Systems Driven Approach For Solar Applications of Energy Storage

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Welcome –

Solar Energy Technologies Program

FreedomCAR and Vehicle Technologies Program

Energy Storage Systems Program

Industry

Universities

National Laboratories

Objective and Agenda

To explore a new generation of energy storage solutions for potential use with photovoltaic systems.

Day 1: Groundwork

- Establish a baseline understanding of current energy storage products, with an emphasis on markets.
- Reception and Banquet

Day 2: Group Discussions of factors influencing:

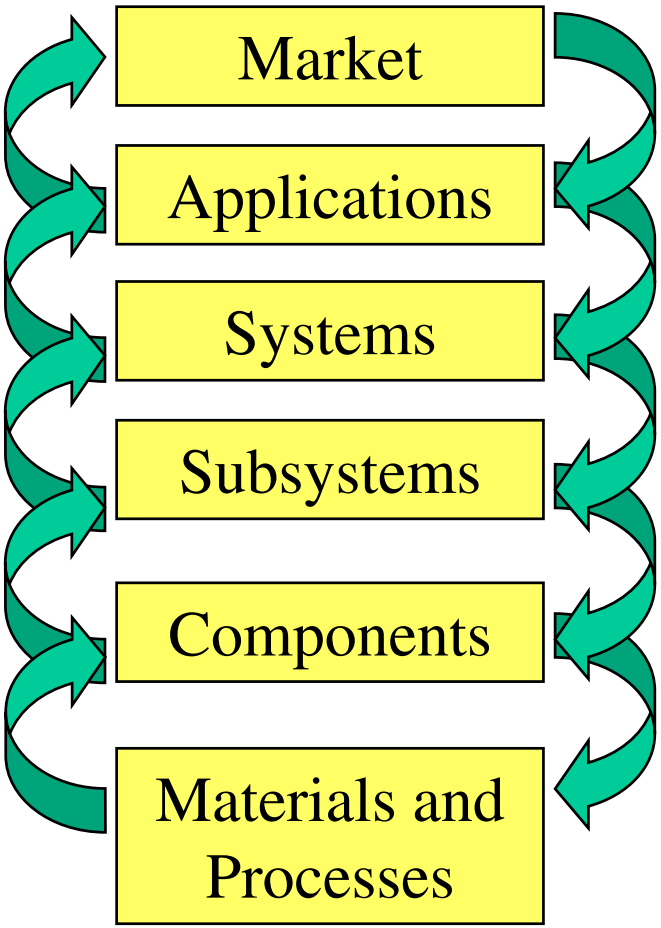
- efficiency,
- reliability,
- cost,
- maintenance,
- manufacturability, and
- cross-technology applications,

Results: Industry insight for a study on US energy storage systems that is due by fiscal year 2005, input for Solar Program Systems Driven Approach (SDA).

OMB Applied R&D Investment Criteria: Merit and Plan Elements

- How well does plan build on existing technology, complement related RD&D, and propose technically feasible federal activities?
- How well does planning and prioritization involve industry?
- What is level of industry cost-sharing?
- How well does plan incorporate performance indicators?
- How well does planning incorporate “off-ramps” and clear end point?
- To what extent is plan the result of competitive merit-based process and subject to external review?
- What is expected number of years to commercialization?
- Is R&D activity basic, applied, demonstration or development?
- What is extent of technological risk?

Framework for SDA



Sample Questions/Issues

What are the highest-value applications for storage and solar?

What are the performance and cost characteristics of storage for the largest markets?

What are the key factors in a storage device? Response? Weight? Ease of maintenance? Durability?

How do other components like inverter software impact value? Reliability?

How do power density, durability, toxicity impact performance, marketability?

Example: Advanced Vehicle Simulator (ADVISOR)

