

10 most promising green energy technologies

Background

A study mission on Green Energy Technology was organized by the APO, 15–19 September 2014, in Taipei in collaboration with the Industrial Development Bureau, Ministry of Economic Affairs, Taiwan Environment Management Association, Foundation of Taiwan Industry Service, and China Productivity Center. The mission was attended by 24 green energy professionals from 14 APO member economies in the Asia-Pacific region. After intensive discussions and careful examination of various aspects over five days and review of regional and international initiatives such as ministerial meetings, the study mission identified the following 10 most promising green energy technologies/practices for the Asia-Pacific region. The document produced by the mission is reprinted below.

Most promising green energy technologies

1. **Energy-Efficient Solid-State Lighting (SSL):** SSL lighting has superior energy conversion efficiency. Light-emitting diodes (LEDs) have revolutionized energy-efficient lighting, as have compact fluorescent light (CFL) bulbs. Supported by appropriate smart monitoring and control technologies, green building standards will help in constructing smart buildings that are more energy efficient.

2. **Advanced Biomass Energy Technologies:** Biomass contains stored energy because plants absorb energy from the sun through the process of photosynthesis. When biomass is burned as fuel, the stored energy is released as heat. Advanced technologies can help realize the true potential of millions of tons of available biomass to replace fossil fuels.

3. **Alternative-Fuel Vehicles:** Improving vehicle efficiency is the single most effective means to reduce petroleum dependence. In addition, progress in the development of alternative fuels will pave the way for low-carbon transportation systems. Electric and/or hydrogen fuel cell vehicles are currently being produced by most major automobile companies. Some countries are introducing the infrastructure required for electric charges on streets and in buildings. Hybrid vehicles can also continue to be utilized, supplemented with, for example, solar energy collected on carport roofs or in car parking facilities to power electric vehicles and batteries. Service stations of the future will not only charge electric vehicle batteries but also lease batteries for quick change/charge.

4. **Carbon Capture and Sequestration:** Carbon capture and sequestration is a technology that can capture the carbon dioxide (CO₂) emissions produced by the use of fossil fuels, preventing the CO₂ from entering the atmosphere. Advances and cost reductions in carbon capture and sequestration technology are keys to reducing greenhouse gas emissions. Biomass and biofuel production acts as a form of sequestration, as found in current algae production trials in Australia and Southeast Asia utilizing CO₂ emissions from coal-fired power plants.

5. **Intelligent Energy Information and Communication Technology (ICT):** This includes wirelessly connected sensing devices allowing us to gather big real-time data on energy consumption so that intelligent decisions can be made for energy savings. Such systems can be employed as part of building/factory energy management systems. The technology also functions as a platform for exchanging success stories on energy conservation and efficient energy management systems. ICT-based monitoring and validation systems include technologies like variable-frequency drives (VFDs), which are utilized effectively in some industries but still relatively unknown and costly. Designing cost-effective VFDs therefore represents a business opportunity. The Institution of Energy Conservation Awards for building and factories are recognized as stimulating conservation and energy efficiency improvement efforts.

6. **Smart Micro Grids:** Smart micro grids have multiple benefits. They accelerate improvements in energy systems, increase grid reliability, help consumers save money, and reduce overall carbon footprints.

7. **Super-Efficient Solar, Offshore Wind, Ocean Wave, and Tidal Power:** Creating more efficient solar panels is a must to revolutionize the photovoltaic industry, although advanced production techniques in a number of countries have already reduced the cost of solar power. Offshore wind technologies that can convert wind off coasts into electricity will bring about a paradigm shift in wind power. The required technology exists and is already being applied to harvest wave and tidal power in some parts of the world, including the Asia-Pacific.

8. **Energy Storage Systems:** Advanced energy storage systems are an emerging industry with great relevance to renewable energy. Successful applications of this technology will contribute significantly to stabilizing renewable energy flows.

9. **Renewable Hybrid Energy Systems:** There is a significant increase in energy production when hybrid systems are set up to include multiple renewable energy sources. Such systems can provide energy during most weather conditions. Hybrid systems can be installed as either on grid or off grid. They reinforce renewable energy by leveraging the synergy between different sources.

10. **High-Voltage Direct-Current (HVDC) Electric Power Transmission Systems:** HVDC electric power transmission systems use direct current for the transmission of electrical power. HVDC systems are less expensive and result in less electrical power loss during long-distance transmission. HVDC also allows power transmission between unsynchronized alternating-current systems. It can carry high-voltage currents efficiently across regions. 