Technology of energy storage

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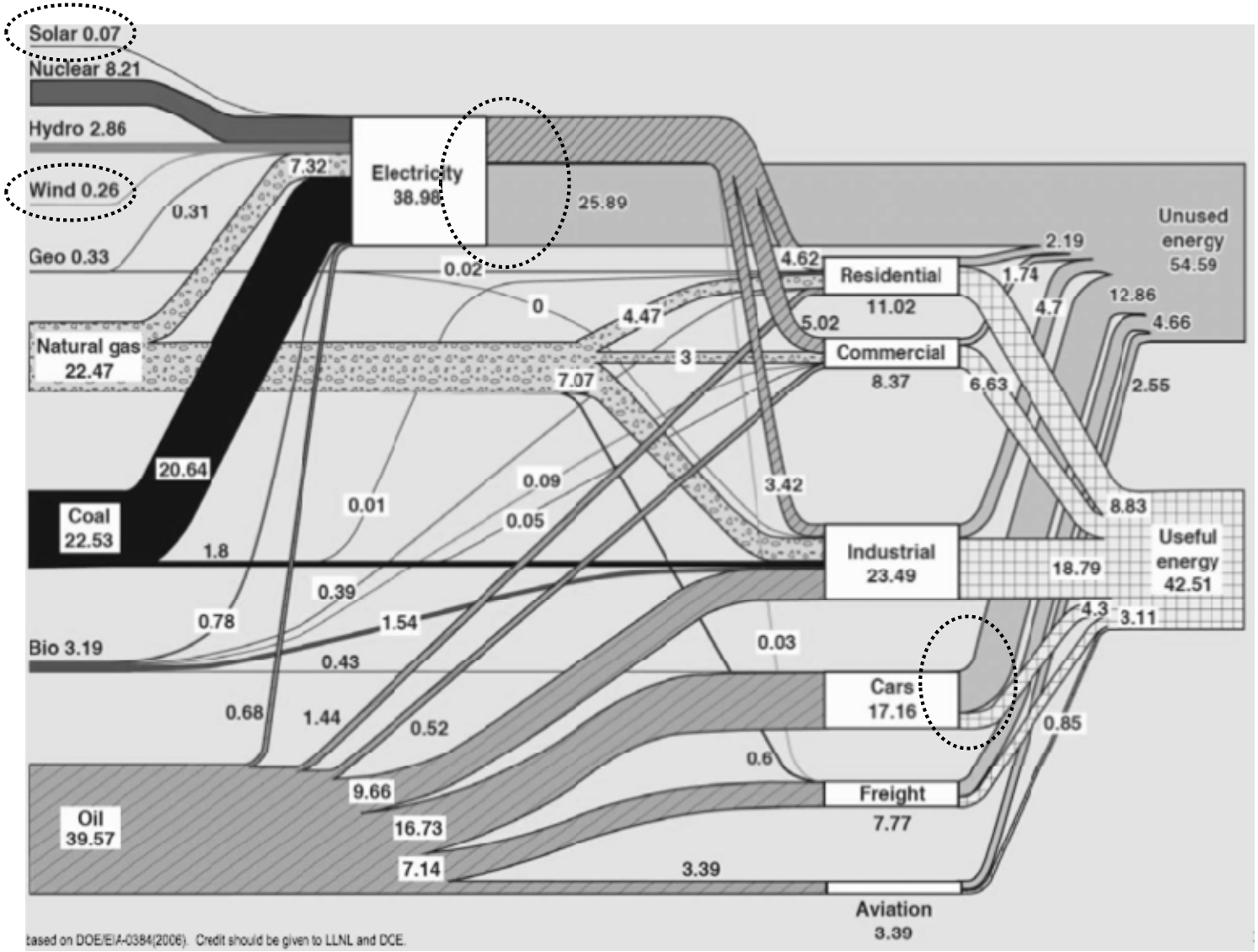
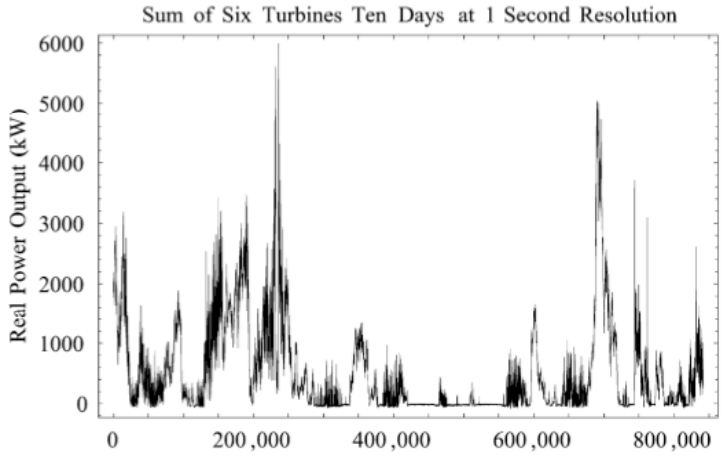
Energy flows

