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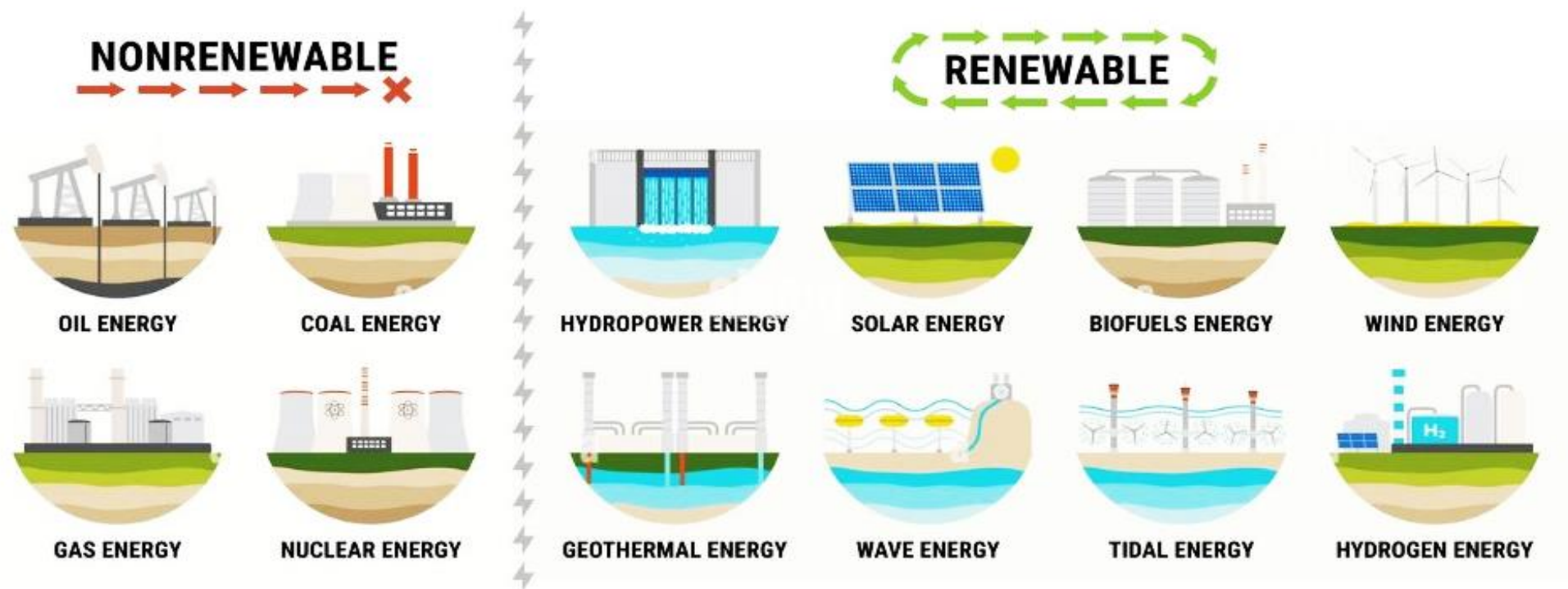
Dilshod KODIROV

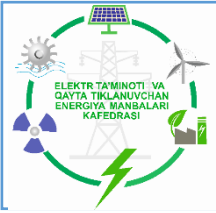
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HYBRID RENEWABLE ENERGY SYSTEM



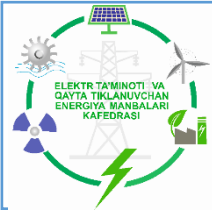


WHY HYBRID RENEWABLE ENERGY SYSTEMS?

Renewable Energy Resources

Most of us already know how a solar/wind/biomass power generating system works, but, all these generating systems have drawbacks of some kind. Solar panels, for example, are expensive to set up, and their peak output is not obtained during the night or cloudy days. Similarly, Wind turbines can't operate safely in high wind speeds, and low wind speeds produce little power. Biomass plants collapse at low temperatures.



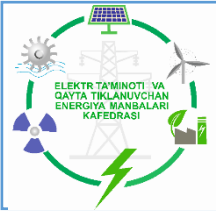


WHY HYBRID RENEWABLE ENERGY SYSTEMS?

