
Hybrid Generation Simulator

HybSim© 1.0

DAVID TRUJILLO

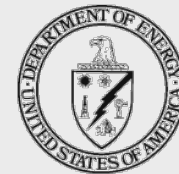
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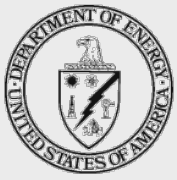
Presented by

Joshua Bartlett – University of Michigan



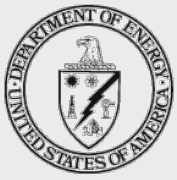
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Introduction

- **HybSim© 1.0 copyrighted 2006**
- **First license to University of Michigan**



Introduction

HybSim© Model

What – “Hybrid Simulator”; Tool designed to evaluate the economic and environmental benefits of adding renewable energy to the fossil fuel generation mix in remote and difficult-accessible locations.

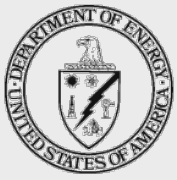
Why – Benefits of energy storage, decision analysis, risk analysis, load growth issues, load management, economic analysis, planning (what-ifs)

Who - Availability to coops, field techs, project managers, administrative personnel

Where – Remote villages, military installations, remote industrial systems; any climate

How - Designed for simplicity of use, Windows OS, open MS Excel executables, imbedded libraries for batteries, gensets, PV systems, reports, modulated design for expansion – wind energy to be added in ‘06

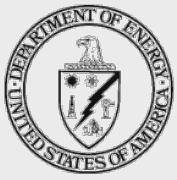




HybSim© Model – Application

- Primarily established to help technical and non-technical personnel reduce the “guess work” on the benefits of energy storage and renewable hybrid options for existing or new systems.
- Not intended to emulate the exact response of the components.
- Variance in component response expected.





HybSim© Model – User GUI

Hybsim dbp - A hybrid power system simulator

Village | Generator-only System | Hybrid Generators | Battery/Power Electronics | Renewables | Fuels/Fuel Storage

Load Saved Simulation

Simulation Name

Save simulation before run

General Information

Location Name

Description

Load Profile File

Load Profile Sheet

Output File

Weather Data

Longitude (deg) Elevation (m)

Latitude (deg) Time Zone

Weather Data File

Weather Data Sheet

Dispatch Algorithm

Peak Shave

Cycle Charge

Battery Setpoints:

Charge Cutoff (V/cell)

Discharge Cutoff (V/cell)

Economic Analysis Details

System Life (yr)

Discount Rate (%)

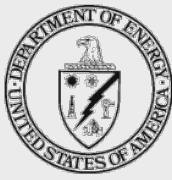
Power Factor

Village Power Factor

HELP

Note:

Green boxes are *essential data*. The model will not run without these values being entered into the program.



HybSim© Model – Help Feature

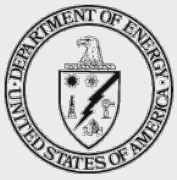
The screenshot displays the HybSim dbp software interface. The main window title is "HybSim dbp - A hybrid power system simulator". The interface includes a menu bar with "Village", "Generator-only System", "Hybrid Generators", "Battery/Power Electronics", "Renewables", and "Fuels/Fuel Storage". A "Help Topics: HybSim 2.3" window is open, showing a list of topics such as "Introduction", "Quick Start", "Operating HybSim Simulator 2.0", "Working with the Input User Form", "Input Data Requirements", "User Input Form Data", "Input Data Sheet Requirements", "System Components", "Components", "Dispatch Algorithm", "Progress Indicator", "Output Data Form", "Output Data Sheet", and "Contact Information". A "User Input Form Data Requirements" window is also open, displaying the following text:

User Input Form Data Requirements

The user input form data can be entered manually or loaded from an existing simulation. The input data boxes with a green background indicate that these are data inputs that are absolutely necessary to run the model. **Failing to enter one or more of these mandatory input data points will result in an error message.** Non-critical input data for a selected component that is not entered or loaded by the user is considered to be 'zero' by the model.

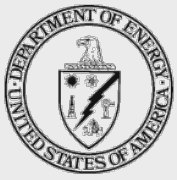
Tip: Entering in all the data inputs will result in a better simulation.

Charge Cutoff voltage is the voltage at which charging should be terminated. It is specific to the battery.



Model Validation – Aerial Site View Carol Springs, Arizona, APS

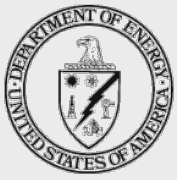




Current Work

- **Not funded at this time**

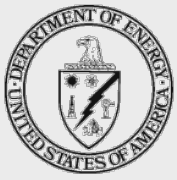




Future Work

- Add wind energy technologies as an option – size restricted to less than 100 kW
- Distribution
 - Alaska users, utilities, coops, project managers, universities





Acknowledgements



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