

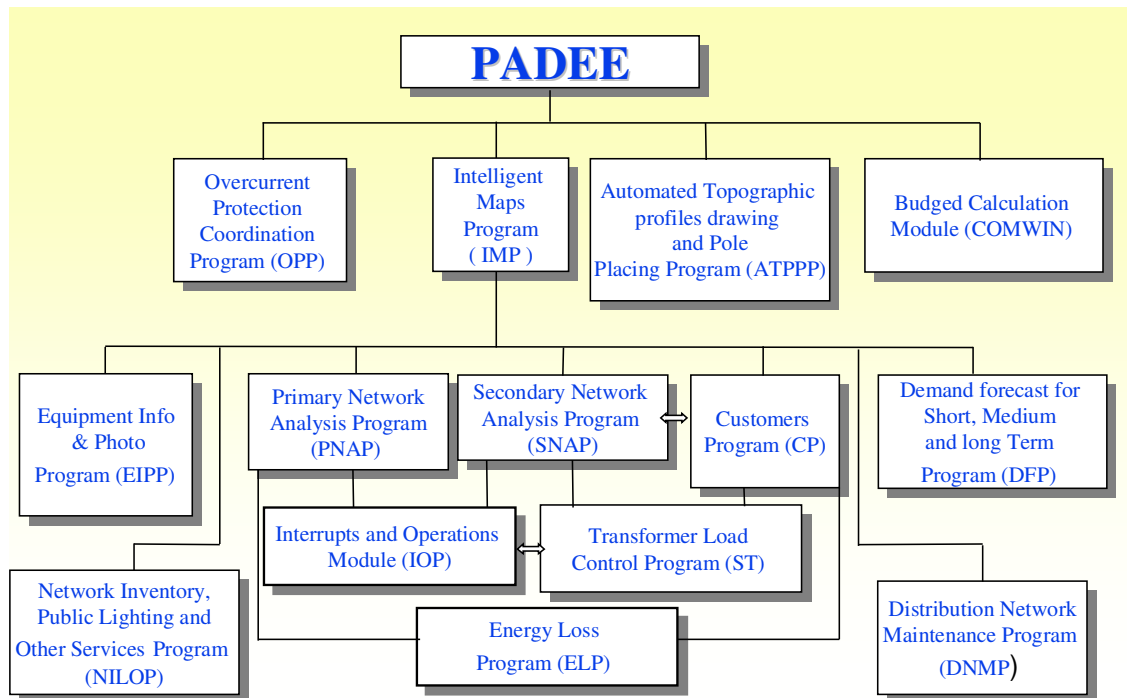
PADEE Electric Power Distribution Network Analysis, Design and planning in low and medium voltage based on CAD-CAE-GIS

This Tool is for Designing, Planning, Operation, Maintenance and Loss Reduction in distribution networks feeders, it is mostly used by utilities and consultants who work in Electric Power Distribution Systems. It connects the medium voltage, Low voltage and Customers systems under integrated and common software.

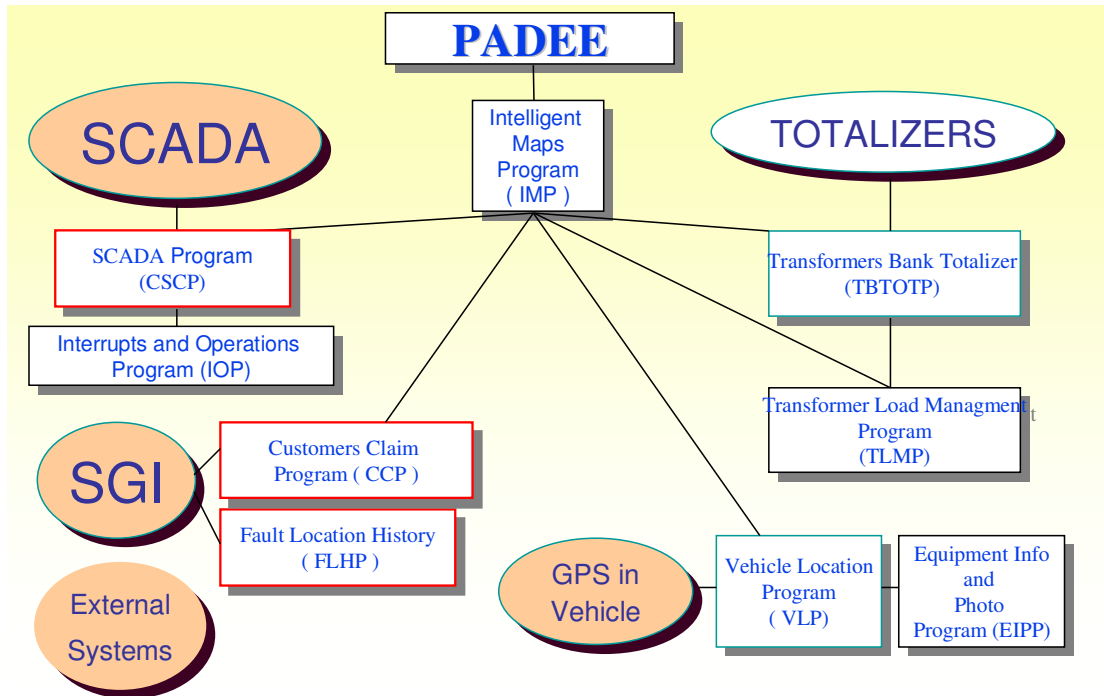
This Software takes the electric data directly from distribution networks maps in Autocad and analyzes them (running a load flow analysis), placing the results directly on maps automatically and interactively.