Renewable Energy Resources

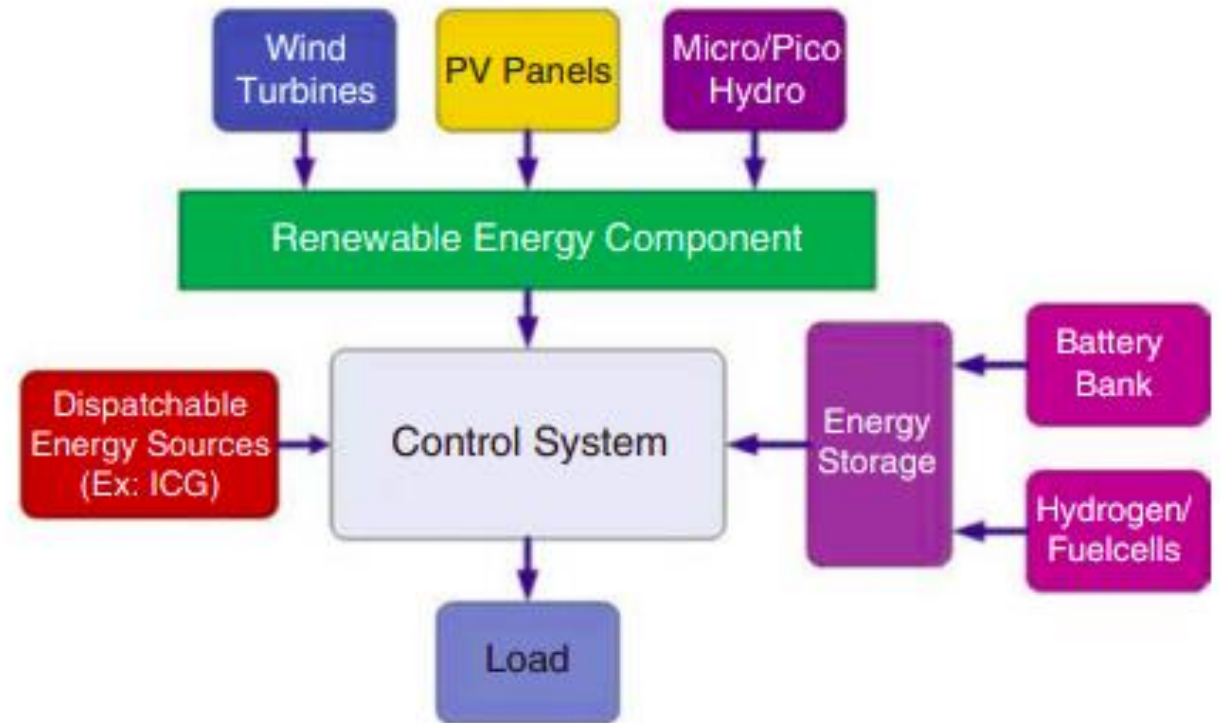
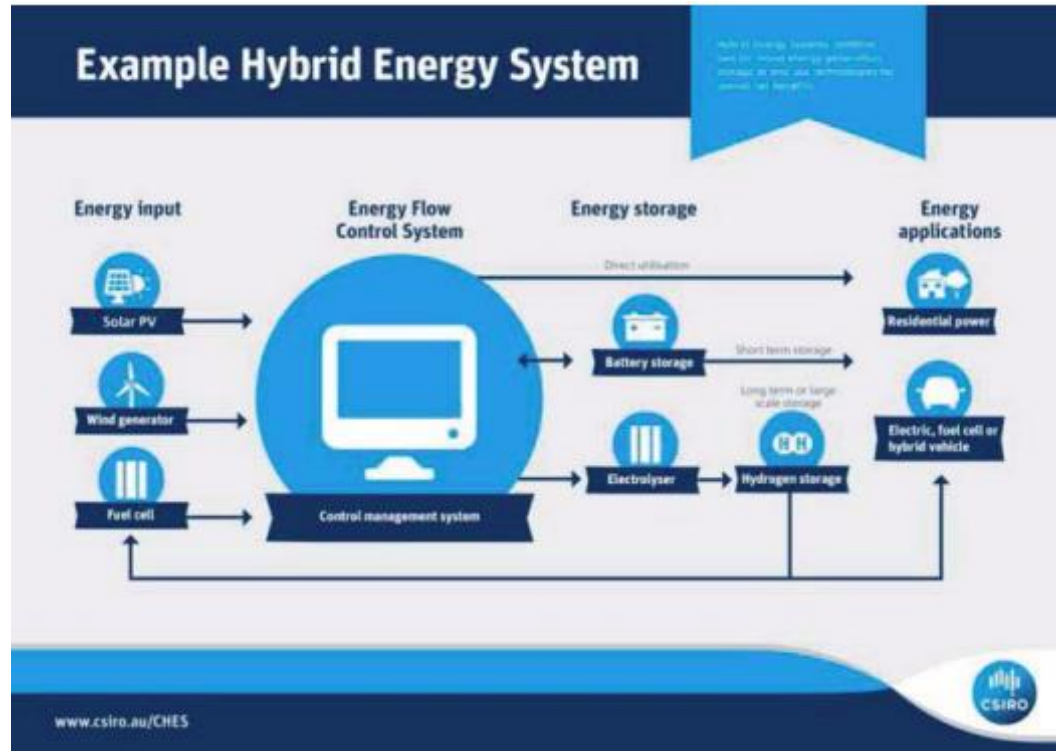
One of the biggest downfalls of renewable energy is that energy supply is not constant; sources like solar and wind power fluctuate in intensity due to the weather and seasonal changes. Therefore, a reliable backup system is necessary for renewable energy-generating stations that are not connected to a national power grid, and they can produce energy during off-peak and store them for utilization during on-peak period.





