

## INTRODUCTION

**P**ower\_system Online\_simulation Unveil Your Analysis (POUYA) is an amazing way to unveil your analysis through simulation. POUYA is indeed a power system Real Time simulator, designed to easily be used for power system operating, designing, planning, and training. It is highly interactive and developed in closed co-operation with the electrical industry. POUYA has the power for engineering analysis of any network based on phasor transient stability calculation, but it is also so interactive and graphical that it can be used by any non-technical audiences. It is also the fastest simulator you can find around.

POUYA can also be used to connect to the real world and controls the real power system through well-known Lab View software<sup>1</sup> (needs license).

Besides POUYA simulate the whole power system distributed in multi platforms even through Internet connection. In this way a Global network simulation would be possible,

Most power system analysis software available today was designed for one CPU, either on a desk computer or a server in control (data) center. There are major advances in computer hardware architecture that provides a scalable virtual hardware environment with a set of networked computers. Each machine might have multiple multi-core CPUs.

The goal of Mutiprocessor grid computing solution is to provide a foundation for creating computational grids to perform computation-intensive power system simulation in parallel using conventional, inexpensive computers in a local area network (LAN) or through Internet connection with minimum administration overhead (needs license).

The user can control the simulation process by the menu options using mouse and/or the keyboard. For example a generator mechanical power can be increased or decreased by just clicking the mouse on generator symbol.

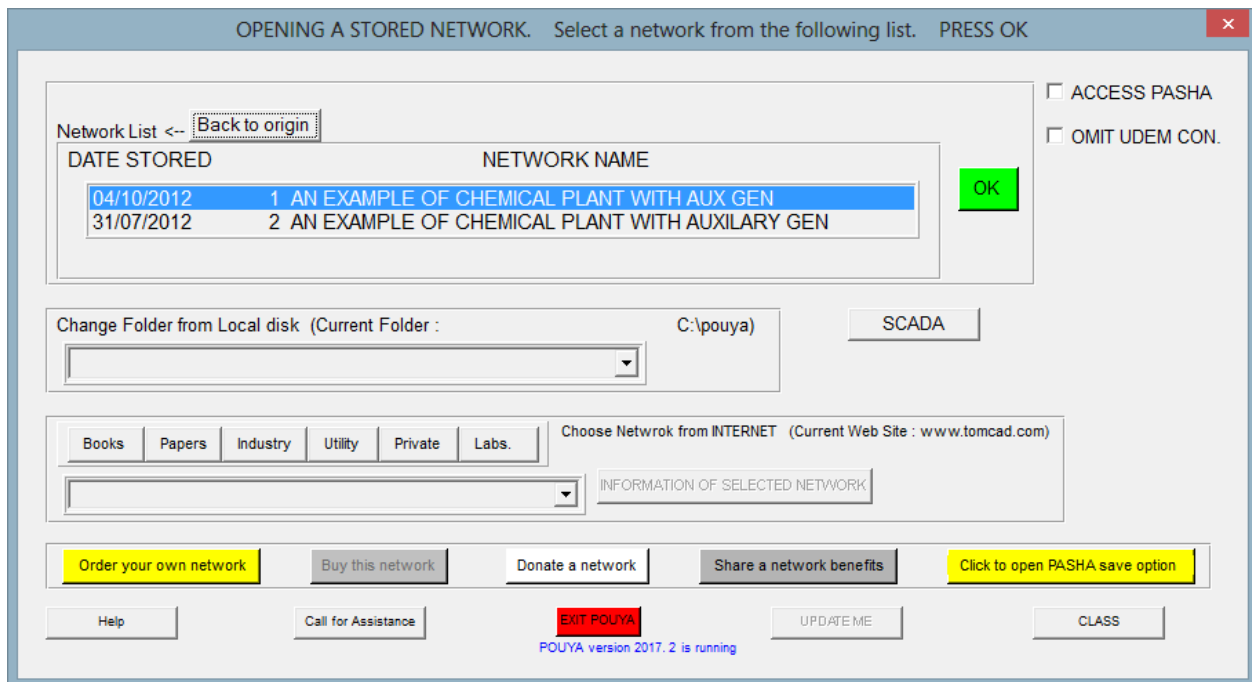
A quick user guide is provided in this document; however, the software usage is so easy that this quick guide will get you all the options available.

