SIMULATION OF AN AUTONOMOUS MICROGRID
WITH DIFFERENT TYPES OF RENEWABLE ENERGY SOURCES

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The version of the Matlab 2023 program presents a block diagram (Fig. 1) for Simulink, which allows you to relatively quickly simulate transient and almost static processes in an autonomous electrical network (microgid) during the day, in which the energy sources are solar and wind power plants. The load is a settlement consisting of a thousand households. In addition, an electric vehicle charging station is used as a load, whose power is 30 percent of the power of the entire load. A diesel generator is used to balance the consumed and generated power. The load is consistent and the so-called vector mode of operation allows you to simulate the situation for 24 hours. The rotor speed of a synchronous machine can be monitored to control the frequency of the voltage in the microgrid. A three-phase 25 kW transformer is used to connect sources and loads We can change some parameters of a solar power plant, for example, the area of solar panels, and therefore the amount of energy generated, and we can also vary the irradiance and efficiency of the solar power plant. For solar generation, partial shading can be taken into account It is also possible to vary the characteristics of wind generation: for example, wind speed and its profile, taking into account that the wind power plant produces energy in a certain range of wind speeds. When the wind speed exceeds this certain level, the wind farm is disconnected from the network. Maximum wind generation is achieved at the nominal wind speed. It is convenient to visualize graphs of generated power, and they can be viewed individually, as well as the total graph. The same can be done for load power.
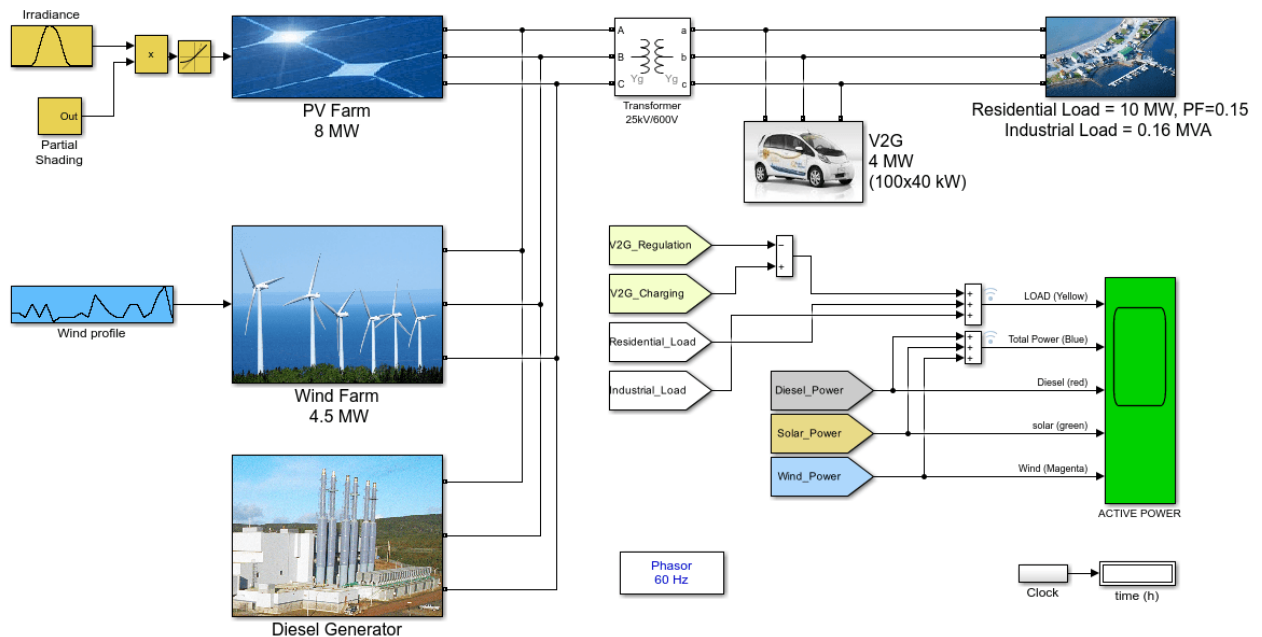

Figure 1 – Microgrid model with renewable energy sources

Reference:
1 https://uk.mathworks.com/help/sps/ug/24-hour-simulation-of-a-vehicle-to-grid-v2g-system.html