TYPES OF HYBRID RENEWABLE ENERGY SYSTEMS

Renewable Energy
Resources

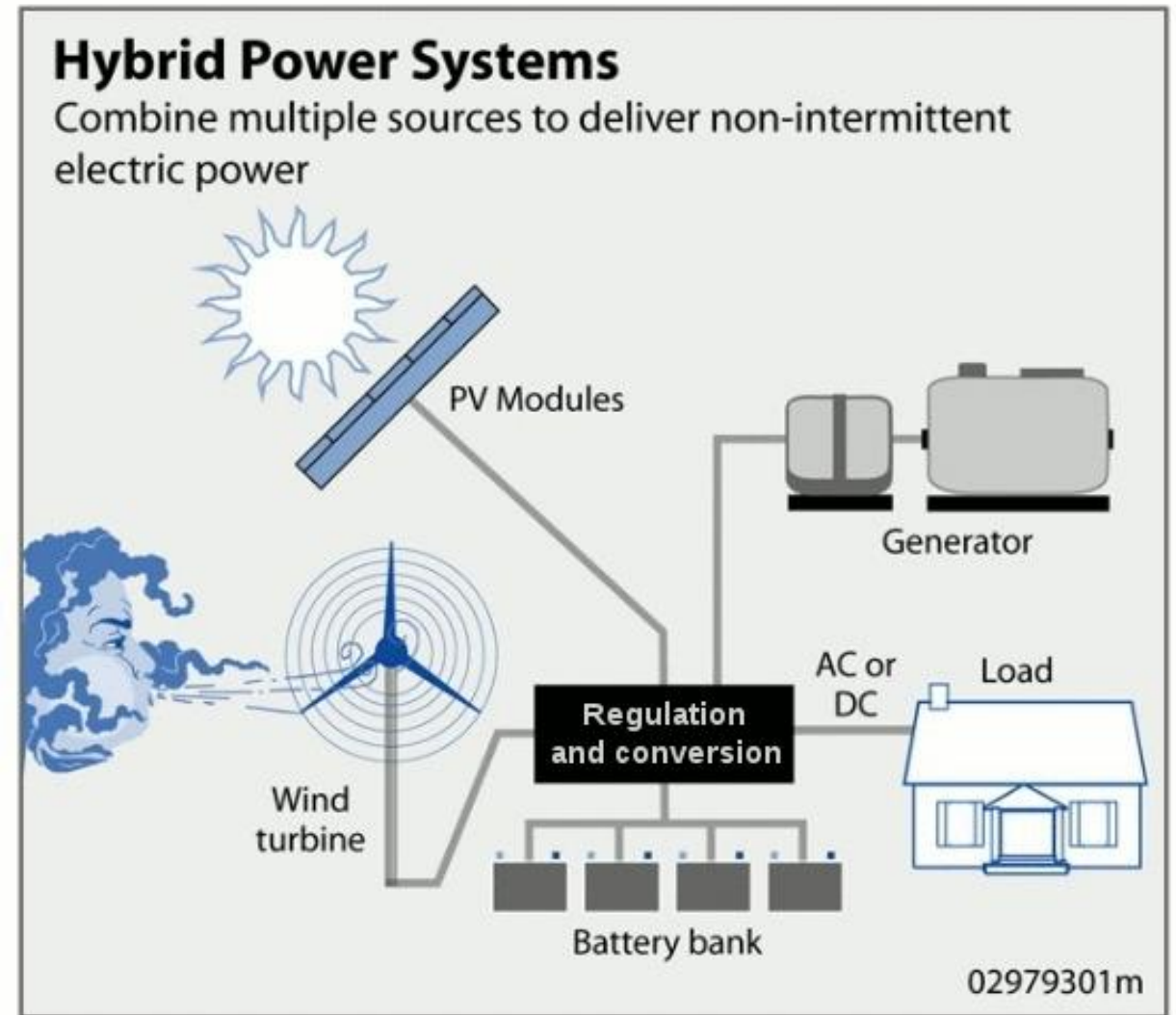


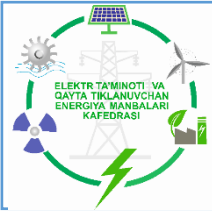
There are several types of hybrid energy systems such as wind-solar hybrid, solar-diesel, wind-hydro, and wind-diesel, which are among present in production plants. The design of a system or the choice of energy sources depends on several considerations. The factors affecting the choice of hybrid power technology can also tell us why people use hybrids and some of the advantages. The main factors are cost and resources available.



WHY HYBRID RENEWABLE ENERGY SYSTEMS?

Another example of a hybrid energy system is a photovoltaic array coupled with a wind turbine. This would create more output from the wind turbine during the winter, whereas during the summer, the solar panels would produce their peak output. Hybrid energy systems often yield greater economic and environmental returns than wind, solar, geothermal or trigeneration stand-alone systems by themselves.

