HOMER: System Planning Homework

EGR 325
Oct 22, 2014

System Planning

• Screening Curve Method
  o Review on your own, and be able to construct a screening curve and determine the technology mix
  o Bare bones system plan
• Computer Simulation – HOMER
  1) Specify your criteria and target reliability measures
  2) Gather input data
  3) Define scenarios and sensitivities
  4) Analyze results

HOMER: DSM and RETs

• For load management programs such as peak-shaving, you model these by...?
  o By adjusting the hourly load data or the LDC
  o For peak shifting or peak shaving, you must adjust your load input data.
• For conservation programs and RET generation
  o HOMER adjusts the net load as needed

Sensitivity Analysis

• Simulate the operation of the power system over different futures
  • Each future has different set of unknown parameters:
    • Temperature, wind, solar, water supply, fuel prices
• HOMER
  • YOU must define different “futures” in order to perform sensitivity analyses
  • Discuss sensitivity analyses
    • What are they?
    • What purpose do they serve?
Reliability Analysis & HOMER

- Discuss how to model and analyze the reliability of your system
- Input vs. output measures of reliability
- The use of EFOR (expected forced outage rate) for traditional generators (diesel, CT)
- The use of ELCC and/or capacity credit

Including Reliability Measures

- **Input**: Decisions by Planner and Society
  - Target Reserve margin
  - Target LOLP
- **Output** of computer modeling (all of them)
  - Achieved Reserve margin
  - Achieved LOLP
  - LOLE
  - Cost of unmet energy
  - Indices: SAIFI, SAIDI (D = ‘duration’)
  - Duration, frequency and MW of outages

HOMER Planning HW

- Prepare a proposal for an electric power system expansion plan or new system plan, to the government of Ossipee, for creating a stand-alone or grid connected system (your choice)
- Use HOMER to help with your analysis
- Analyze base case scenario(s) and perform sensitivity analyses
- Draw conclusions, based on evidence
- Make a recommendation to the government

System Planning Criteria

Use to guide questions for HOMER

- Meet system demand into the future
- Typically there are tradeoffs between other criteria:
  - Low cost (…may not allow for many RETs)
  - High reliability (… is more expensive)
  - Low environmental impacts (emissions) (…expensive?)
  - Fuel diversity (… might not be sustainable?)
  - Sustainability (inter-generational issues)

- The data is mostly time series data
- System planning implies questions for the future
HOMER HW – Specify …

- The generating technologies: diesel, biodiesel, combustion (gas) turbine, CHP (cogen), wind, PV, hydroelectric, batteries, etc.
  - Costs and resource availability
- Demand side programs
- Capacity factor of every generator, and...
- Capacity credit of RETs
- An estimate of the total emissions (CO2 alone is fine)
- Sensitivity analyses on input data such as fuel costs, wind resource, etc.

HOMER HW

- For October 31 – collaborative effort!
  - Use KF (?) to decide who among you will find and share which data
- For November 7 – submit final analyses (with team)
  - Report, as detailed in the posted assignment

HOMER to hand in… Oct 31

- Your scenario definition(s) with input data.
- Identification of demand side programs & data.
- Identification of the sensitivity analyses, with input data.
- How to perform pollutant emissions analysis
- A brief description of how you will model and analyze the reliability of your system.
  - Reserve margin?, LOLP?
- Justification for the interest rate and other input data used in the NPC calculation
  - See posted “HOMER Algorithms” article
- A list of the type of results you expect
- A brief statement of the type of conclusion or proposal you expect to make → the purpose

Missing from HOMER

- Societal concerns
- Equity
- The transmission system
  - Use power flow analysis for Tx system planning
  - Large industry standard model, GE MAPS, does include Tx system model
HOMER Discussion – Future

With a partner, discuss each others’ analysis

1) Agree on a single element to compare and discuss
   i. Technology mix; Include DSM?
   ii. System reliability; Sensitivity analysis
   iii. Conclusions
   iv. etc.

2) Comment on strong elements in analysis

3) Comment on what is not clearly explained

4) Take the perspective of the Ossipean government, and ask proposer to defend the selected, specific element of her proposal