ENERGY STORAGE
by Rich Romer

Energy Storage is the capture of energy produced at one time for use at a later time. Energy comes in multiple forms including radiation, chemical, gravitational potential, electrical potential, electricity, elevated temperature, latent heat and kinetic. Energy storage involves converting energy from forms that are difficult to store to more conveniently or economically storable forms. Bulk energy storage is dominated by pumped hydro, which accounts for 99% of global energy storage. In the recent past, fossil fuels—coal, oil, and gas--have been the predominant source of energy production through their conversion to heat to power electrical generation. Atomic energy appeared at one time to be a promising replacement source of energy generation and storage but safety concerns, exacerbated by accidents at Three Mile Island, Pennsylvania, and Chernobyl, Russia, and the challenge of safely moving and disposing of spent nuclear fuel have resulted in a visceral reluctance to expand the application of this technology to the production of electricity.

In the twentieth century grid electrical power was largely generated from fossil fuel. When less power was required, less fuel was burned. Concerns with air pollution and global warming have since spawned the growth of intermittent renewable energy such as solar and wind power. Being intermittent, they could be generating at a time when no additional power is needed, hence the interest in storing it.

Off grid electrical use was a niche market in the twentieth century, but in the twenty first century it has expanded. Portable devices are in use all over the world. Solar panels are now a common sight in the rural settings worldwide. Access to electricity is now a question of economics, not location. Powering transportation without burning fuel, however, remains in development with rapidly growing interest.

Without going into detail, the existing technologies for the storage of energy are listed to illustrate the large number of possibilities for future development and application.

Mechanical
- Compressed air energy storage (CAES)
- Fireless locomotive
- Flywheel energy storage
- Gravitational potential energy (device)
- Hydraulic accumulator
- Liquid nitrogen
- Pumped-storage hydroelectricity

Electrical
- Capacitor
- Superconducting magnetic energy storage (SMES)

Biological
- Glycogen
- Starch

Electrochemical
- Flow battery
- Rechargeable battery
- Supercapacitor
- UltraBattery

Thermal
- Brick storage heater
- Cryogenic liquid air or nitrogen
- Eutectic system
- Ice Storage
- Molten salt
- Phase Change Material
- Seasonal thermal energy storage
- Solar pond
- Steam accumulator
- Thermal energy storage (general)

Chemical

- Biofuels
- Hydrated salts
- Hydrogen
- Hydrogen peroxide
- Power to gas
- Vanadium pentoxide

The increased interest in electrically powered motor vehicles has incentivized a dramatically growing interest in increasingly efficient energy storage. Japanese and American manufacturers are producing and selling growing numbers of totally electric and hybrid powered vehicles. CEPA's President is one of the early owners of a Toyota Prius hybrid car. Silicon Valley entrepreneur Elon Musk has created a new market segment with his totally electric Tesla cars and is investing heavily in a new evolution of energy storage for mobile, commercial and residential applications.