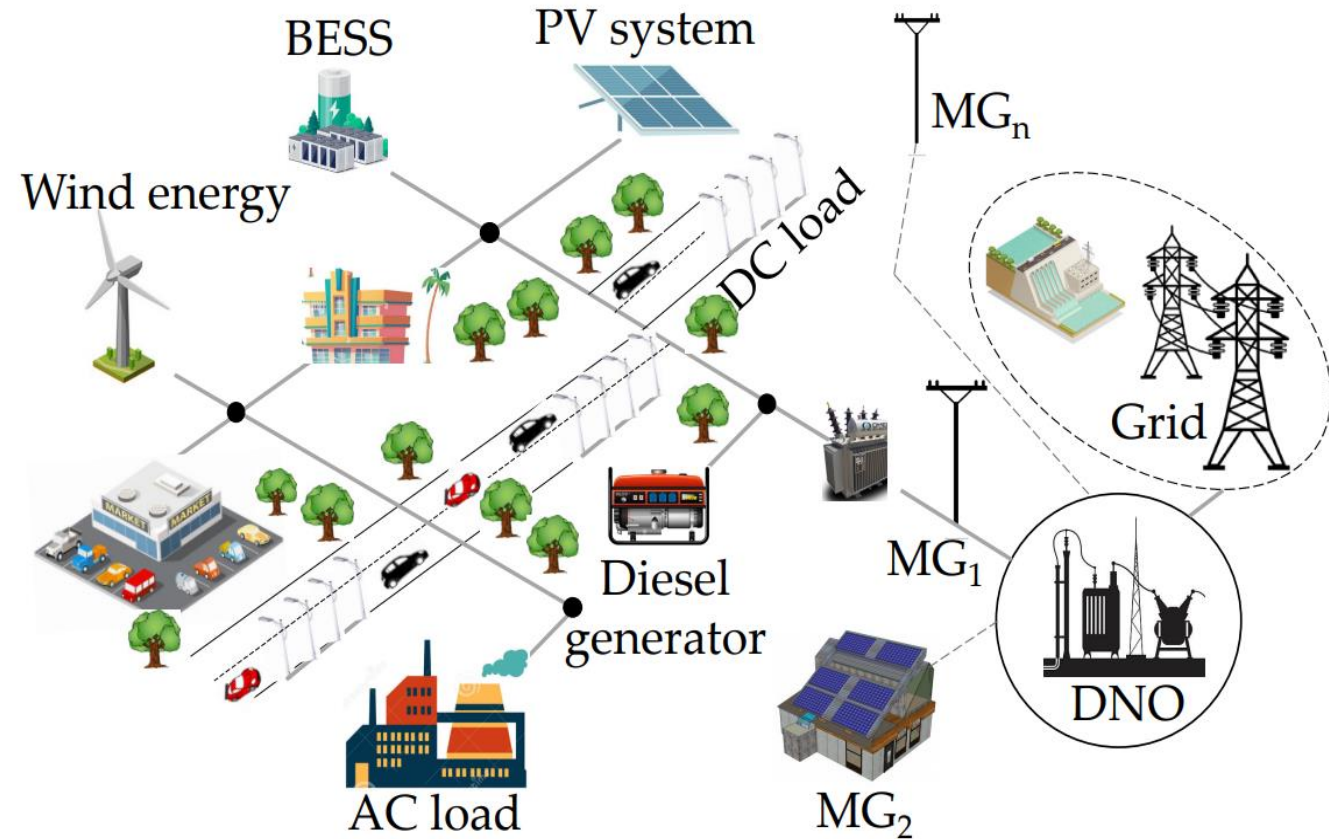




WHY HYBRID RENEWABLE ENERGY SYSTEMS?

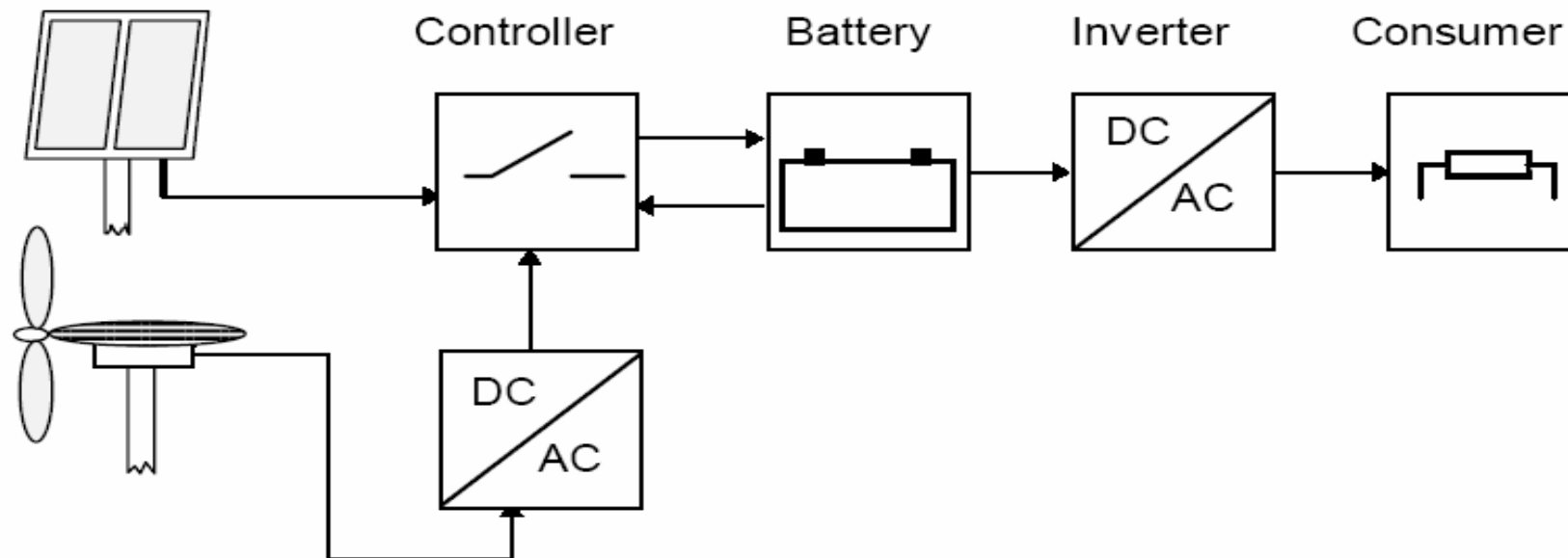
Renewable Energy Resources

A wind-diesel hybrid power system combines diesel generators and wind turbines, usually alongside ancillary equipment such as energy storage, power converters, and various control components, to generate electricity. They are designed to increase capacity and reduce the cost and environmental impact of electrical generation in remote communities and facilities that are not linked to a power grid. Wind-diesel hybrid systems reduce reliance on diesel fuel, which creates pollution and is costly to transport.





