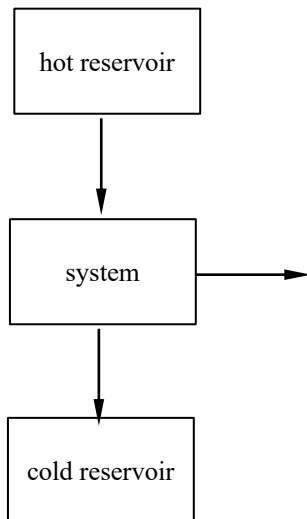**Energy Analysis of Cycles**

A <u>cycle</u> is a sequence of processes that begins and ends at the same state.

$$\Delta E_{sys} = Q_{into\ sys} - W_{by\ sys}$$
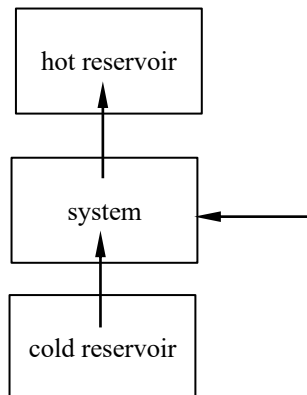
Since we start and end at the same state =>

Three Common Cycles

Power Cycle

```
┌─────────────────┐
│  hot reservoir  │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│     system      │ ─────────────▶
└─────────────────┘
         │
         ▼
┌─────────────────┐
│  cold reservoir │
└─────────────────┘
```

Thermal efficiency, $\eta_{power} =$

Refrigeration and Heat Pump Cycles

```
┌─────────────────┐
│  hot reservoir  │
└─────────────────┘
         ▲
         │
┌─────────────────┐
│     system      │ ◀─────────────
└─────────────────┘
         ▲
         │
┌─────────────────┐
│  cold reservoir │
└─────────────────┘
```

Coefficient of performance, $\text{COP}_{ref} =$

Coefficient of performance, $\text{COP}_{HP} =$

To convert a COP to an Energy Efficiency Ratio (EER): EER = [3.41214 BTU/(W.h)]*COP Capacity is often given in kW/ton, where 1 ton = 12,000 BTU/h