have positive influence on the environment. In the nearest future they will prevent the emission of near 600,000 tons of carbon dioxide per year.[2].

References:
1. Солнечная башня [website]. URL: http://aenergy.ru/21/.
2. Solar thermal collector [website]. URL: http://en.wikipedia.org/wiki/Solar_thermal_collector/.
3. Solar thermal or coal for regional Australia? // Yes 2 Renewables [website]. URL: http://yes2renewables.org/2011/09/19/solar-thermal-or-coal-fo-regional-australia/.

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EUROSTAG: power system dynamic simulation for transient, mid and long term stability
National Research Tomsk Polytechnic University.

EUROSTAG® is a software developed by Tractebel Engineering GDF SUEZ and RTE for accurate and reliable simulations of power systems dynamics.

It is dedicated to the dynamic simulation of the power systems, and fulfils the following three basic requirements. First, a single software program to simulate fast and slow phenomena in a continuous way. Second, for any phenomenon, a performance at least equal to those of the specialized software programs. Third, faster and easier studies.

EUROSTAG is based upon a unique algorithm using a continuously and automatically varying integration step size, featuring:
− A unique program using unique modelling of processes for a whole range of applications,
− A continuous display for both fast and slow phenomena.

EUROSTAG integrates all power system components and actions necessary to produce an accurate and faithful dynamic simulation: Generators – Motors – Controllers – Protection devices – Control equipment.

The advanced dynamic functions of EUROSTAG allow for the full range of transient, mid and long-term stability to be covered thanks to a robust algorithm using an auto-adaptative integration stepsize. The differential and algebraic equations are solved simultaneously with a variable integration time step. The stepsize varies automatically according to the actual behavior of the system (typically from 1 ms to 100 s) in order to secure a constant accuracy of the calculation process. In fact, the truncation error is calculated at each step for the determination of the exact step length to be used.

Open to import and export data in various international formats, the software is also renowned for its flexibility. Indeed, the user can directly access a vast library of power system models or modify them using a flexible graphical modelling language.

Various manoeuvres and operations can be initiated at predetermined momenta or during the simulation by user intervention. This is made possible by the graphic monitoring of the changes of the system's main quantities.

EUROSTAG can read the data in international formats and can recover models and parameters used in older programs, allowing knowledge acquired with other tools to be saved. It goes further in result exploitation through export to specialized programs (Microsoft Office, Matlab).

The following operations can be carried out:

- opening and closing circuit breakers Seven if a separation or resynchronization occurs, the relevant phenomena being simulated);
- shutdown and start-up of generating units;
- shutdown and start-up of induction motors;
- switching loads and compensation means on and off;
- transformer tap-changer operations;
- changes in set-points of controllers.

In order to help you understand and analyse in depth all your critical system phenomena, EUROSTAG software embeds the following calculation tools:

- Load Flow computation: system analysis in normal steady-state situation, the starting step to any power system study.
- Application Program Interface (API): allows for the integration of the power of EUROSTAG dynamic simulation engine into an external process through Matlab, Python, C or C++ code.
- Critical clearing time calculation: automatic determination of the faults clearing times to avoid instabilities on power systems.
- Full-scope dynamic analysis: dynamic simulation of wide range of incidents, topological modifications or process commands happening in a power system.
- Eigenvalues computation and system linearization: entry points of small signal stability analysis, study of the behavior of the system subject to small fluctuations around an operating point.

In conclusion, with more than 25 years of continuous development, the pioneering dynamic analysis tool EUROSTAG presents the following features:

− *Efficient and powerful algorithm*, able to manage large power systems and enable the simulation of extended scenarios thanks to an auto-adaptive integration stepsize
− *Wide range of applications*, allowing users to solve conventional but also highly complex power system problems (black-out scenarios, voltage collapse…)
− *Flexible and secure modeling*, thanks to its unique editors: File Editor, Model Editor, Network Editor
− *Advanced post-processing*, for both interpretation of results and the editing of reports
− *Open software*, permitting the import and export of various data from international formats
− *Reliable simulations*, due to daily use and continuous improvement over 25 years by world class experts

References:
1. Stubbe M., Bihain A., Deuse J., Baader J.C. STAG. A unified software program for the study of the dynamic behaviour of electrical power systems (IEEE Transactions on Power Systems. Volume 4 №1, February 1989).
2. Bornard P., Meyer B., Stubbe M., Antoine J.P. EUROSTAG, a major step in power systems simulation. (ХЕКЕ. Rio de Janeiro meeting -Brazil 1991).
3. URL: http://www.ntcees.ru/departments/nio_3/eurostag.php

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