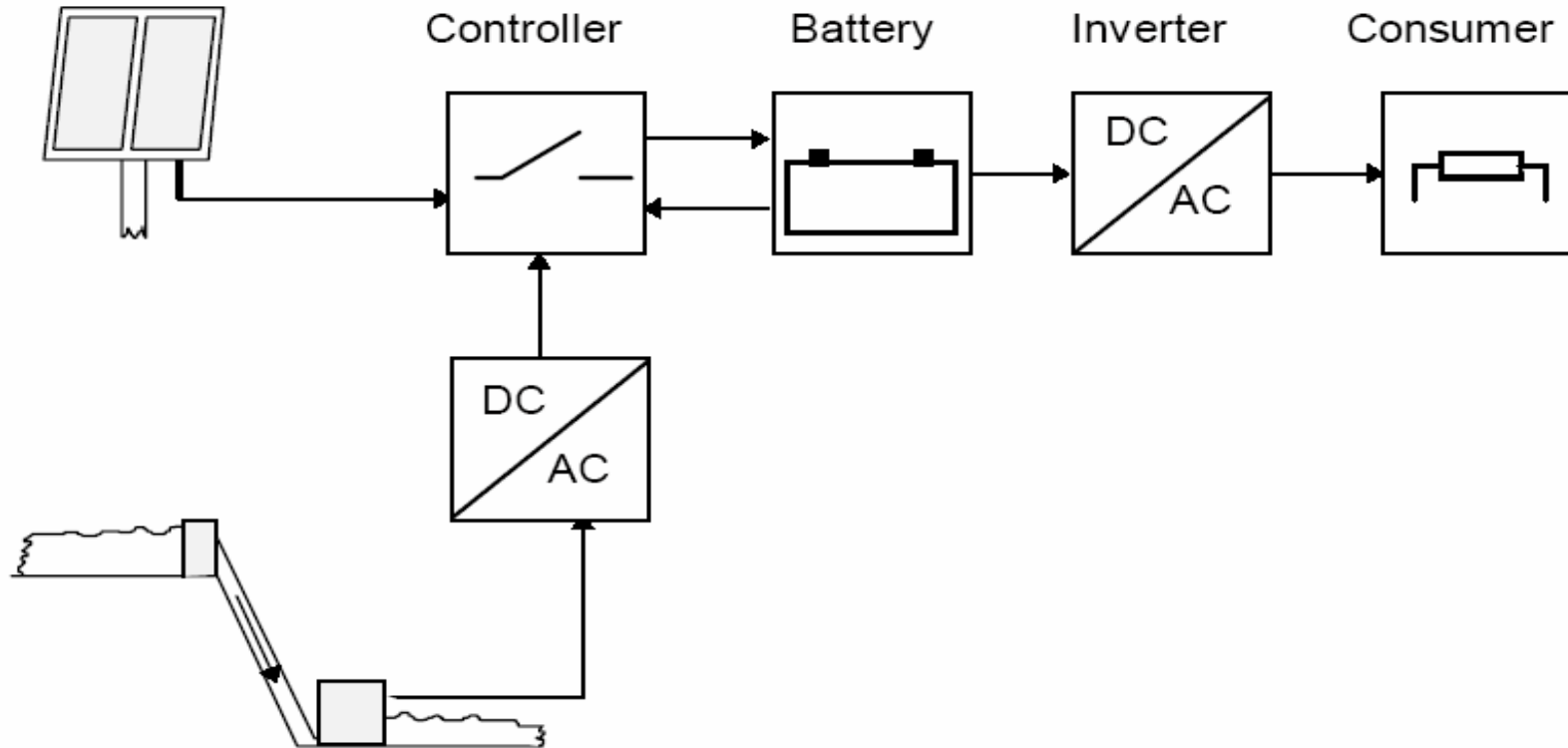
WIND/PV HYBRID SYSTEM



1. A typical hybrid energy system consists of solar and wind energy sources.
2. The principle of an open loop hybrid system of this type is shown in Figure above.
3. The power produced by the wind generators is an AC voltage but have variable amplitude and frequency that can then be transformed into DC to charge the battery.
4. The controller protects the battery from overcharging or deep discharging.
5. As high voltages can be used to reduce system losses, an inverter is normally introduced to transform the low DC voltage to an AC voltage of 230V of frequency 50 Hz.