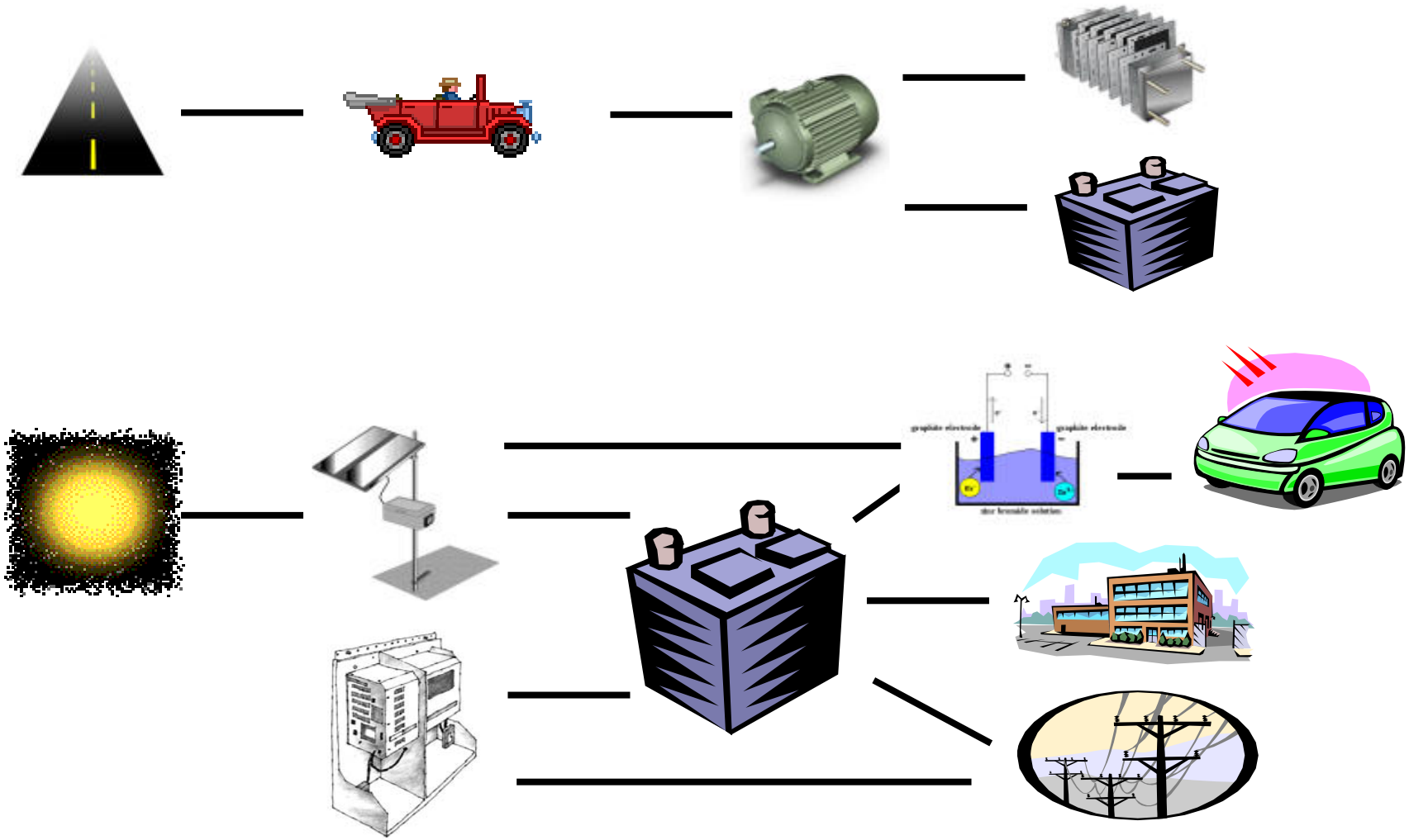
Capabilities

- Codes process for product development
- Automates and facilitates product design and analysis
- Identifies and draws methodologies and roadmaps

Benefits

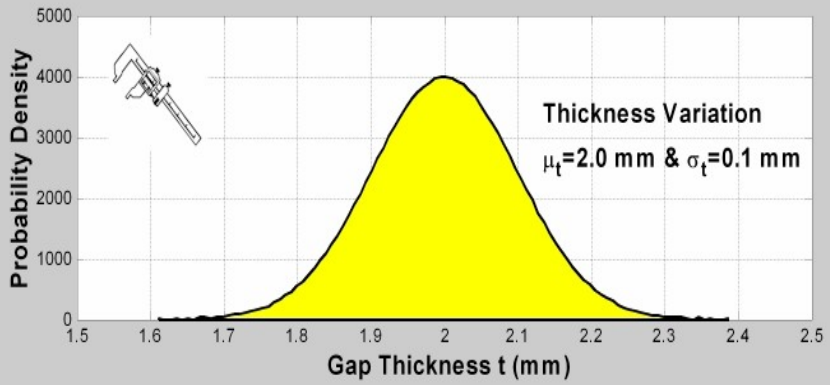
- Allows concurrent product development
- Reduces learning curve for advanced technology
- Decreases throughput and cost with higher quality results
- Technology targets can be modeled and verified

