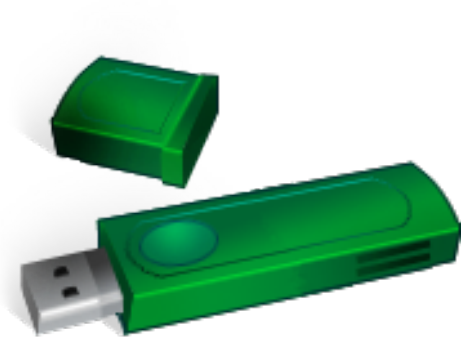
- Describe HOMER Pro's SOS: Simulation—Optimization—Sensitivity paradigm
- Familiarize you with the user interface

- Lessons:

1. Conceptual/prefeasibility analysis with HOMER Pro
   - Quick & easy
2. Refined analysis
   - Detailed load data & specific components
3. Detailed costing
4. Larger systems with multiple generators
   - Dispatch strategies & operating reserve

Before we begin

- You should have HOMER Pro installed and licensed

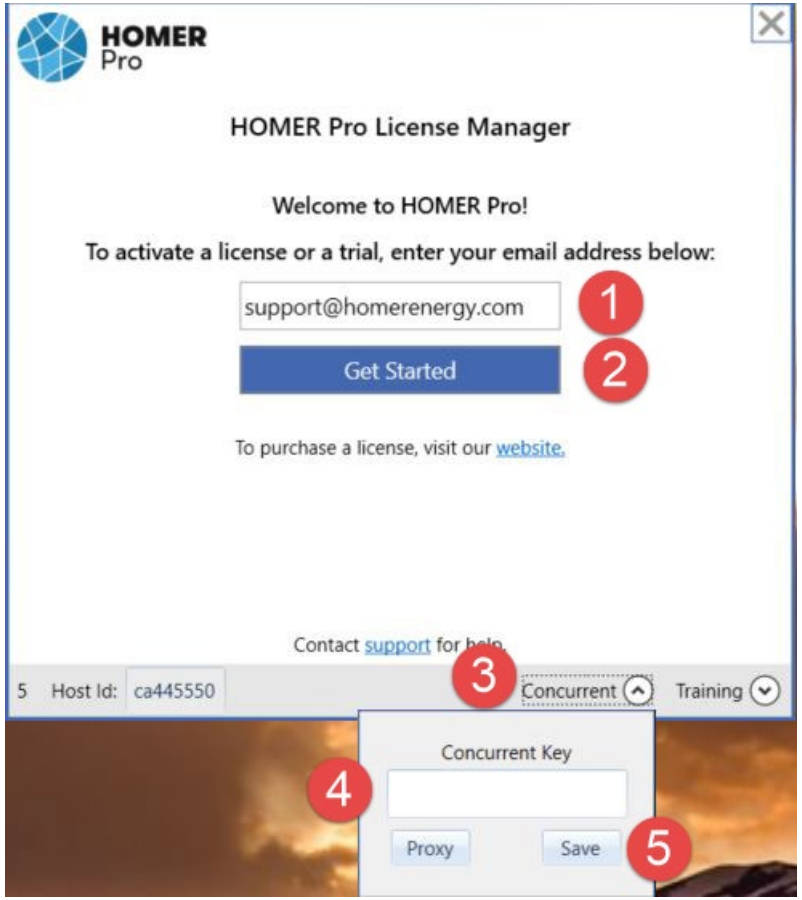


- On your USB Drive
  - HOMER files for each lesson
  - HOMER Pro Foundations Presentation
  - HOMER Pro Foundations Student Training Guide
  - Description of HOMER Products & Services

To Activate License:

- Double-click Install file on USB drive
  - “HomerPro-3.13.1_x64.msi” or
  - “HomerPro-3.13.1.msi” if your Windows is 32 bit
- Open HOMER Pro

1. Enter your email address →
2. Do **NOT** click on Get Started
3. Click on down arrow next to “Concurrent”
4. Type Concurrent Key in popped up window
   - Concurrent key: 49988411050756300 3
5. Click Save



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The Microgrid and DER Modeling Experts