PV/HYDRO HYBRID SYSTEM

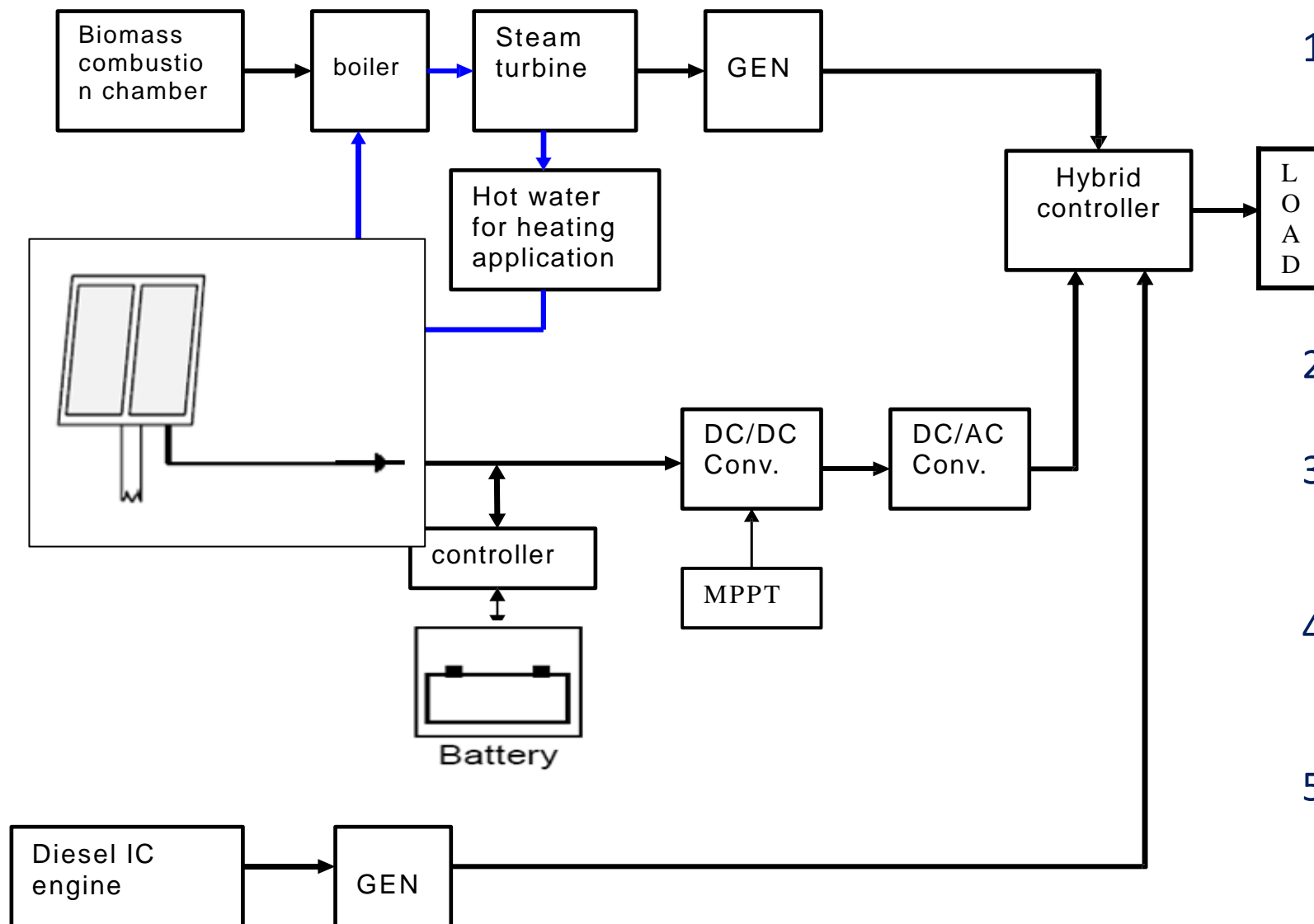


1. The block diagram of hybrid system, which combines PV with hydro system, is shown above.
2. In this system there is a small reservoir to store the water.
3. This type of hybrid system sometimes depends upon the geographical condition where the water at some height is available.
4. System capacity is depends upon at the water quantity and solar radiation.