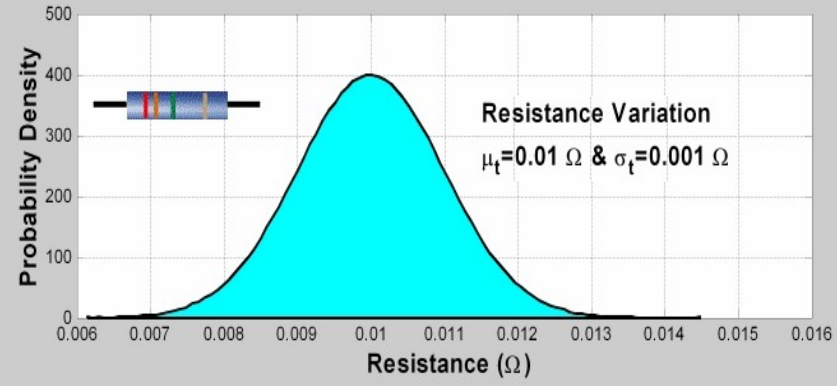
Systems Modeling Approach – Vehicles, Solar

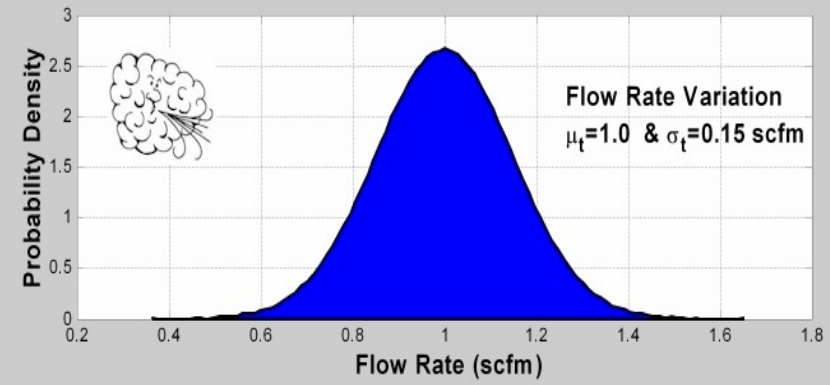


Input Parameters: Six Sigma Battery Design

- Gap Thickness
- Cell Resistance
- Flow Rate
- Six input parameters:
  1. μ_{tgap}
  2. σ_{tgap}
  3. μ_R
  4. σ_R
  5. μ_{Frate}
  6. σ_{Frate}