- Created at **National Renewable Energy Lab (NREL)** in 1992; privatized in 2009
- Exclusive developer and distributor of the HOMER® software suite
- The **trusted global standard** for economic analyses of hybrid system design

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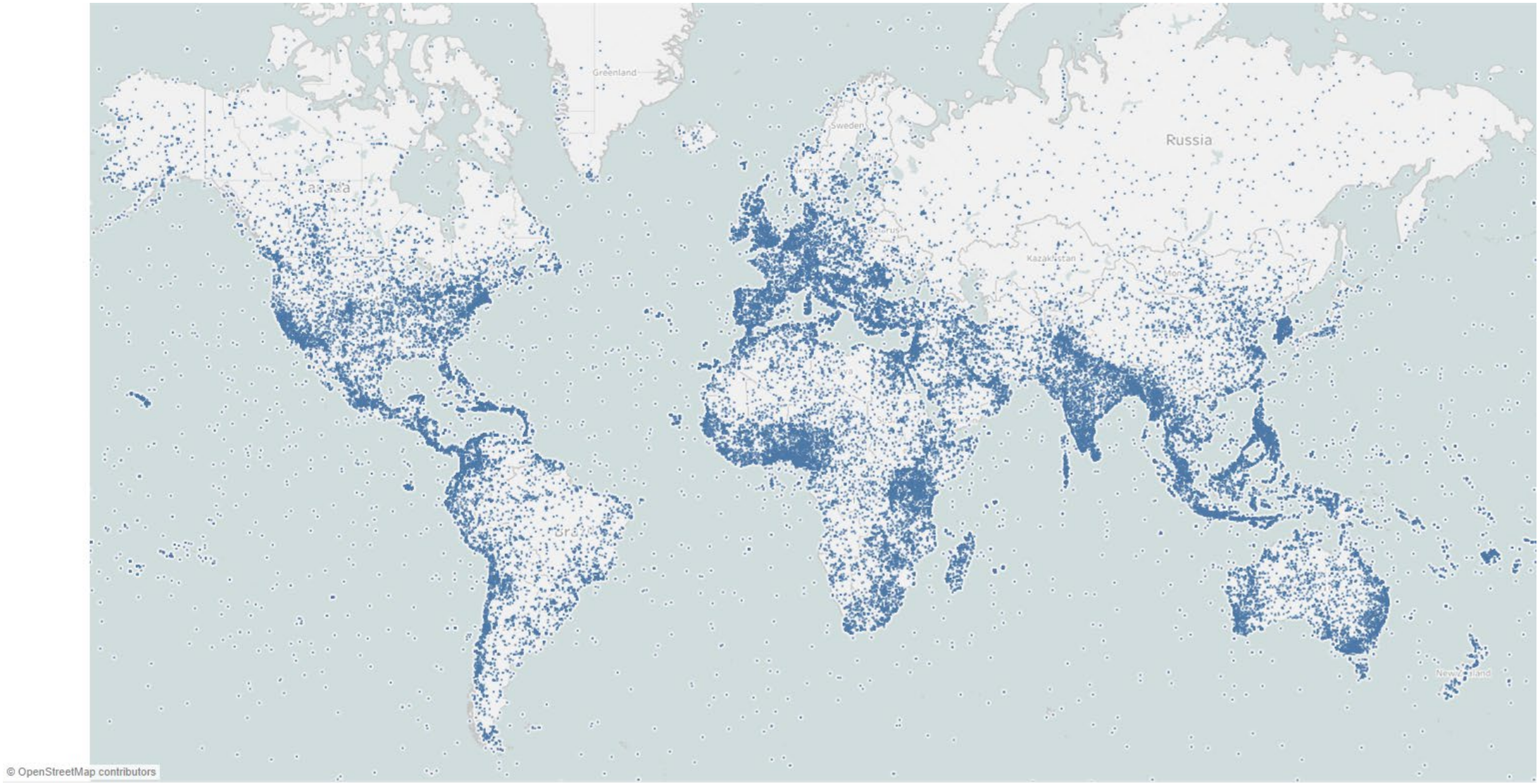
70,000+ microgrid projects in HOMER® Pro