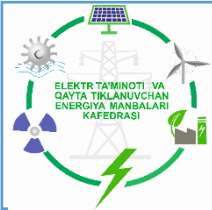


BIOMASS-PV-DIESEL HYBRID SYSTEM

Renewable Energy Resources

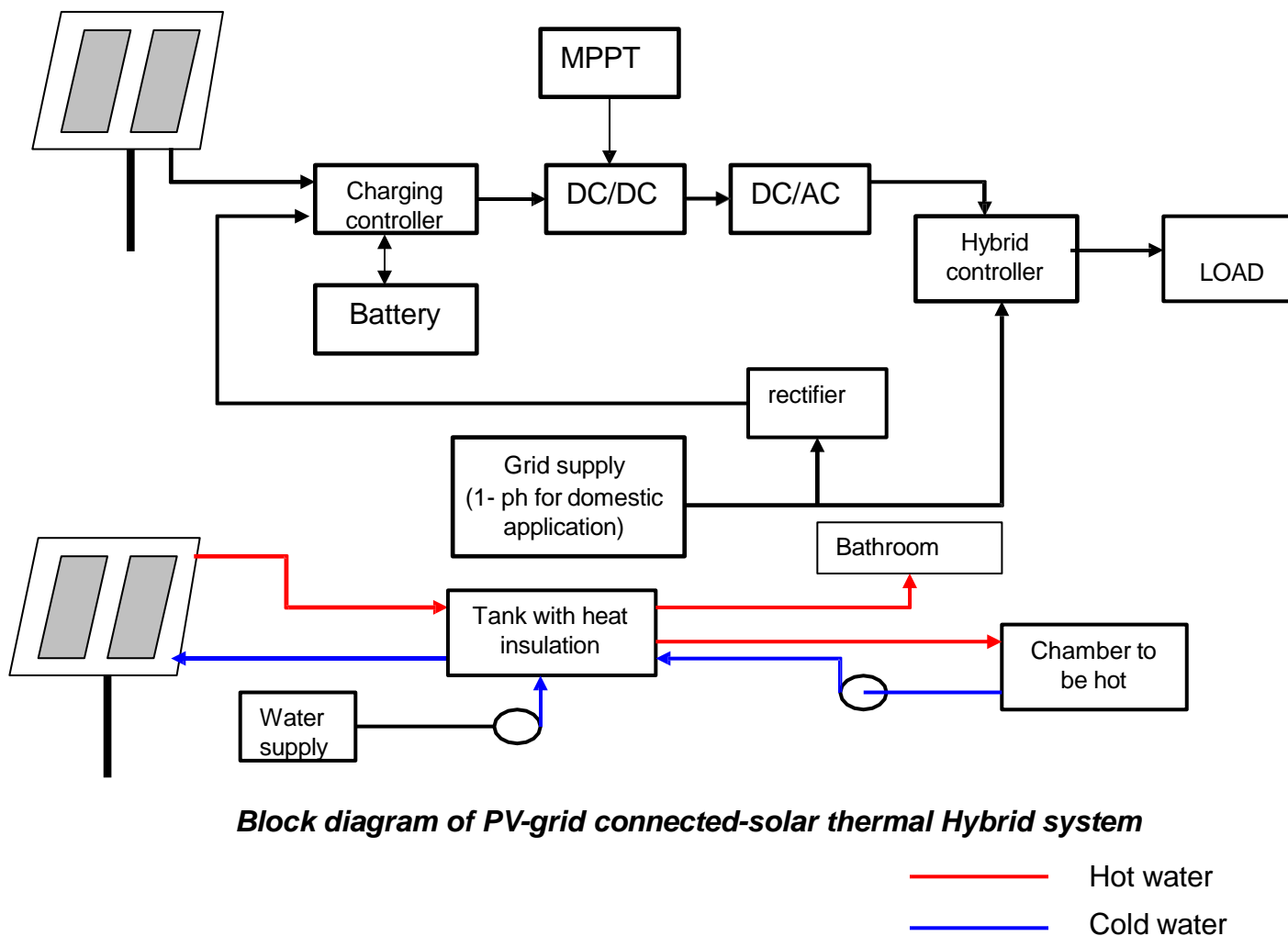


1. Biomass is matter usually thought of as garbage. Some of it is just stuff lying around -- dead trees, tree branches, yard clippings, leftover crops, wood chips and bark and sawdust from lumber mills.
2. It can even include used tires and livestock manure.
3. The waste wood, tree branches and other scraps are gathered together in big trucks.
4. The trucks bring the waste from factories and from farms to a biomass power plant.
5. Here the biomass is dumped into huge hoppers. This is then fed into a furnace where it is burned.



PV/SOLAR THERMAL/GRID-CONNECTED HYBRID SYSTEM

Renewable Energy
Resources



1. Solar heat is one of the cheapest and most practical forms of renewable energy.
2. Here are few of the most common applications:

3. Solar Hot Water Heaters:

4. The sun's light is an excellent source of hot water for home or commercial use, such as swimming pools, car washes and Laundromats.

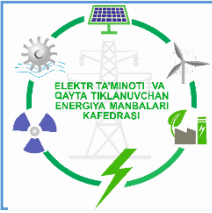
5. Cooking:

6. Simple solar ovens and cookers are used around the world in both commercial kitchens and in people's homes.
7. Solar cookers can be made with everyday materials such as cardboard and tinfoil.



FEATURE OF HYBRID SYSTEM

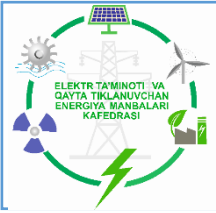
1. Hybrid systems can address limitations in terms of fuel flexibility, efficiency, reliability, emissions and / or economics.
2. Incorporating heat, power, and highly efficient devices (fuel cells, advanced materials, cooling systems, etc.) can increase overall efficiency .
3. conserve energy for a hybrid system when compared with individual technologies.
4. Achieving higher reliability can be accomplished with redundant technologies and/or energy storage.
5. Some hybrid systems typically include both, which can simultaneously improve the quality and availability of power.
6. Hybrid systems can be designed to maximize the use of renewable.
7. Resulting in a system with lower emissions than traditional fossil-fueled technologies.
8. Hybrid systems can be designed to achieve desired attributes at the lowest acceptable cost, which is the key to market acceptance



ADVANTAGES OF HYBRID ENERGY SYSTEMS

The hybrid energy systems have various advantages. Let's have a look at few of them:

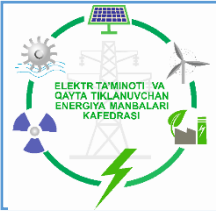
- **Continuous power supply** – The hybrid solar systems provide power continuously, without any interruption, as the batteries connected to them store the energy.
- **Utilize the renewable sources in best way** – Because the batteries are connected to the system to store the energy, there is no waste of the excess energy generated on bright sunny days.
- **High efficiency** – The hybrid solar energy systems work more efficiently than your traditional generators which waste the fuel under certain conditions.
- **Load management** – Unlike traditional generators, which provide high power as soon as they turned on, most of hybrid solar power systems manage load accordingly.