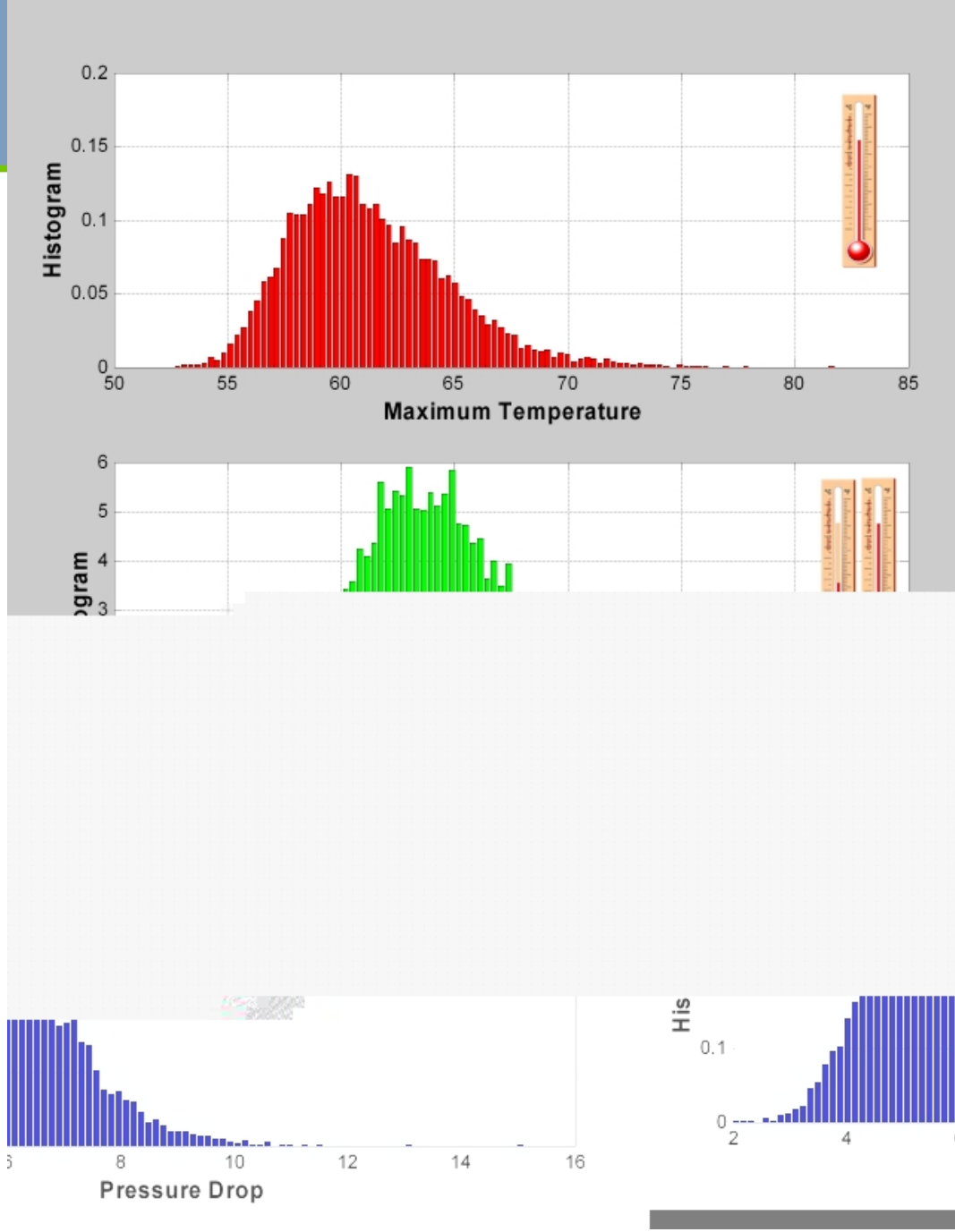






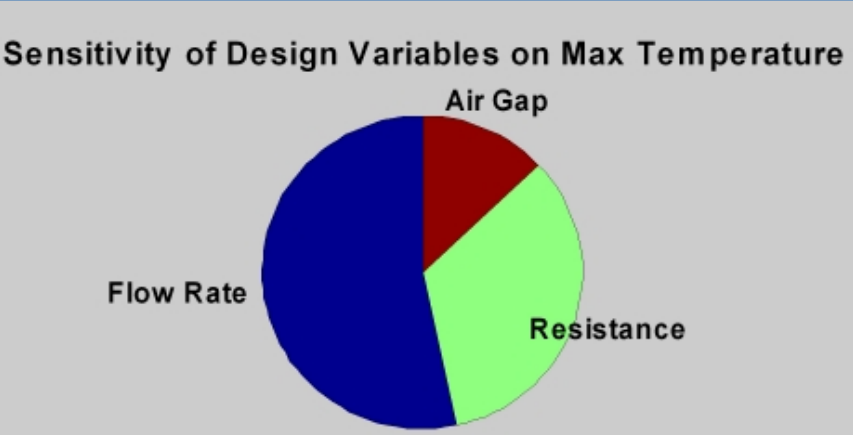
Outputs

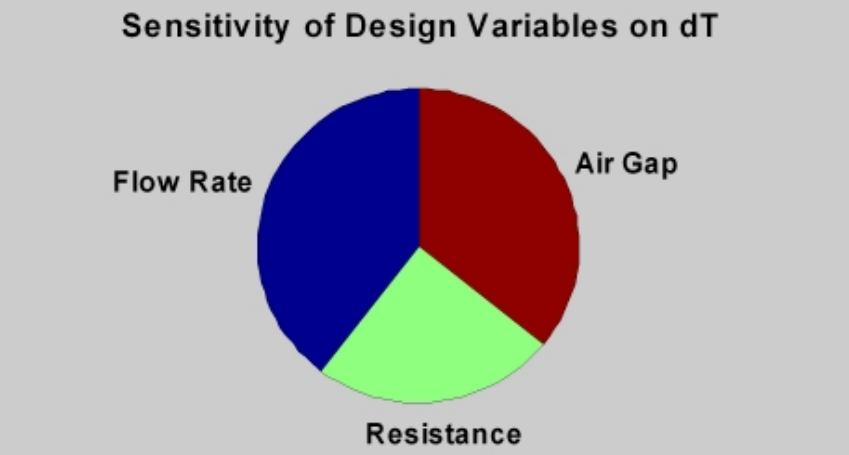
- SMART Attributes
  - Simple
  - Measurable
  - Agree to
  - Reasonable
  - Time-based
- Outputs – variation
  - max temperature
  - differential temperature
  - pressure drop
- Six input parameters:
  - μ_{Tmax}, μ_{dT}, μ_{dP}
  - σ_{Tmax}, σ_{dT}, σ_{dP}