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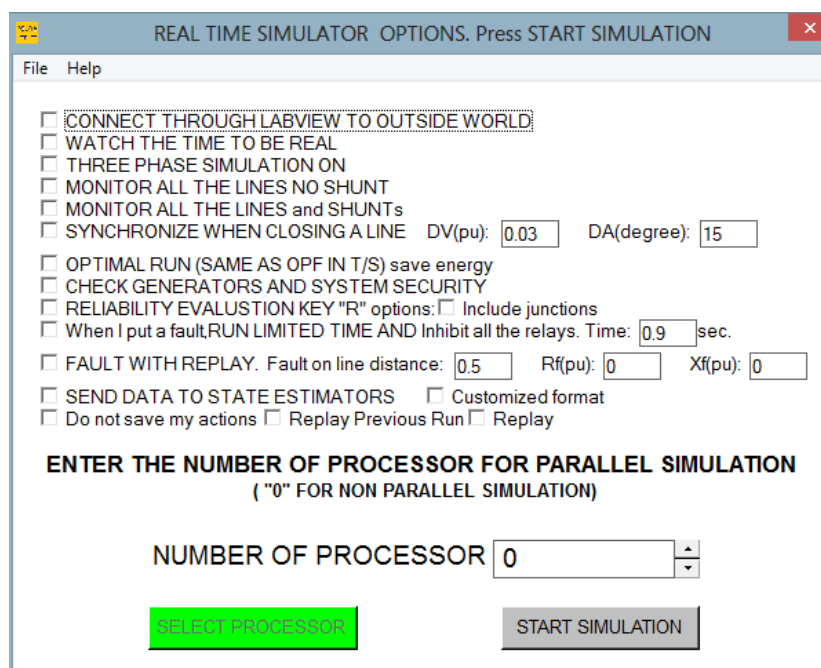
<sup>1</sup> Lab view is a trademark of National Instrument.

# RUNNING POUYA

Clicking on this ICON will bring you to POUYA world. The first menu selects the power system network you wish to simulate. Choose one of them and press OK. Beginners just click OK.



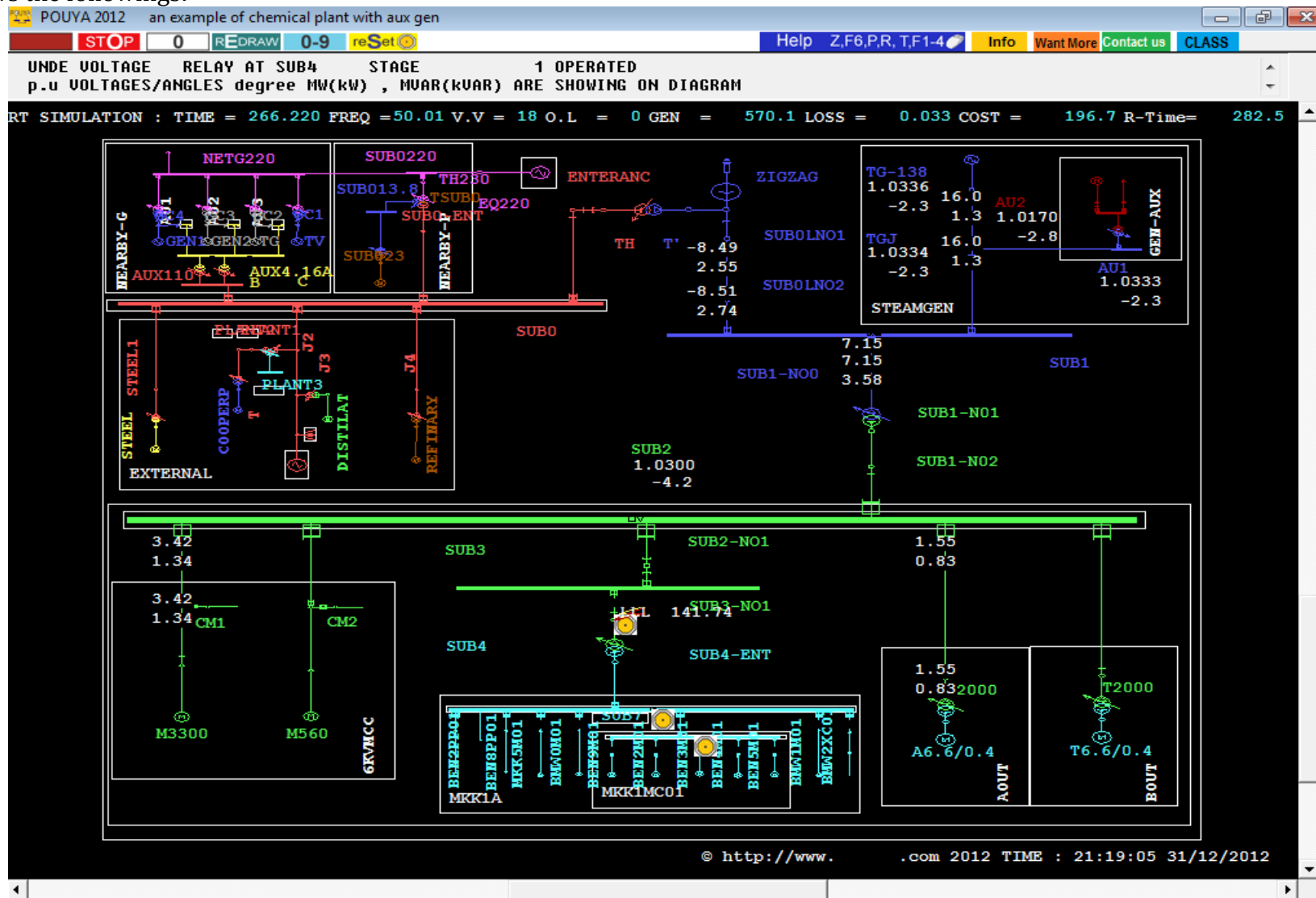
After that another menu that contains the simulation options will appear. This is shown below; beginners just click START SIMULATION. For class option refer to student manual or teacher manual as appropriate.