DISADVANTAGES OF HYBRID ENERGY SYSTEMS

Like all things, hybrid energy systems also have few disadvantages. Let's have a look at them:

- **Complicated controlling process** – With different types of energy sources in use, the systems require some knowledge.
- **High installation cost** – Although the maintenance cost is low, the initial investment for the installation of a hybrid solar energy systems is high as compared to a solar systems.
- **Less battery life** – The batteries connected to the system may have a lower life as they are often exposed to natural elements like heat, rain, etc.
- **The number of instruments connectable is limited** – The number of devices you can connect to a hybrid solar energy system is limited and vary from system to system.



CONCLUSION

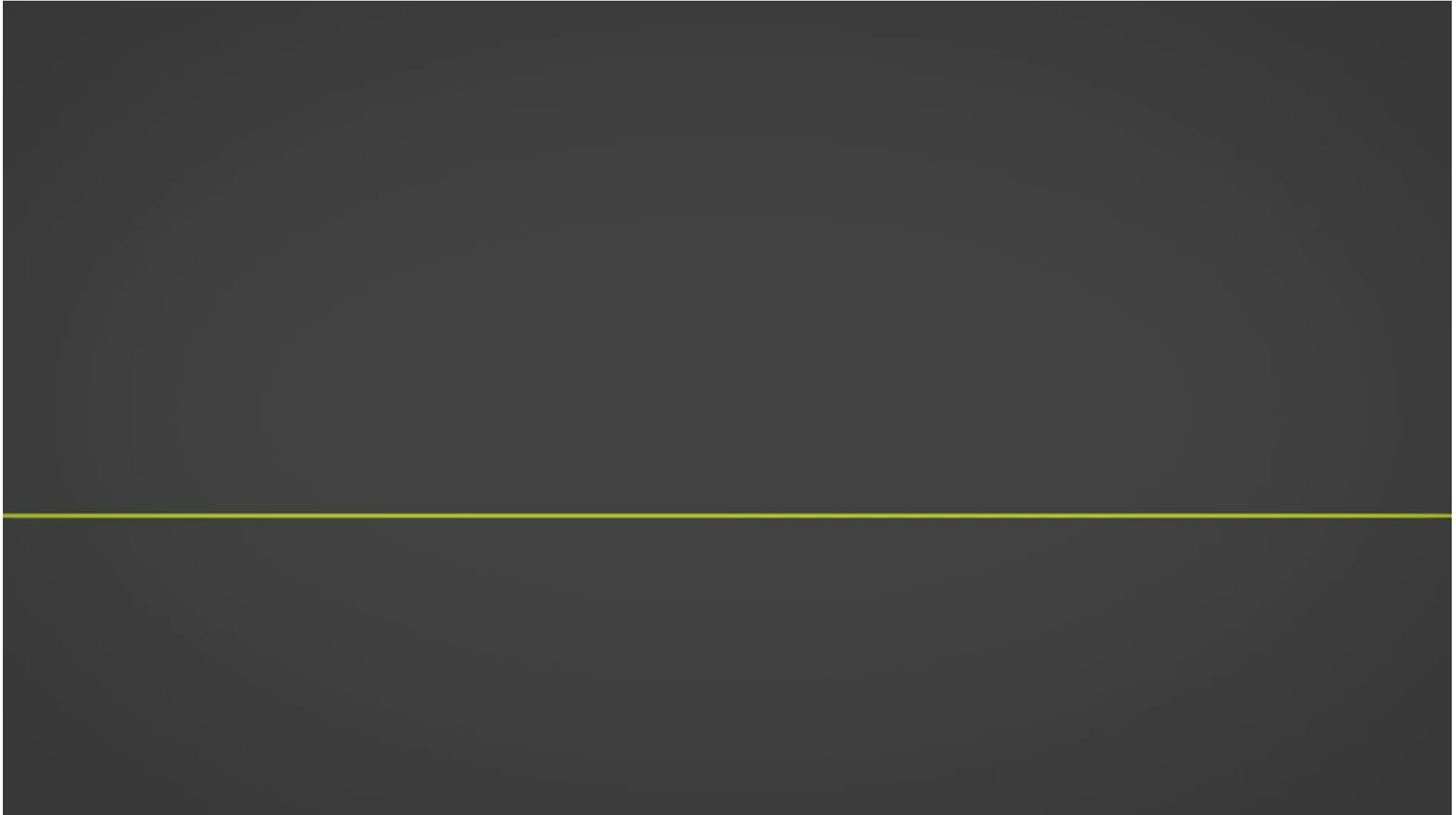
Hybrid energy systems have been designed to generate electricity from different sources, such as solar panels and wind turbines, and now tap into sources such as hydrogen that is stored in a different manner and standing by as a class of renewable energy. Therefore, a demand for its production is most efficient and costeffective in the scope of every researcher and scientist at university, industry, and national laboratory level who are working in this field.

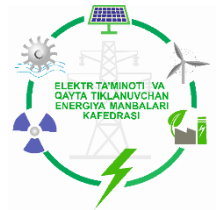
According to many renewable energy experts, a small "hybrid" electric system that combines home wind electric and home solar electric (photovoltaic or PV) technologies offers several advantages over either single system.



HOW DOES IT WORK?

Renewable Energy
Resources





Thank you very much for your attention!

Dilshod KODIROV

Professor, Doctor of Science

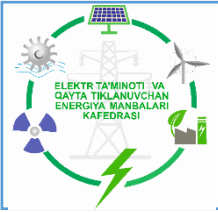
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HOW DOES IT WORK?

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