

Stand-Alone PV-Wind-Hydrogen Power System



Getting started with the TRNSED Demo

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Installing and Launching the program

The setup program has copied all the required files in the destination directory you selected (the default destination directory is C:\H2Demo11).

The setup program should also have created a shortcut on your desktop. The easiest way to launch the demo is to double-click on that shortcut. This will launch the TRNSED

program (the stand-alone interface for the TRNSYS program) and open the H2Demo.trd file.

In case you do not have the shortcut or you prefer to remove it from your desktop, you can launch the demo by running the "trnsed.exe" program which was installed in the destination directory (e.g. C:\H2Demo11). Once Trnsed is launched, you should click on OK to close the welcome window, then go to File/Open and select the "H2Demo.trd" File that was created in your destination directory.

What is TRNSYS? What is TRNSEd?

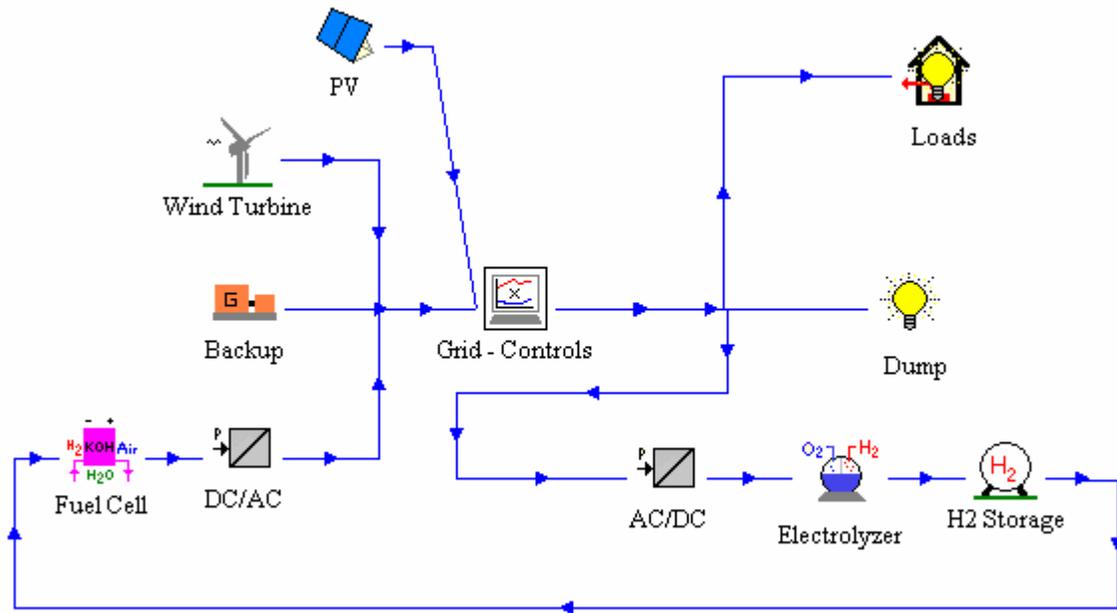
TRNSYS ('tran-sis') is a TRaNsient Systems Simulation program with a modular structure. It recognizes a system description language in which the user specifies the components that constitute the system and the manner in which they are connected. The TRNSYS library includes many of the components commonly found in thermal and electrical energy systems, as well as component routines to handle input of weather data or other time-dependent forcing functions and output of simulation results. The modular nature of TRNSYS gives the program tremendous flexibility, and facilitates the addition to the program of mathematical models not included in the standard TRNSYS library. TRNSYS is well suited to detailed analyses of any system whose behaviour is dependent on the passage of time. TRNSYS has become reference software for researchers and engineers around the world. Main applications include: solar systems (solar thermal and photovoltaic systems), low energy buildings and HVAC systems, renewable energy systems, cogeneration, fuel cells. For more information, please visit the [TRNSYS website](#).

TRNSEd is a stand-alone visual interface for TRNSYS. It can be freely redistributed and allows TRNSYS users to share their work with other persons who do not own a TRNSYS license or who do not understand all the details involved in a simulation.

Uninstalling the Demo

If you wish to uninstall the program, you can do so by using the "Add/Remove Program" feature in Windows (Go to Settings/Control Panel). This Demo is listed as 'PV-Wind-Hydrogen Power System demo (Ver 1.1)'

Simulated System



The Renewable Electricity is produced by a [Photovoltaic \(PV\) Array](#) and a [Wind Turbine](#) (or WECS, Wind Energy Conversion System).

Energy storage is realized using Hydrogen, which is produced by an [electrolyzer](#) and converted back to electricity by an [Alkaline Fuel Cell](#) (AFC). That energy storage allows decoupling the load from the electricity generation to some extent in this stand-alone system.

Auxiliary energy is provided by [backup diesel generators](#) (or DEGS, Diesel Engine Generator Sets).