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HOMER Solutions

Services

- Consulting
- Training
- Support

Software Solutions

- HOMER Pro
- HOMER Grid
- HOMER QuickStart
- HOMER QuickGrid
- HOMER SaaS API
- HOMER Controller API

Market Access

- Conferences and Webinars
- Microgrid News
- Industry Partner Program
- Network Component Library

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HOMER Energy's Component Partners

STUDER

LEONICS

XANT
WIND POWER MADE EASY

AZIMUTH ENERGY

SPARKMETER

MICROGRID
Systems Laboratory
Accelerating Our Energy Future

HOMER Pro

Get **insight** into the complexities and tradeoffs of **cost-effective**, **reliable microgrids and hybrid energy systems.**

Microgrid Markets

- Off-Grid
  - Energy Access
    - No existing infrastructure
  - Island & isolated utilities
    - Existing diesel-based power system
- Grid-Connected (behind the meter)
  - Reliability & resilience
  - Utility cost management
    - Demand charge, TOU, and sellback restrictions

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HOMER Grid

Too Many Choices

Solar

Wind

Hydro

Geothermal

Biomass

New Storage Techs.

Electric Vehicles

Smart grids

Fuel Cells

Micro-turbines

Micro-grids

Demand Response

Load Management

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What's Best?

- It depends on:
  - Resources
  - Loads
  - Equipment prices
  - Equipment performance

- A Confused Mind Says "No!"

- HOMER fits the pieces together

How Does HOMER Work

Project Inputs

Load Profile

Site-Specific Resources

System Components

Analysis

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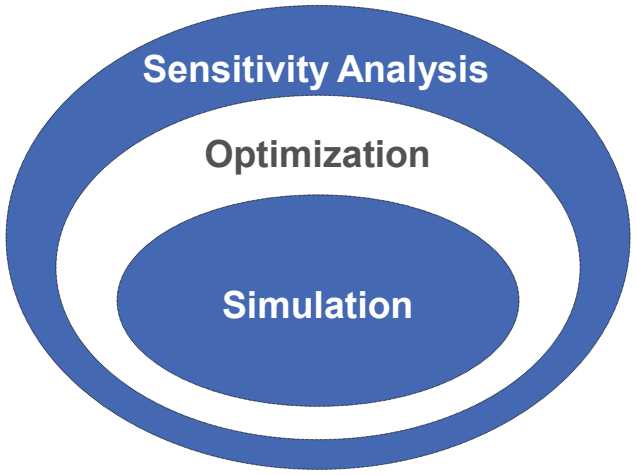

Results

Economic & Engineering

System Sizing

Performance Details

Financials

Various Reports

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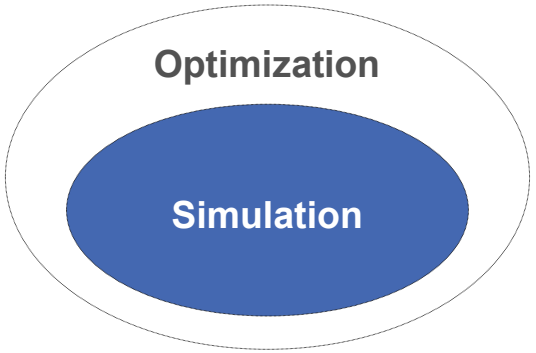
Simulation

- Model system's operation in consecutive time-steps
  - 8,760 hours or
  - 525,600 minutes

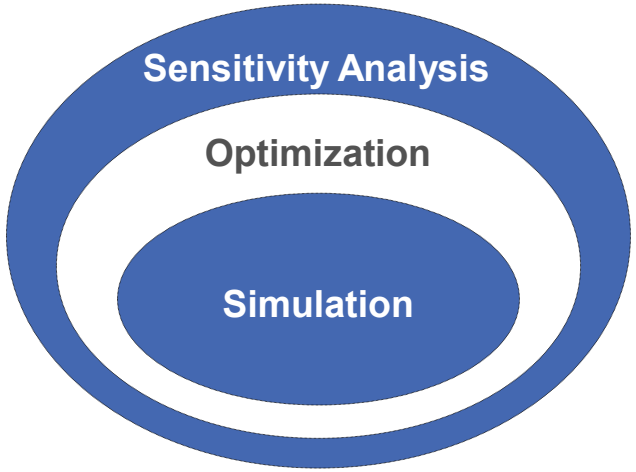
- Calculate the total cost of the system over its lifetime
  - CapEx – Total installed capital cost
  - OpEx – Operation, fuel, and maintenance (O&M) costs
  - Replacement costs

