Clean Energy from vegetable oil

A rapeseed plantation, together with other natural sources (Sunflower, palm or soya) produce vegetable oil utilized as fuel to produce 'clean' electric power.

Electricity and thermal energy from renewable sources is an ever increasing necessity. Powertron proposes solutions based on generators powered by vegetable oil.

Inside the cabin of a 100 kW electric-thermal energy production generator designed by Powertron. The system works on an average of 650 hours/month continuously.

POWERTRON Engineering is conceived from an enthusiastic team of engineers with consolidated experience in the Renewable Energy sector.
POWERTRON Engineering's mission is to provide turnkey solutions in realizing electric power stations powered by vegetable oil. The company is currently working together with the Cambridge University (UK) in researching and developing innovative technological solutions for increasing vegetable oil powered station performances based on the conviction that one of the main challenges that the mankind face in the third millennium is the increasing demand for alternative energy solutions that do not pollute or harm the environment or health of its inhabitants.
In this context the European Commission has issued a specific Act targeted at encouraging energy saving and using renewable sources (non-fossil) to produce it, such as wind, solar, geothermal, hydrothermal ocean energy, hydropower, biomass, landfill gas, gas waste from sewage treatment and biogas.
The EU has set a target of 20% increase by 2020 on the following 'Energy Packet' issues:

1. Energy Saving
2. Renewable source usage
3. Emission reductions

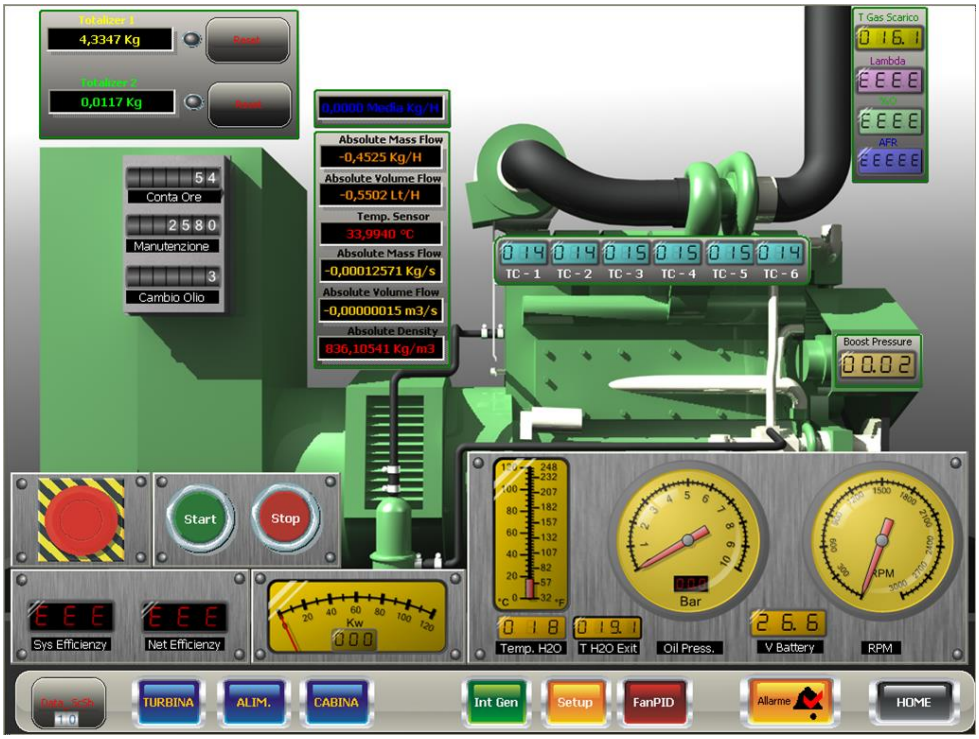
The UE State members have self imposed this as their "20/20/20 target" as part of the European 2020 strategy, promoting incentives for sustainable energy produced from renewable sources. In Italy in narrowing the field to power plants fueled by biomass and specifically vegetable oils, the Ministerial Decree of 18th December 2008, subsequently amended by Decree 1195, imposes the incentive for an all-inclusive feed-in tariff obliging the GSE (Energy Service Company) to purchase produced energy.

