**Thermoelectrochemical Energy Storage**

**Motivation:**

- Use low-grade waste heat to increase voltage efficiency of flow batteries:
  - control stack temperature to decrease voltage required during charge and increase voltage output during discharge
- Thermal management must consider the thermodynamic dependence of voltage on temperature
- Proposed configuration:
  - one stack for charge
  - another stack for discharge
  - heat exchanger at inlet of one stack

\[
-nFE^o = \Delta G^o = \Delta H^o - T\Delta S^o
\]

- equilibrium potential (voltage)
- \( \frac{\partial E^o}{\partial T} \bigg|_P = \frac{1}{nF} \Delta S^o \)
  - reaction entropy
  - temperature coefficient (mV/°C)

\[
g = \frac{dE}{dT} = 1.14 \text{ mV}/^\circ\text{C}
\]

**FY11 Activities:**

- Conducted literature survey of prior work
- Assessed existing thermodynamic data to identify candidate electrochemical reactions
- Identified two candidate system designs

**FY12 Plans:**

- Determine dependence of equilibrium potential on temperature (dE/dT) for typical flow cell reactions (e.g. all-vanadium, iron-chromium, zinc-bromine)
- Demonstrate the technical and economic feasibility of such a system