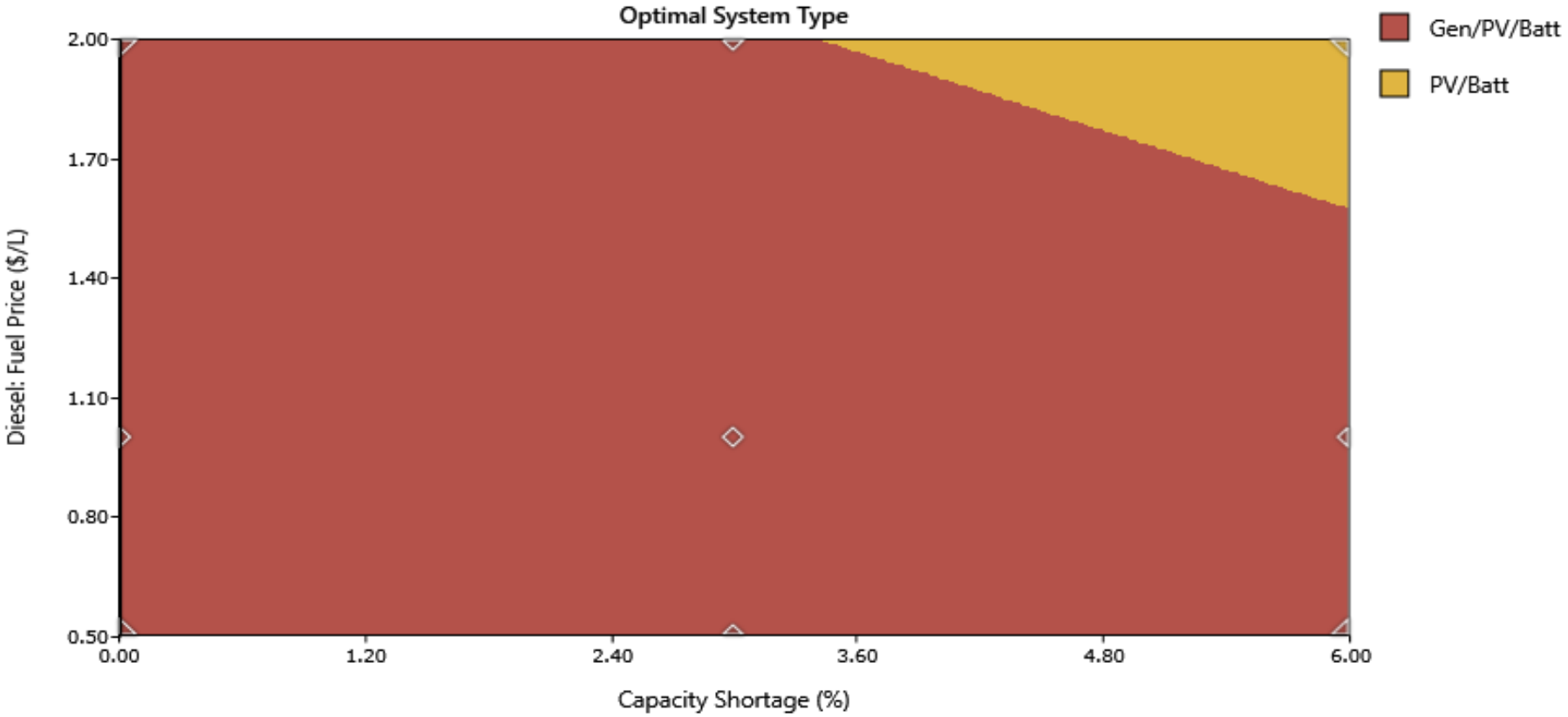
Optimization



- HOMER runs many Simulations to determine an Optimal system
  - *Optimal* means lowest *Net Present Cost (NPC)*, the present value (in $) of all costs over the lifetime
  - Results can be sorted on many other criteria