Please also visit the following for CONNECT THROUGH LABVIEW TO OUTSIDE WORD option <https://www.tomcad.ca/man1/LAB0.pdf>

The simulation shows the followings:

- 1 →
- 2 →
- 3 →



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1. Network title appears in the top bar.

2. Graphical menu symbols appear in the menu bar.

3. Message bar shows any events during the simulation run. The information about the simulation e.g. a trip of a relay will also be appearing here during the simulation run.

Graphic area shows the Single Line Diagram (the symbol used are described latter in this document) together with the simulation results. The magnitude of voltage and the voltage angle are shown under the busbar or junction names. The sending and receiving MW/KW and MVAR/KW flows are shown in the vicinity of the lines or transformers.

**Simulation variables:**

**Simulation Time:** The time that the simulator has passed from the start of simulation

**FREQ:** The frequency of one of the generator of the network. Key F can be used to change it.

**V.V:** The number of Voltage Violated (VV) busbars. VV is defined outside 0.95-1.05 pu

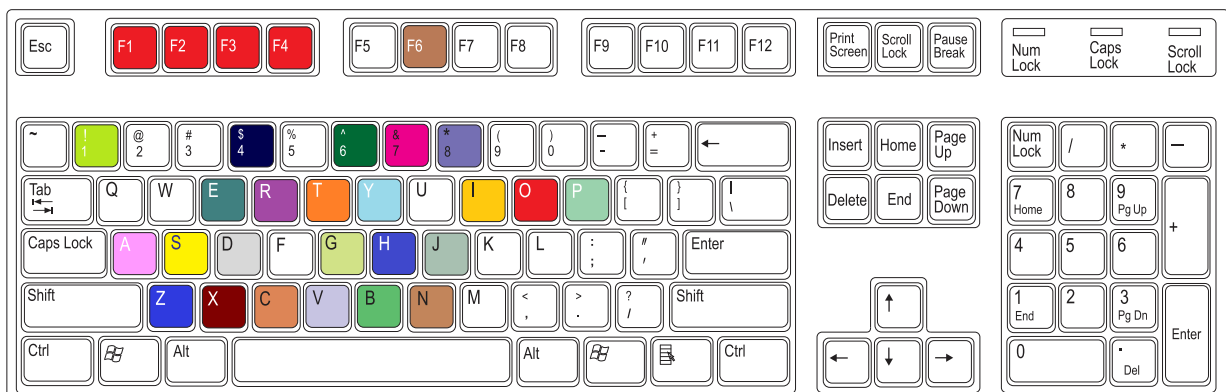
**O.L:** The number of overload lines. **GEN:** Total generation in the network in MW.