Other simulation components are Controls, Power Conversion Devices and Utility Components (Weather Data, Solar Radiation Processor, Load, Dump, etc.).

Simulation Parameters

The TRNSYS models are often very detailed and require some technical knowledge to modify their parameters. The aim of this TRNSED application is to allow users to modify a

few global parameters (system location, yearly load, rated power of the different components) in order to get a feeling on how the system works without having to understand the detailed models. The detail level of required parameters can be adapted to the intended user of the simulation. The Wind Turbine selection among commercially available models illustrates an interesting option: users can run a simulation with a detailed model without having to enter all the parameters.

Simulation outputs

The main simulation results are plotted during the simulation, and two output files are also created (H2Demo.ou1 and H2Demo.ou2). Moreover, the most important results are printed to an HTML document by a post processing program. They are accessed by clicking on the "View simulation Results" picture at the bottom of the TRNSED window. For more details, see the "[Viewing and Interpreting Results](#)" section of this document.

Setting Up a Simulation and Getting Detailed Help

The simulations are set up entirely from the main input screen. In that screen, you will notice that there are certain types of input fields. In numerical value fields, you will type the value of a certain parameter, say the yearly electric load, or the slope of the PV array. TRNSED will try to detect if a parameter that you have typed is out of range and warn you accordingly. In a pull down field, you are asked to select an option from a list, for example the manufacturer and model of a wind turbine. The final type of input field is a check box in which you are also asked to select an option.

Getting Detailed Help

Most of the parameter groups (a set of inputs enclosed in a box) are set up with an associated help file. To get help on a given parameter, click on the question mark icon at the top of that group and your internet browser (e.g. Netscape, Internet Explorer, etc.) will launch, displaying additional information about all the parameters in the group.

Launching a Simulation

To launch a simulation, select "Calculate" from the TRNSYS menu at the top of the screen or press the F8 key. After a moment, an online display of system variables will pop up and your simulation will begin to run. At the end of the simulation, a message will pop up saying that calculations have completed, do you wish to exit the online plotter. If you click yes, the program will revert back to its input screen. If you click no, the online plotter will stay visible until you select "Exit Online Plotter" from the "Calculations" menu at the top left of the screen. Information on viewing and interpreting results is included in the "[Viewing and Interpreting Results](#)" section of this document.

Viewing and Interpreting Results

There are a few different ways that you can see results from a TRNSYS simulation.

Using the online plotter

Once a simulation has completed, you can click "No" when asked whether you want to exit the online plotter. With the online plot still displayed, hold down the shift key and move the mouse back and forth and the names of the displayed variables (at the top of the plot) will be replaced by their values. If the plot is too complex, you can "switch off" variables from the display by clicking on their names. You will notice that some variables are switched off in the default configuration to make the plot more readable. They are greyed out on the display. Just click on a variable name to activate it again.

You can also zoom in the plots by selecting a rectangular area with the mouse (click on the plot to select the upper left corner and then drag to define the rectangle. The zoom window is created when you release the mouse button). In the zoom window, you can display the value of all variables for a given time by pressing shift and moving the mouse. If you click on an axis (time, left or right axis) a control box will popup where you can modify the axis limits.

You can also change the background color of the plot between black and white using the "Plot Options" menu.

Viewing the HTML output file

The second way of looking at results is that certain variables are integrated and reported monthly and over the entire simulation length. These results are deposited in an HTML file that can be accessed by clicking on the "View Results" picture at the bottom of the TRNSED window. The file is named Results.htm and is located in the destination directory that you selected to install the program.

Additional output files

The hourly values plotted in the "instantaneous plot" and the "average plot" are also printed to text files (respectively H2Demo.ou1 and H2Demo.ou2, located in the destination directory). You can import those text files in any post-processing program for further analysis.

Troubleshooting the simulation

If ever you run a simulation and TRNSYS encounters a problem, it will display the message that "an error was found in the deck, please check the listing file for more information." The deck is the TRNSYS input file and the listing file (H2Demo.lst) is generated every time the TRNSED demo is run. There is a large amount of complex information in the listing file but the actual errors that caused the simulation to stop are likely to be printed at the very end of the file.

Most errors come from bad parameters or bad a parameter combination. You can try to solve the problem by reverting the last parameter change you made. If everything else fails, you can replace your H2Demo.trd file with a fresh copy of the H2Demo-Default.bak, which is included in the destination directory. You can click on the "Getting Errors" picture at the bottom of the TRNSED window for [more information on TRNSYS errors in this Demo](#).

Contact Information

For more information, please contact the TRNSYS coordinator at the Solar Energy Lab, UW-Madison.

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This demo uses the HYDROGEMS Library, developed by Øystein Ulleberg for IFE (Institute For Energy technology, Norway). See www.hydrogems.no for more information