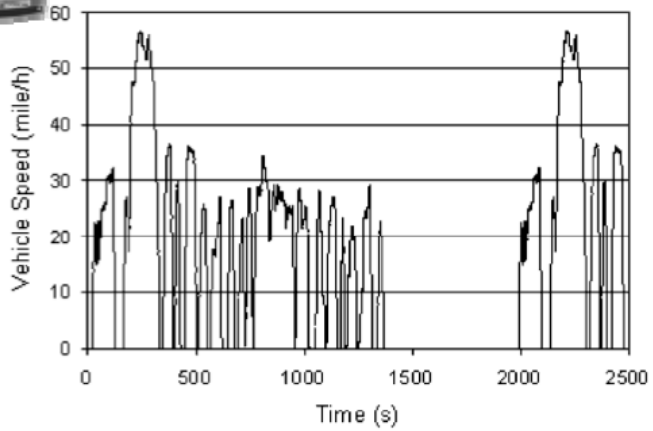


Importance of energy storage

- Load leveling

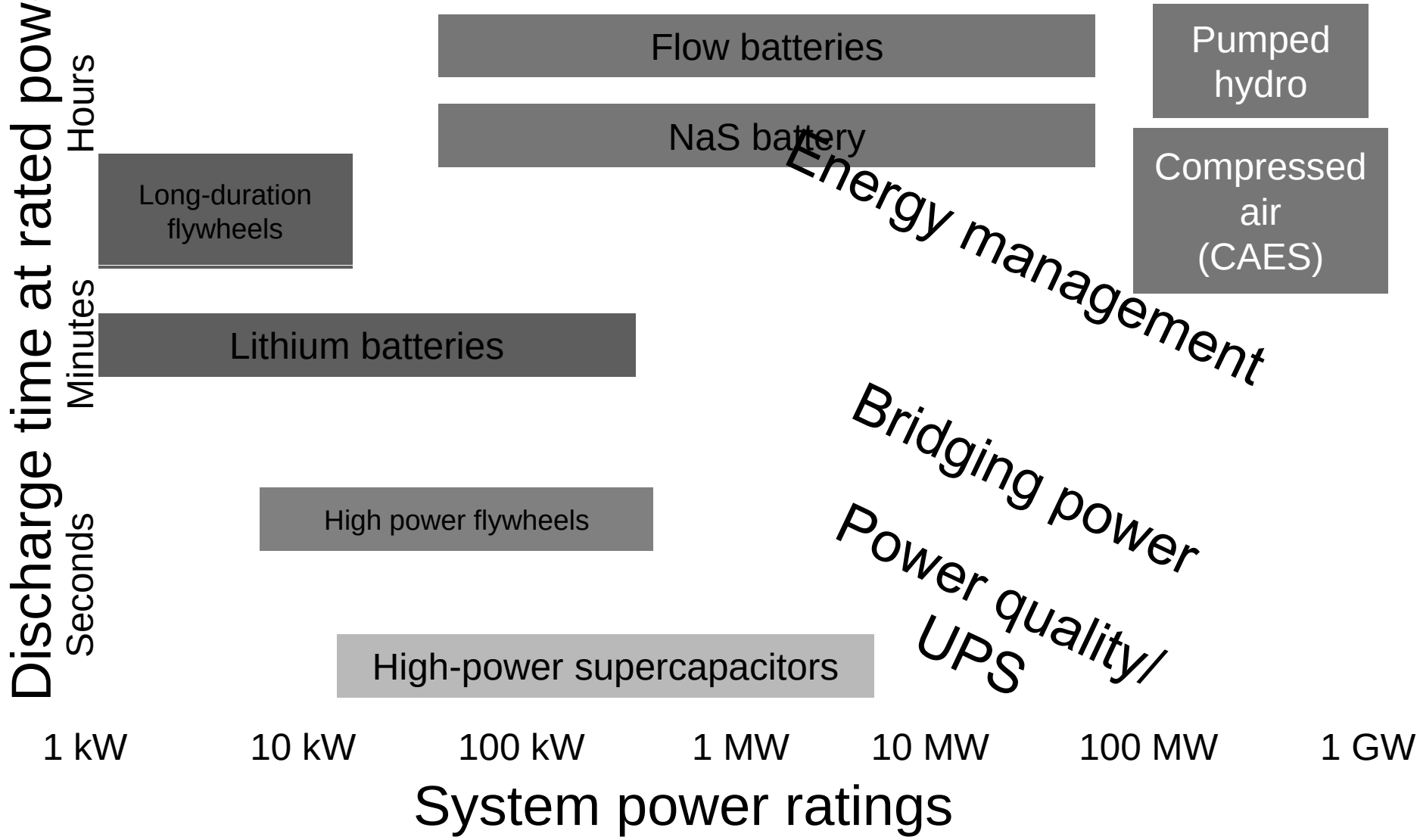


- Fuel efficiency



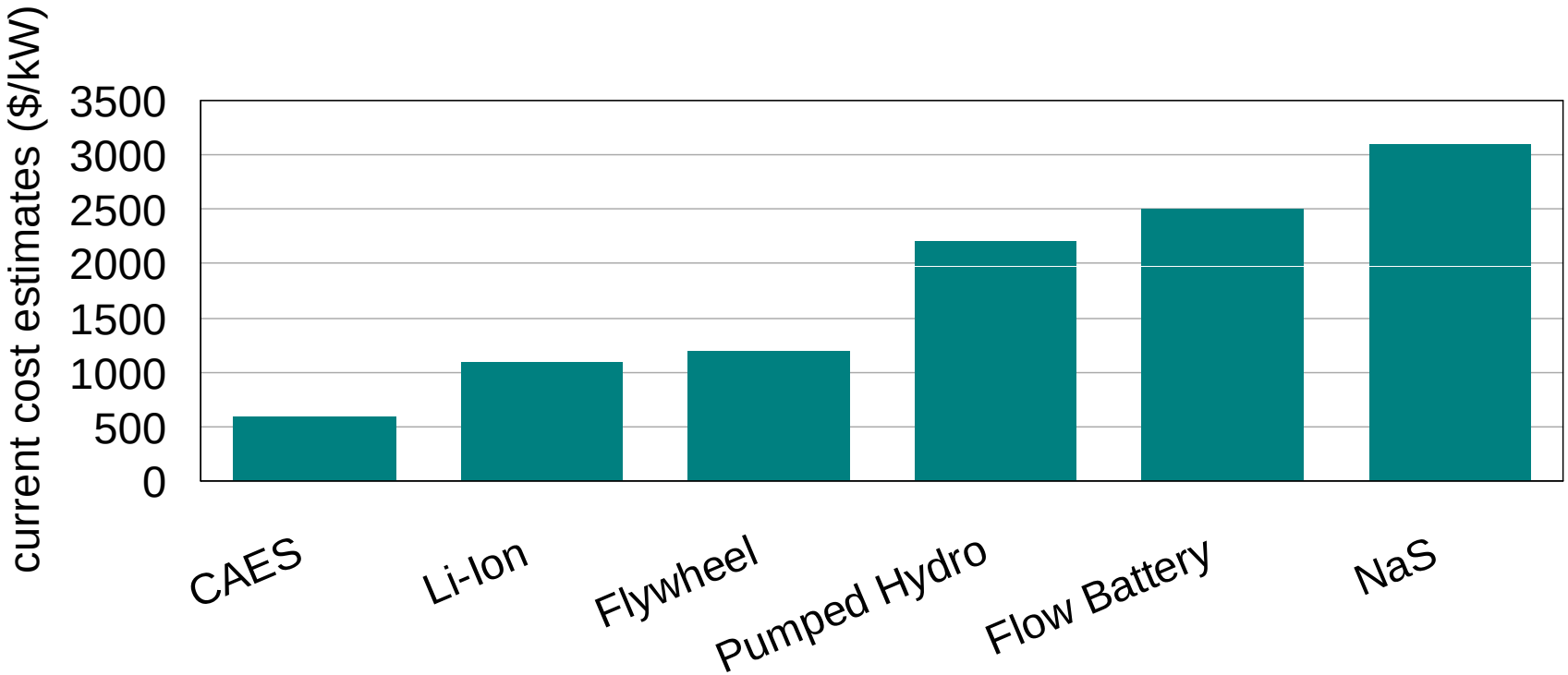
- Portable power

Types of grid storage



A. Price, “Electrical energy storage—a review of technology options,”Proceedings of ICE Civil Engineering 158 November 2005 Pages 52–58 Paper 14175

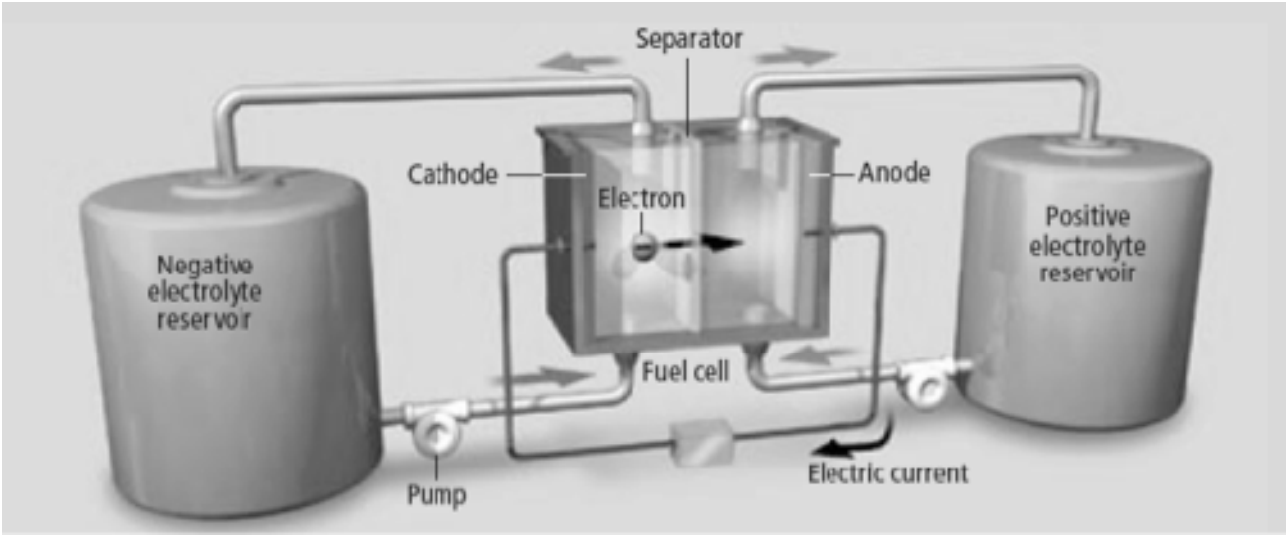
Energy storage technology present-day cost estimates



source: "Bottling Electricity: Storage as a Strategic Tool for Managing Variability and Capacity Concerns in the Modern Grid."
http://www.oe.energy.gov/eac.htm

Flow batteries

- allow for de-coupling of power and duration of storage



Research areas in grid storage

- identifying inexpensive electrochemical couples that are highly reversible and which provide a sufficiently large cell voltage
- cheap, durable electrode materials that will provide rapid kinetics for the preferred reaction, while resisting corrosion and degradation under operating conditions
- cell designs to optimize electrode utilization and to minimize external pumping and control requirements.

Electrochemical energy systems

- Means of storing electricity
  - De-couple primary source and use
  - Recover more wasted energy
- Need to improve rates, storage capability
  - Materials and engineering go hand-in-hand
- Opportunities for new uses

What can we do?

- Research and development
- Think about enabling technologies

- "Killer apps"
  - Plug-in hybrid vehicles, smart grid
  - When is one kilowatt-hour worth more than another to end users?