**Loss:** Total loss of the network. **Cost:** Total generation cost.

**Real time:** The actual time elapsed from the start of simulation. In order you can have Real Time simulation; your computer must be capable of running the network such that the simulation time passed is more than the real time passed.

**Control of the simulation**

The simulation continues but takes order from the user through mouse keys or keyboard keys. The Following Keys can be used during the simulation run:



**Z**ooming in a window; Window is an area of the network shown on single line diagram inside a box. The user can zoom in the area just by pressing this key. All the networks are surrounded with a big window. Pressing the z key outside the area

that is zoomed indeed will zoom in the outside area. In this way the user can zoom in or zoom out in single line diagram and focus on the interested area.



**O**n generator Transfer and shows the UDEM FOR AVR, Governor, on bus bar shows UDEM load model e.g. SVC, on line shows UDEM line model e.g. TCSC. UDEM is stands for User Defined Equipment Modeling. In each network some models are represented in block diagram form by using UDEM. Please visit addition manual. <http://www.tomcad.ca/man1/daddm.pdf>

**O**n transformers turns off and on transformer on load tap changer.



**A**utomatic generation control in an area.



**O**n a line or bus bar will plot the variables of that line or Bus bar. The variables can be changed to: MW, MVAR, MVA. KA, and the Relays status for sending and receiving ends of the lines And/or Voltage "V", Voltage kV, Angle, MW, MVAR of the loads located on the bus bar and the frequency of the bus bars for substations. Pressing <P> on cost plots running cost of the plant.



**O**n a line reset the relays of that line if they have recently tripped.



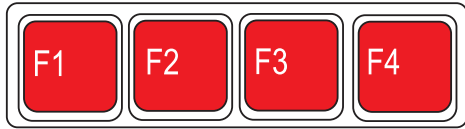
**S**hows the current flows in A or kA (instead of MW/MVAR flows);



**S**hows the MVA flows (instead of MW/MVAR flows) on single line diagram;



**S**hows the power MW/MVAR flows. If it is less than 0.9 it shows as kW/kVAr.



**I**n a bus bar or lines applies (or removes previously) faults. F1 is for three phase fault. The faults can also be applied inside the lines or inside machines and the equipment. Simultaneous faults can also be presented in the network. However, the latter two needs license.



**O**mits/recovers the monitoring of the results inside an area;



**P**ressing on a line containing distance relays, will show the phase and earth distance relay characteristic as well as their related curves in R-X axis. It also shows the trajectory of the real time passing currents on them if any.

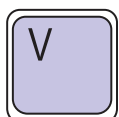
Pressing on a busbar or junction finds all the existing paths between that busbar and the sources; it also shows the overcurrent-fuse-MCCB-Thermal curves existing on that particular path. Please visit addition manual

<https://www.tomcad.ca/man1/daddm.pdf>

to find out more about the options available for these curves, and the current passing through the relays.



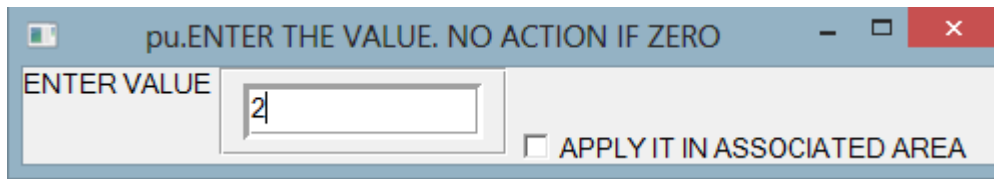
**P**ressing C will adjust the screen. It must be used by teacher when he is teaching on a class in order the student to see the entire diagram on their screen. Please refer to teacher-student manual.



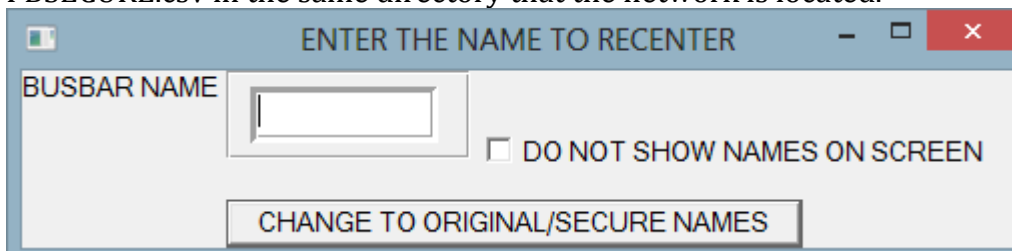
**P**ressing V will invite you to enter a value. The value entered will be replaced for the action you will do by clicking the mouse left or right click. For example Governor set point will be adjusted TO PROVIDE ENOUGH MECHANICAL POWER associated

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with this value. All the generators in an area can be adjusted to this value if you select APPLY IT IN ASSOCIATED AREA option.