Power Distribution Networks Program (PADEE 2011) is software with AUTOCAD Front – End, over Windows XP and Vista or WIN 7 to perform load flow calculations, analysis on electric distribution networks. It is also an information system to support works and Customer location and behavior. Use CAD - CAE (Computer Aid Design) – (Computer Aid Engineering) and GIS (Geographic Information System), technology so all activities are carried out graphically, inside the street and electric feeder map in AUTOCAD. Inputs for calculations are taken automatically and the output is presented over the map, with color graphics or signs that highlight the most relevant aspects of the analysis. The detailed results can be printed out. This software make load flow calculations in medium and low voltages systems, and link customers directly to medium voltage substation, so customers can be located geographically and get it feeder or substation in forward or backward queries.

The next figure is present PADEE basic modules.



There are some other higher end modules that require custom made interfaces for each individual Utility, which must be "customize" at additional cost. These modules are shown in the following figure.



All these packages or modules are described below:

- **Intelligent Maps Program (IMP)**, contains standards for making maps drawing. These programs help users to draw maps systematically and standardized making easy to analysis program to obtain the input data in an automatically way. It consists of automated libraries, aids to maps drawing and user's manuals. It introduce data to later use GIS technology and easily location of every network elements
- **Primary Network Analysis Programs (PNAP)**, it calculates voltage drop, losses, short circuit levels and reactive compensation optimization on medium voltage feeders. It has intelligent algorithms to build the topology of the circuit based on the graphic conventions or drawing standards without the intervention of users.
- **Secondary Network Analysis Program (SNAP)**, it also makes calculations of voltage drop, losses and load flow but for low-voltage distribution network. It also creates additional files for link the customers affected by the disruption of service with a distribution transformer bank outage, parts off feeder or complete feeder outages

- **Customers Program (CP)**, allows the connection of customers or subscribers to the structures of the electrical system, allowing obtaining the billing data (energy sold) located at each point in the grid. It also works as an information system to support the customer's location (applications and claims) and / or routes of meter reading collection, analysis and characterization of energy consumption by loading type zones, and others. Use ActiveX script and linking to the ODBC customer database.
- **Transformer Load Control Program (TLMP)** has dual function, one is summation of energy served by a transformer bank then the totalized energy is converted into demand and get load levels vs the maximum capacity, resulting in an important distribution transformers loading monitoring (TLM) in banks that have no other measurement.
The other function is let the engineers input a demand measures recorded in the field to verify or establish the conversion factor energy-demand. This option allows a very important analysis for the detection of non-technical energy losses, because compare the billed energy with the theoretical energy dispatched by the transformer bank.
- **Equipment Information and Photo Program (EIPP):** This module allows link any maps element to any multimedia file. For example photos of equipment, measured records, thermo vision videos, diagrams or details, other one-line diagram in other Autocad files, etc. It also brings Google maps get view of customers serves by the network.
- **Demand Forecast for Short, Medium and long Term Program (DFP)** This module helps demand forecast for the grid. Takes the load of regular areas, totalize the demand for distribution transformers of each regular area and produce an Excel file with the loads. The load for each regular area are processed with Excel using whatever mathematical analysis of demand forecasting you prefer, then performs the reverse process... After the mathematical analysis produce the forecast results, the values are incorporated into the network, for each regular area in proportion to the installed capacity.
The Users Manual presents a typical example using "Land Use Based methodology" to calculate demand forecast, but users can developed other methods with the help of this module.
The resulting demand file per regular area can be read by Microsoft Excel or another spreadsheet, allowing the user to perform any calculation or using any kind of extrapolation formulas.
- **Overcurrent Protection Coordination Program (OPP)** This module is a tool to draw log-log curves for overcurrent protections coordination. Contains a series of data curves of multiple relays and fuses used for overcurrent coordination, plus the electronic relays. It has special help tools easily make One-Line diagrams of the system associated with protection study through automated libraries of symbols, and also has simple short circuit levels calculations of the portion of the systems being study.
- **Automated Topographic profiles drawing and Pole Placing Program (ATPPP)**
Its function is to calculate and draw the topographic profile for power lines, it use the book's typesetter of the topographic survey and make the draw in autocad. It also

