Presentation Outline

- Objective
- Proposed model diagram
- Multiobjective solver
  - First approach
  - Search / Evaluation
  - Software
- Metrics
Objective: Pareto Surface of Solutions

- Cost
- Resiliency
- Sustainability
Proposed Model Diagram

- Policies
- Forecasts
- Technologies
- Scenarios

Multiobjective solver

- Analysis
- Visualization
- Interdependencies
- Contingencies
From data to model
Proposed Model Diagram

Current system

| Database |
| Data |
| Model generator |

Projections

Multiobjective solver

Master Problem
Investment
Storage

Year 1 Flows
Year 2 Flows
Year 40 Flows
Multiobjective Solver

- **Multiobjective algorithm**: Select front of solutions, Generate new generation

  - **Cost Minimization**
    - Investment Portfolio
    - Sustainability Metrics
    - Resiliency Metrics

  - Search and selection

  - Evaluation (fitness functions)
Interaction search-evaluation

- String of characters

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  - Investment
    - X: Investment not allowed
    - 0: Investment allowed, not enforced
    - 1: Small investment enforced
    - 2: Medium investment enforced

  - Tax / Subsidies
    - Carbon tax, “use of depletable resource” tax

  - Limit on emissions
Why?

- Concern with minimizing cost
  - Bias in the solution towards cost

- Enforcing investment
  - Reinforce weakest links: resiliency ▲
  - “Cleaner” alternatives available: sustainability ▲

- Tax, subsidies, limits
  - Enforce the use of capacity made available
Software

- Search & Selection: off the shelf (?)
  - Find and test different alternatives
  - PISA: ready to use algorithms

- Feedback from optimization
  - Weak links, economic opportunities, sustainable links
Proposed metrics (I)

- **Cost**: Operational + Investment

- **Sustainability**
  - Emissions
  - Rate of consumption of depletable resources
  - Market share for renewables
  - Use of water
Proposed metrics (II)

- Resiliency
  - What to measure?
    - Increase in cost
    - Increase in prices
    - Demand not met
  - Under what conditions?
    - Weight effect with probability
    - Predetermined worst-case-scenarios
    - Interdiction: find maximum damage wrt to probability