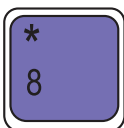
Pressing N will ask you a name. The busbar with the name you entered will be located at the center of the diagram. You can select to remove all the busbar names from screen. User defined secure names can also access by changing file named: PBSECURE.csv in the same directory that the network is located.



Pressing B will re-center the diagram to the previous location.



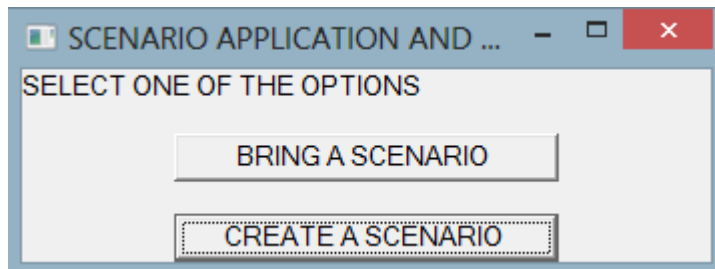
Shows the voltages of busbars in kV instead of p.u.



SOUND (BEEP) ON/OFF



Creates / Ends a scenario. Opening a predefined scenario is also possible.



**When pressed on a generator breaks all over-speeded generators in the network. This causes them to slow down faster. You need to press it many times if you wish to slow down over-speeded generators. Bear in mind that Governor Frequency set point should be set on a small value too.**

Mouse Usage:

Left Click	Right Click
<ol style="list-style-type: none"> <li>1. Left click on generator symbol (upward from center of generator Symbol) increase the mechanical power. If the generator has governor it increases the governor set point (reference) either it is defined in IEEE standards or UDEM.</li> <li>2. Left click on Induction Motor increases the Mechanical load of Motor.</li> <li>3. Left click on a line opens it up. If the line is out brings it in.</li> <li>4. Left click on intersection of a transformer increases the tap.</li> <li>5. Left click (downward from center of generator Symbol) increases the voltage for AVR.</li> <li>6. Left click (upward/downward from center of load Symbol) decreases the MW/MVAR.</li> <li>7. Left click on "simulation time=" increases minimum step size.</li> </ol>	<ol style="list-style-type: none"> <li>1. Right click decrease the Generator Mechanical power. Please also look at the message box to find out how much it increased or decreased.</li> <li>2. Right click on Induction Motor decreases the Mechanical load of Motor.</li> <li>3. Right click on intersection of a transformer decreases the tap.</li> <li>4. Right click (downward from center of generator Symbol) decreases the voltage for AVR.</li> <li>5. Right click (upward/downward from center of load Symbol) decreases the MW/MVAR.</li> <li>6. Drag right click to zoom in an area dragged.</li> <li>7. Right click on "simulation time=" decreases minimum step size.</li> <li>8. Right click on "COST=" optimize the running cost of your network (OTF=OPF)</li> <li>9. Right click on "V.V" shows Voltage Violated busbars and its options</li> <li>10. Right click on "O.L" shows over loads and its options</li> <li>11. Right click on "GEN" shows generation schedule and its options</li> <li>12. Right click on "LOAD" shows loss of the areas and their options</li> <li>13. Right click on RESET option test and coordinate the relays</li> </ol>



Mouse middle tab action is an informative click and will show additional information on message box:

- 1- Mouse middle tab will show additional information by clicking on line, transformer, load, generator, motor, area, and so.
- 2- If a line has a "TO BUSBARNAME" or "FROM BUSBARNAME" clicking the mouse tab while the pointer refer to the TO or FROM symbol refresh the diagram to the other side of a line.

## Main Menu Options

The main menu options are described in the followings:

**START**

Starts the simulation



Stops the simulation (Pressing Key **O** when the mouse is located in the graphic area does the same).