Why use Vegetable Oil?
Rapeseed oil is a vegetable product extracted from the rape plant (light yellow flowers), which grows to a height of one and a half meters. While the use of biofuel in cars has been complicated by technical and legal issues, in a power plant fueled by rapeseed oil, the situation is a different story and is extremely beneficial. Rapeseed oil cost less than half the price of diesel and petrol and creates 98 percent less pollution.
These factors are particularly interesting when linked to cogeneration engines that produce electric and thermal energy, directly injected with this "Ecofriendly" fuel source.
In fact as a burnt combustible byproduct, it is 100% renewable and therefore completely compliant to the Kyoto protocol and qualified CO2 carbon dioxide emission limitations and reduction objectives. In the diverse world of renewable energy, vegetable oil cogeneration systems have the lowest investment costs per KW / h installed and area occupied.
When compared to solar energy systems with the

same annual power output, it costs ten times less and occupies hundred times less space. Vegetable oil systems are therefore easy to install, do not create space, noise and odor problems or any other disturbances usually created by other types of renewable energy sources.
This does not mean that other renewable energy resources are less worthy, on the contrary it means that when evaluating such systems many factors need to be considered such as environmental, geographical or incentive programs.
Today, interest in process control and the use of vegetable oil is constantly on the increase. According to recent studies, vegetable oil can guarantee higher performances than biofuel at the same renewable fuel level. In addition, the agricultural sector can benefit by launching a new crop industry by exploiting crop rotations especially with corn. Soil left to stand between each crop cycle can be used to cultivate rapeseed which is all put to good use without causing waste. It has already been calculated that each acre of land cultivated with rapeseed can produce an equivalent of two thousand litres of fuel oil, an oil farm without waste and pollution costing less than diesel oil. In fact, the green part of the plant is used by the livestock feed industry while extracted oil content is taken to power station and converted into energy.
Carbon dioxide emissions are absorbed during plant growth thus no pollution is created.

Vegetable oil power stations

A Vegetable oil power station is a plant which generates electricity based on diesel reciprocating engines, designed to run on biomass liquid (vegetable oil).
The vegetable oil power station, as any other cogeneration plant, produces electric and thermal energy simultaneously. Thermal energy is created by a recycled water process using heat dissipation exchangers (radiators) and therefore does not need additional costs. The electric energy produced, can be fed into the power grid to profit on the all inclusive fifteen year incentive tariffs or alternatively using the green certificate scheme based on plant size and biomass type used.
A very small part of thermal energy is used for the plant's vital cycle process whereas the remaining part can be used in civil or industrial heating systems or in any other application that requires conventional heating obtained from water heated to about 80 °C.



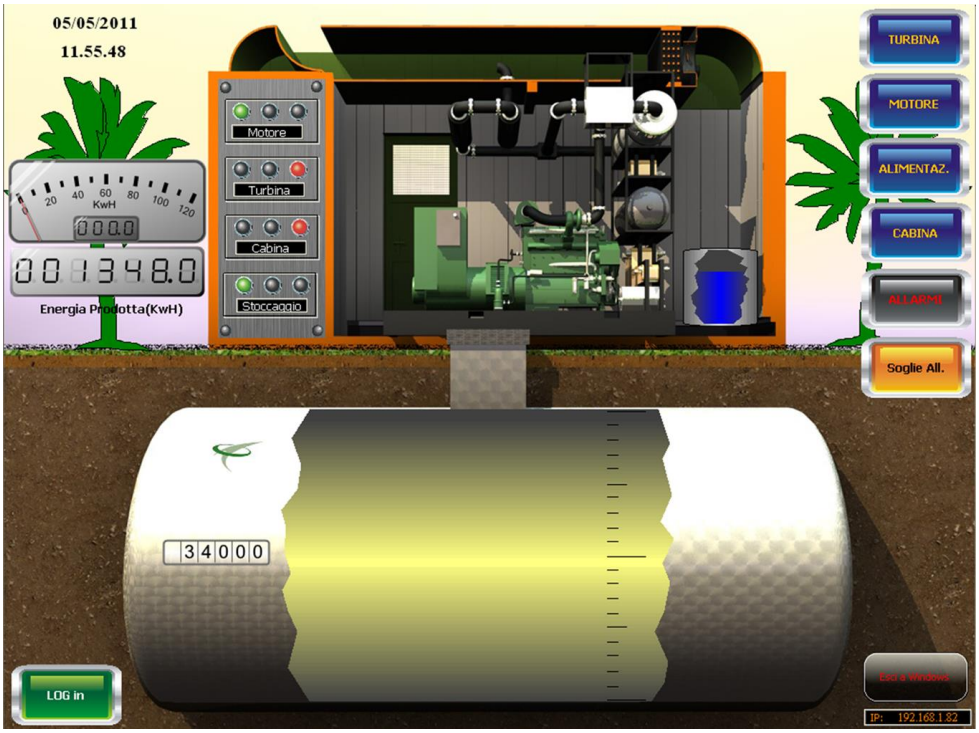
A graphical screen page from the Movicon supervision system. The supervisory system at the production center contains clear and intuitive visualization of all the working parameters.