Sensitivity Analysis





- Vary the assumptions in the HOMER model to determine impact on the Optimal system

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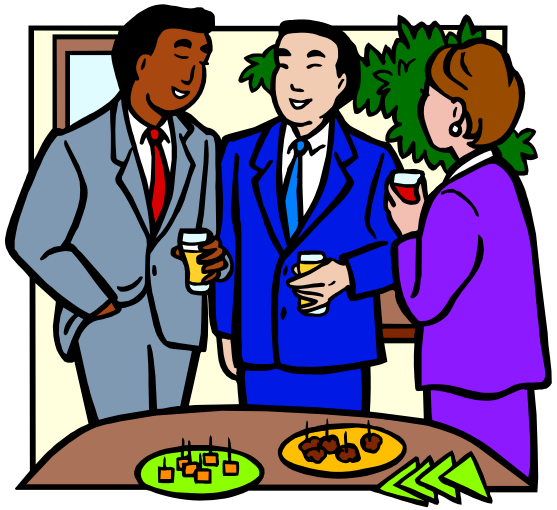
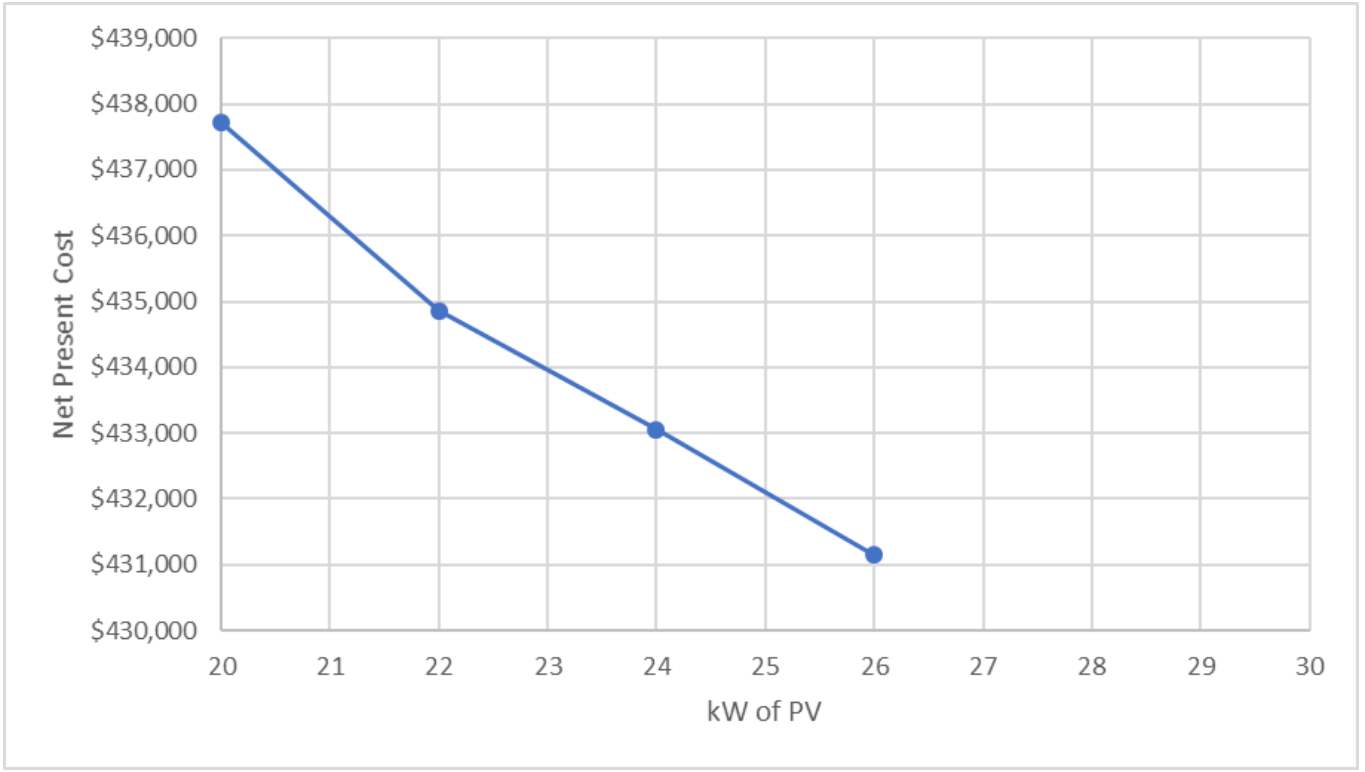
Before we begin

- I will demonstrate each lesson first, then you will use the Student Guide to create your own HOMER file.