offers all the tools, such as catenaries curves for manual placing of poles or supports structures.

This module consists of several programs for each of the sub-activities performed: data capture module of the surveyor's book, module calculation of books, drawing module topographic profile, placement of structures, drawing catenaries, subscriber ID, Automatic Data Collection for the road location, and program for calculating weigh, medium a factitious span, sag and tension resulting from pole placing.

For more information visit <http://matmor.dyndns.org/padee/pptl.html>

- **Budged Calculation Module (COMWIN)** This system is based on a similar system made by the same author for CADAFE and its subsidiaries in 1985 and was upgraded for Windows and multi-user. The system helps budgets, analysis of unit prices, valuations of inventories of electrical works.
- **Interrupts and Operations Program (IOP):** This module simulates the transfer of loads when there is a maneuver in the network. It has the tools to quantify the interrupted load during an operation or maneuver and can identify exactly which subscribers are affected by an interruption. The system stores the outages and can provide the total time of interruption (TTI) or the total KWH interrupted. Presents the length of lines affected and interrupted installed KVA in distribution transformers affected.
- **Energy Loss program (ELP)** This module allows the detection of non-technical losses, making the comparison of the energy dispatched by feeders and billed energy. It presents various types of calculations and results depending on user needs, such as circuit losses for micro areas, macro areas, etc. Calculate total energy losses, taking into account the total energy imported to the system and the energy sold. It also produces a complete summary of network elements, such total of transformers, circuit length, etc.
- **Distribution Network Maintenance Program (DNMP)** This system keeps a record of all the maintenance work done or to be done. The statistics of work carried out in a period of time, can determine whether the maintenance work are becoming more frequent compared to earlier periods, and indicate the need for a massive change of some elements in the distribution system. The system allows the identification of planned maintenance work without need to be done.
- **Network Inventory, Public Lighting and Other Services Program (NILOP):** This module makes pole inventory database for the electric distribution network, improving the knowledge of the network and provision of purchase of components and materials. Additionally allows discriminate the supports being used by other utilities such as communication services, Cable Tv, lighting and advertising.
- **Connection with the SCADA Program (CSCP):** Performs the interface with the SCADA system, it can display in Autocad maps the remote network operations, indicating recloser operation and out of service transformer bank. It can also produce a history of operations and equipment states (open or closed) of reclosers. Need an existing SCADA system to interface with.

- **Transformers Bank Totalizer Program (TBTOTP):** This module works with energy meters installed on every transformer banks. During the meter reading cycle transformers are include in the reading route as any other customer, then are separated filtering the customer's database to produces an estimate load. Finally it calculates the Utilization Factor of each transformer. It is important for the visualization and information management to reduce losses.

PADEE takes advantage of the important and necessary work needed to keep Electric Distribution networks maps updated, and obtain the input data for load flow studies directly from these maps. The Maps constitute the main database for all the modules or subsystems, because either information or analysis data are taken automatically and directly from the maps as they just have all the information to perform electrical studies. Drawings are prepared with AutoCAD and GIS technology and the maps produce with PADEE can be plotted and interpreted by any personnel or any other software because is a standard way of presenting data of feeders maps. There are no hidden data.