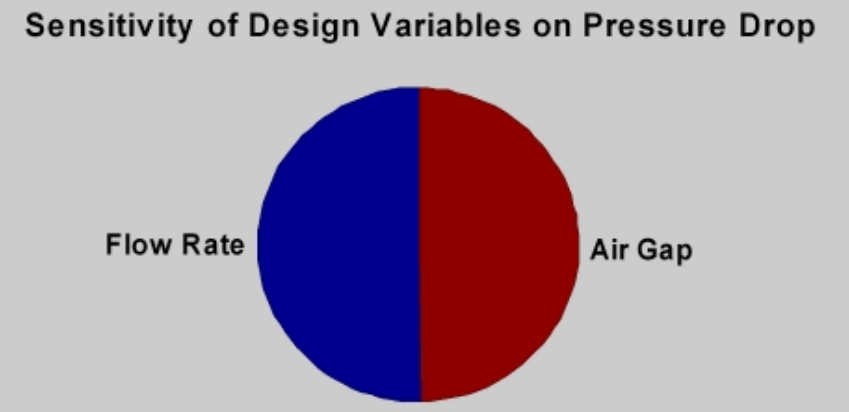


Sensitivity Analysis

- Sensitivity of the design variables on the response attributes
  - The flow rate has the most impact on the maximum temperature
  - All three input design variables have about equal effect on the temperature differential
  - The internal battery resistance has no effect on the pressure drop.

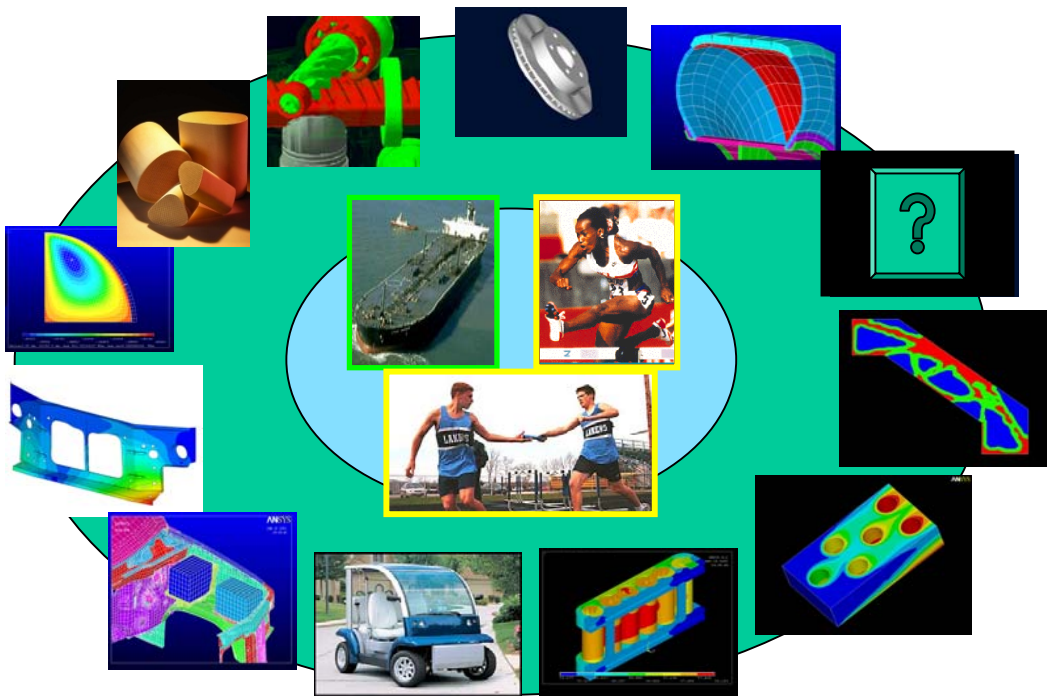






Storage

How can we use these techniques in our program ?



DAY

NIGHT

Taking Solar and Storage off the Mall…

…and into the market.