- Questions
  - Please raise your hand if you have any questions
  - I will keep an “ideas parking lot” in a Word document
    - For important ideas that we will re-visit later



Search space may be insufficient



Is 26 really the optimum? It is at the edge of the search space, so we can't tell.

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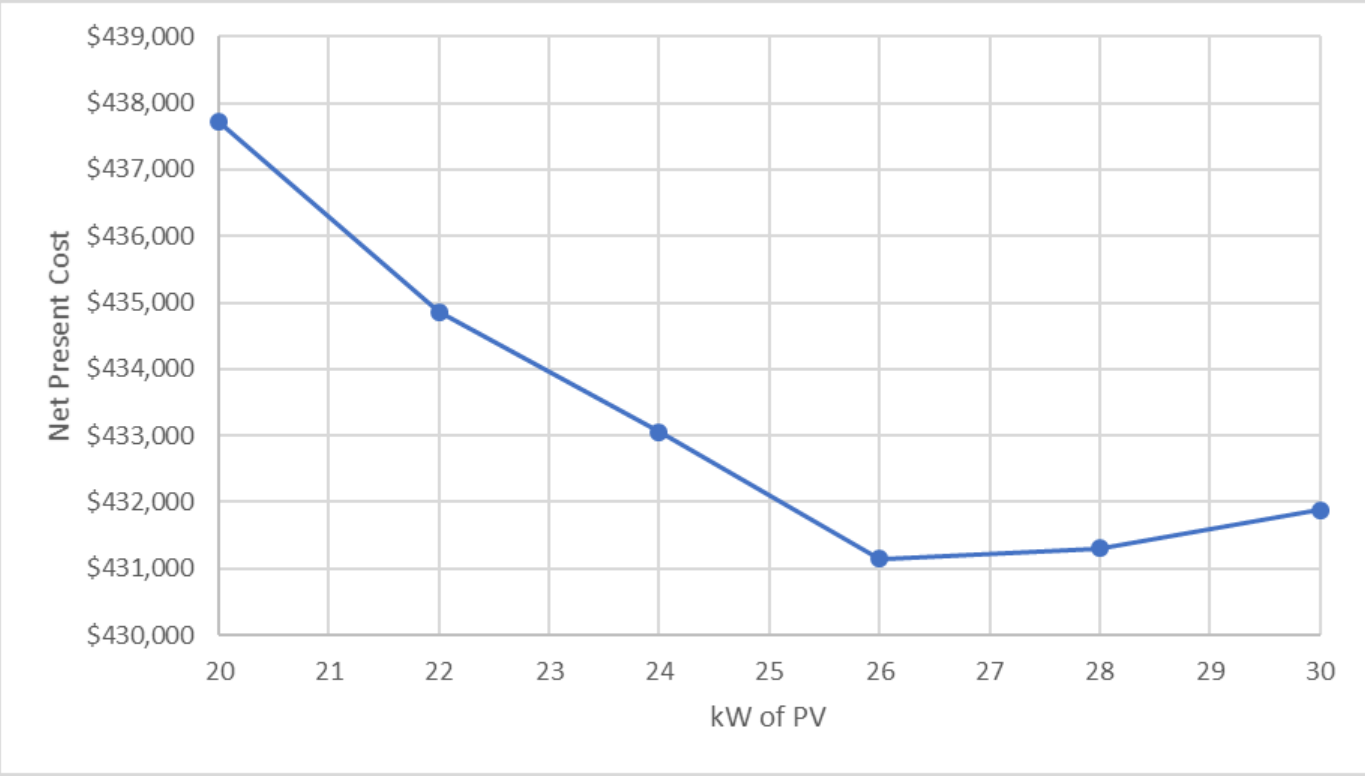
Make search space bigger



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