As MAPS are the database that centralizes all the information, they should be standardized and developed under the drawing standard of the utility company, using aids or tools that CAD technology gives us. PADEE has these tools to make a correct use of "layers" and "blocks" of symbols. In addition to make ease standardization, CAD technology incorporates "intelligence" to provide all the information required by engineers to perform network analysis.

Information systems and analysis modules use these data obtained by examining the maps, and took the values and calculations results directly from the drawings prepared on CAD, giving a graphic capabilities such as geographic information system analysis and unmatched high capacity and calculations performed in a few second or minutes.

The hardware requirements are:

Description	Minimum Requirement	Recommended
Processor	Pentium IV 2.0 Ghz	Intel I7 860-3.0 GHz or better
RAM	512 Megabytes	3 Gigabytes or more
Hard Drive	80 Gigabytes	500 Gigabyte or more
Monitor and Video Card	XVGA, 17	XVGA, 19 or 21 inches
Mouse	Optical 3-button and wheel	Optical 3-button and wheel
Printer	Inkjet or laser	HP inkjet 600 dpi
Plotter	HP inkjet 600 dpi, Color	HP inkjet 600 dpi, Color
Windows	Windows XP or VISTA	Windows XP or Vista, Win 7 32 or 64 bits, Server 2003
Autocad	2004	2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2012
Video Resolution	1024 * 768 and 256 colors	1024 * 768 and 32-bit color
Internet Explorer	Version 6 onwards IE6	Version IE8 or IE9
Excel and Power Point, Microsoft Office	Version 98 or 2000 or Open Office	Version 2003 or newer

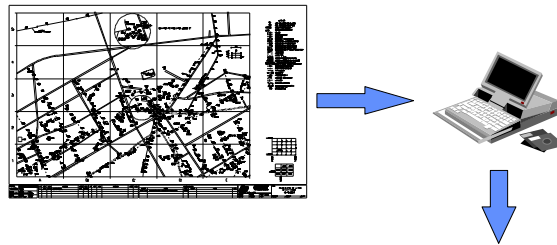
The version for Windows Server 2003 requires the corporative licensing

Installation on Windows XP SP3, Windows Server 2003 ⁽¹⁾ and Windows Vista, and Win 7, needs administrator privileges to enable the user to write on the Windows system directory, Windows registry and program folder. In all cases please download all critical updates from Microsoft®.

The hardware requirement are rule by AutoCAD drawings size, not because PADEE Software. Normally computer with Autocad software than can handle maps easily, will handle the PADEE software without problems.

As simple rule, you must use the AutoCAD version of according with the hardware performance, new Autocad Version needs more hardware requirements, but can it can manage bigger maps easily.

If the client wishes, the data can be exported, allowing compatibility with other Power Distribution analysis software.



- Sistemas de Información Geográficos
- Sistemas de Análisis
- Cómputos de Obra o Inventario

There has been enough pass evidence to think that PADEE can be ported to newer operating systems based on Windows. OPEN SOURCE, however, needs further development in applications interface to gain strength and a greater degree of standardization that can be easily applied in the electricity distribution companies.

Currently tests are being started to use ZWCAD that is CAD software with Open Source technology and lower price than Autocad, but processing time is about 4 times slower than autocad.

The retail price of PADEE per license is:

Module	\$ US
Intelligent Maps Program (IMP)	800.00
Primary Network Analysis Programs (PNAP)	1200.00
Secondary Network Analysis Program (SNAP)	800.00
Customers Program (CP)	650.00
Transformer Load Control Program (TLMP)	650.00

Equipment Information and Photo Program (EIPP)	650.00
Demand Forecast for Short, Medium and long Term Program (DFP)	650.00
Overcurrent Protection Coordination Program (OPP)	560.00
Automated Topographic profiles drawing and Pole Placing Module (ATPPP)	1600.00
Budged Calculation Module (COMWIN)	640.00
Interrupts and Operations Program (IOP)	1150.00
Distribution Network Maintenance Program (DNMP)	640.00
Network Inventory, Public Lighting and Other Services Program (NILOP):	640.00
Energy loss program (ELP):	640.00
Total	11.270.00

1 license 8,000.00 US \$ (Training Course is not included)

2 licenses 16,000.00 US \$ (include training Course in our office in Caracas)

10 licenses and more (Corporate version) 60,000.00 US \$ (include training course in our office or in client office without any additional cost). This license is required to install PADEE in a Virtual Server. (32 Hours)