Inhibit Position of start/stop keys;

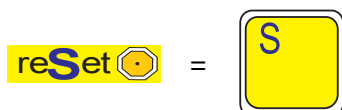


If pressed whenever a UDEM is on screen it will be back to the network simulation process;

Otherwise exits from the simulation and goes to the starting menu to retrieve a network from file or exit from POUYA. Pressing key **X** will do the same.



Erase and redraw the graphics in single line diagram;



Resets all the relays that are actuated during the simulation;



Pressing this icon omits the monitoring of the results on the screen;

**0-9**

Pressing this icon will bring again the monitoring results;



Whites the background;



Blacks the background.;



Brings this document and describes the keys;



Brings the data of the power system network that is under simulation;

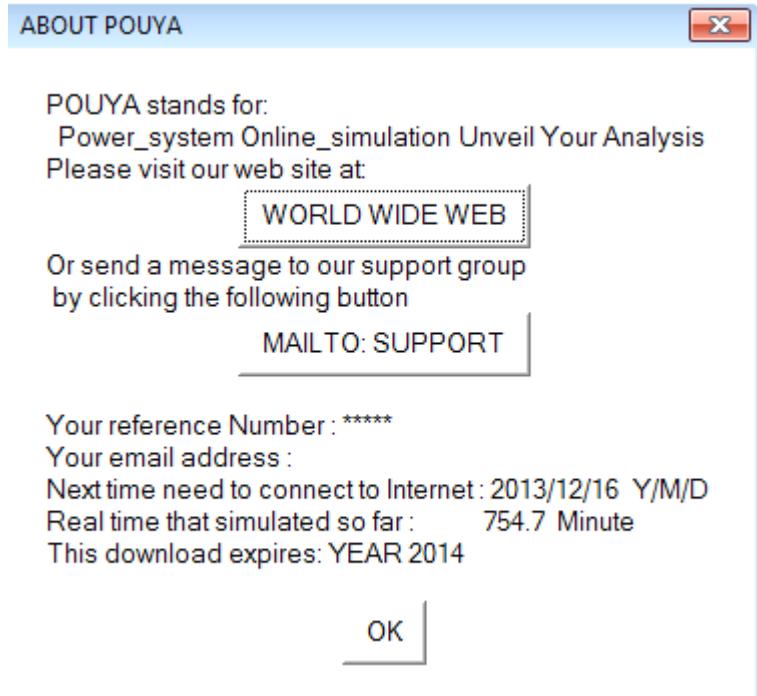
**Want More**

Redirects you to a web site where you may ask for more options. For example you may browse a file and send it to us. You must fill the file with your own network data in order us to put your network in POUYA for the simulation;















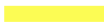










**PAUSE**

Pause the simulation at the instant of time you have pressed;

**Contact us**



## Single Line Graphical symbols

	380 kV Lev		Generator
	220 kV Lev		Syn. Motor
	110 kV Lev		Induction Motor
	30 kV Lev		Load
	20 kV Lev		Circuit Breaker
	13.8 kV Lev		M.C.C.B.
	6.6 kV Lev		Fuse
	4.16 kV Lev		Thermal-Fuse-Conductor
	400 V Lev		Phase Over Current (Over Load) Relays
	JUNCTION		Earth Over Current Relays
	TRANSFORMER		Distance Relays
	CABLE/TRANSMISSION LINE		Area
	OPEN		



**S**hows the trip of the circuit breaker or opening a line;



**S**hows the circuit breaker tripped but has been blown up;



**S**how the relay is tripped and so needs resetting.

**PASHA** access will lead you to PASHA tools, including load flow, faults, transient stability, harmonic analysis and filter design, reliability analysis, EMTP .dat file provider, three phase transient stability, frequency dynamic analysis, and many more features that it is 40 years working on PASHA.

If you have a large scale network and UDEM has been used for its controllers this will slow down the simulation speed. Select to omit UDEM controller and use traditional equivalent controllers by just selecting OMIT UDEM CON. option. This will use the equivalent of those UDEM models that can be converted to traditional equivalent. PSSs are exception.

## Other Guides:

1-Additional information for solar PV networks:

<https://www.tomcad.ca/man1/SOLARguide.pdf>

2- Class entering and testing guide:

<https://www.tomcad.ca/man1/CLASS1.pdf>

And,

<https://www.tomcad.ca/man1/CLASSentry.pdf>