The system setup by Powertron has a group of electric-thermal power generators equipped with all the characteristics needed to exploit the classifications of power stations run on renewable sources. The nominal power is 100 Kw continually working at an average of 650 h per month. The reduced sizes of the containers united with SuperSilent technology make this generator highly suitable for installing in residential areas as well as rural farming complexes, offices, homes, hotels, etc. This generator is composed of a container which houses:

- Electric power generators
- Fuel tank
- ORC heat recovery turbine system
- Coolers
- Oil treatment system
- Control panel with PC supervision

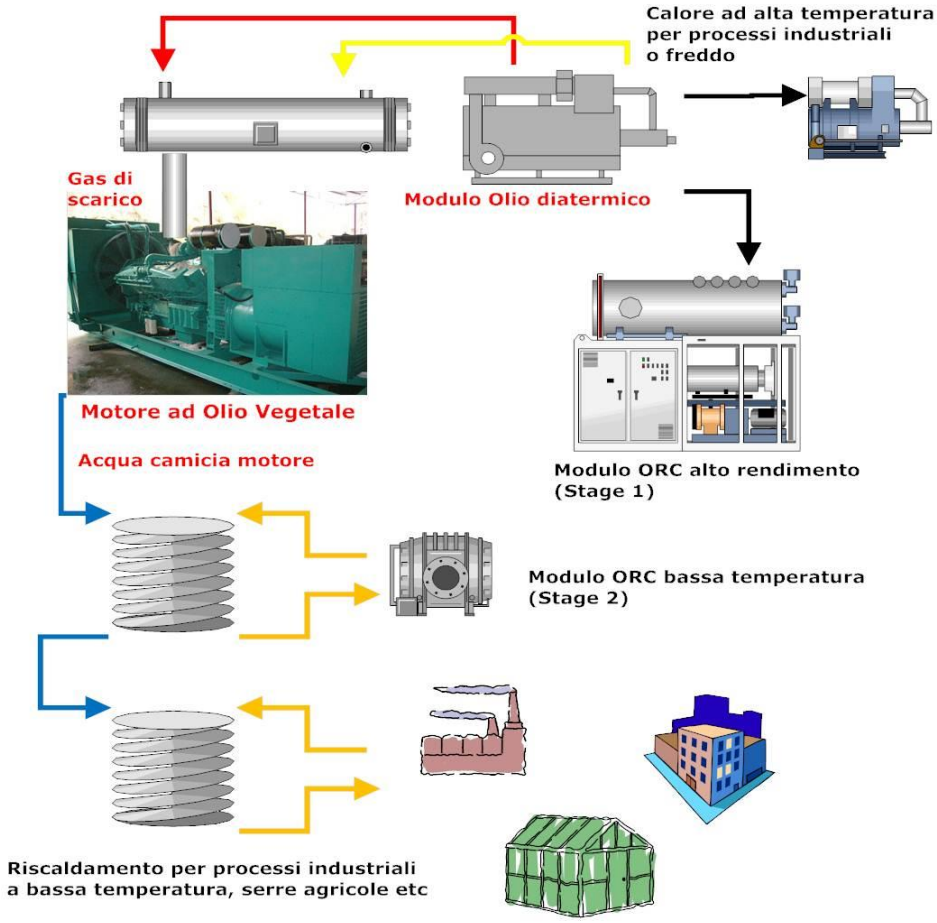
A vegetable oil tank is included with the power production generator's service which provides 50 days of power autonomy with a calculated seven refuels a year. This tank can also be hidden underground to save space and improve visual impact. Complete with provisions for Supervision and Control room use, screen graphics representing the different working areas are used for user interfacing the plant system to control, monitor all situations and obtaining reports on energy produced and consumed. Clients can access this interface using ADSL connections consenting to a full remote control service.

This generator has been designed to work parallel with the ENEL power grid but can also be regulated to work in "island" mode on request.



By means using the supervision system the user an manage and control the system both locally and over the internet, thanks to the Movicon Web Client technology.

How the Generator works. The power generator in question works according to a power generator injected with treated vegetable oil. When in activation mode, through a series of sequences autonomously managed in automatic, it connects to the national power grid and starts producing energy. The sequence consists of a series of compulsory phases in order to reach the correct power set point which is gradually increased when the synchronization operations have terminated successfully avoiding the need of excessive power from the internal combustion engine in conditions where the coolant and lubricating temperatures are too low. When the generator is deactivated, contrary to the activation conditions, the system gradually lowers power output and when nearly reaching zero, disconnects from the grid and switches into Stop mode. In this particular situation the generator is left running for at least another three minutes without any power load so that it can cool down and allow the diesel fuel, which is automatically used at this stage instead of the vegetable oil, to clean the entire fuel system.
Diesel fuel is automatically taken when needed from a tank situated underneath the power generator and is refueled when needed.



Control system Architecure
The system architecture includes a PC station based on Windows XP or Windows 7, in which the Movicon 11 supervisor has been installed to which Control and monitoring subsystems have been connected, comprising of a Rockwell PLC and distributed IO-Point I/O systems, as well as PowerFlex inverters, connected by means of the Movicon native EtherNet IP driver. Other engine control peripherals, power production meters are connected to a sub-network Modbus along with the Coriolis effect sensors to control fuel consumptions. The operator has complete system access from supervisor located on the main panel, by viewing and controlling how the whole system is running using intuitive and easy-to-use video page graphics. By navigating through the different screen pages, the operator and maintenance worker can display and control all system information and alarms both directly from the local Movicon supervision station and remote control stations, such as:
- Left and right combustion engine chambers
-Coolant liquid temperatures
-Lubricating liquid temperatures
- Injection fuel pump intake temperature
- Ignition battery voltage
- Lubricating liquid pressure
- Differential fuel filter pressure

- Engine RPM
- Instantaneous power grid transmission
- Three phase BT currents
- Three phrase F-F pressures
- Instantaenous Power Factor
- Network frequency
- Power transmitted in network
- Fuel kWh/Kg performance
- Silos contents
- Vegetable oil silos temperature
- Vegetable oil treatment circuit pressures
- Automatic circuit breaker status indicators
- Anomaly sensor indicators

The whole system has been provided with security procedures (90 different alarm types) which intervene by turning off the generator if working parameters go out of range. A warning message is then immediately sent via GSM to preset recipients. The built-in Movicon alarm notification feature provides a function that sends SMS to on-call duty staff. Moreover, in the event of overheating the system autonomously reduces its power until it returns back to normal. The Movicon supervisor memorizes, with great precision, all working parameters on the appropriate historical Databases, for complete and relentless historical analysis using grids and reports.

The generator can be monitored and controlled by remote using the Movicon Web Client technology. The user can gain access with password authorization to the system using any PC connected to the internet with a normal browser to view and interact with the system without any additional installations required on both server and client.

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