INL/MIS-22-69579-Revision-1

Resilience Application: MIRACL Advisory Board Meeting 2022

October 2022

Megan Jordan Culler, Mathew Wymore, Jody Dillon, Manual Marin

Changing the World's Energy Future

Idaho National Laboratory

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Power Engineer

Resilience Application

MIRACL Advisory Board Meeting 2022

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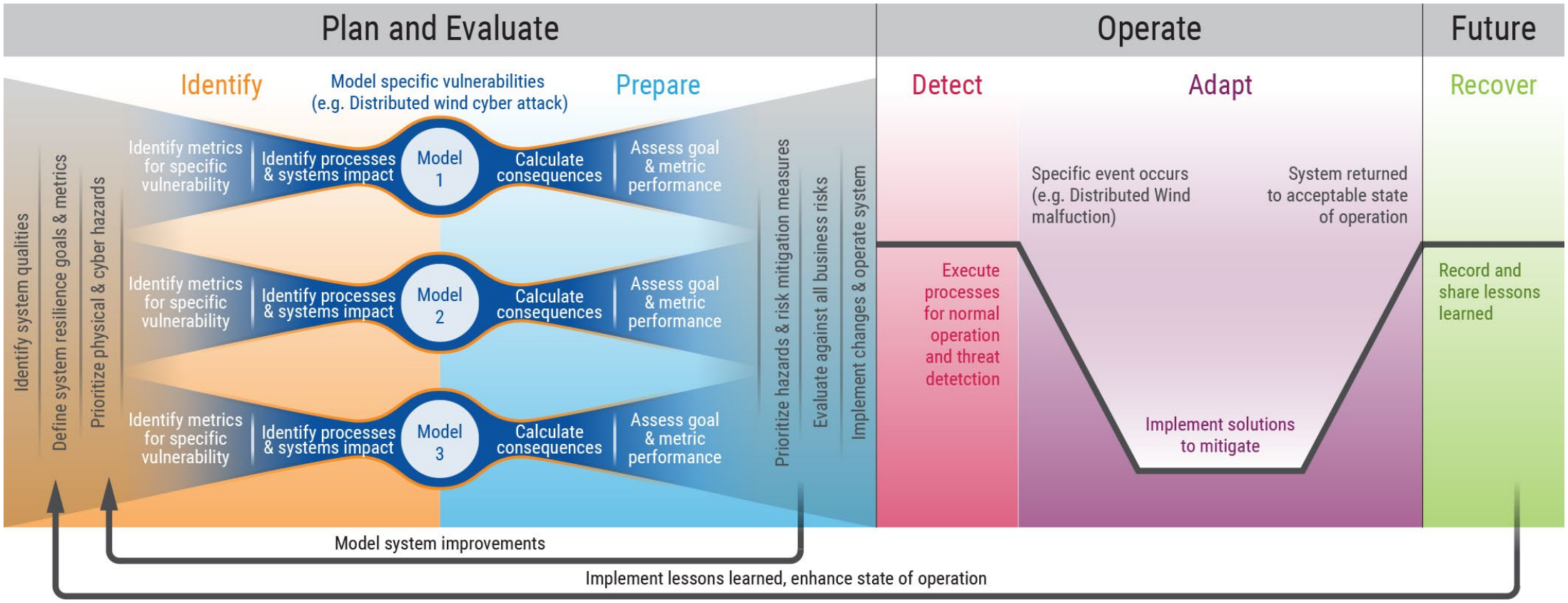
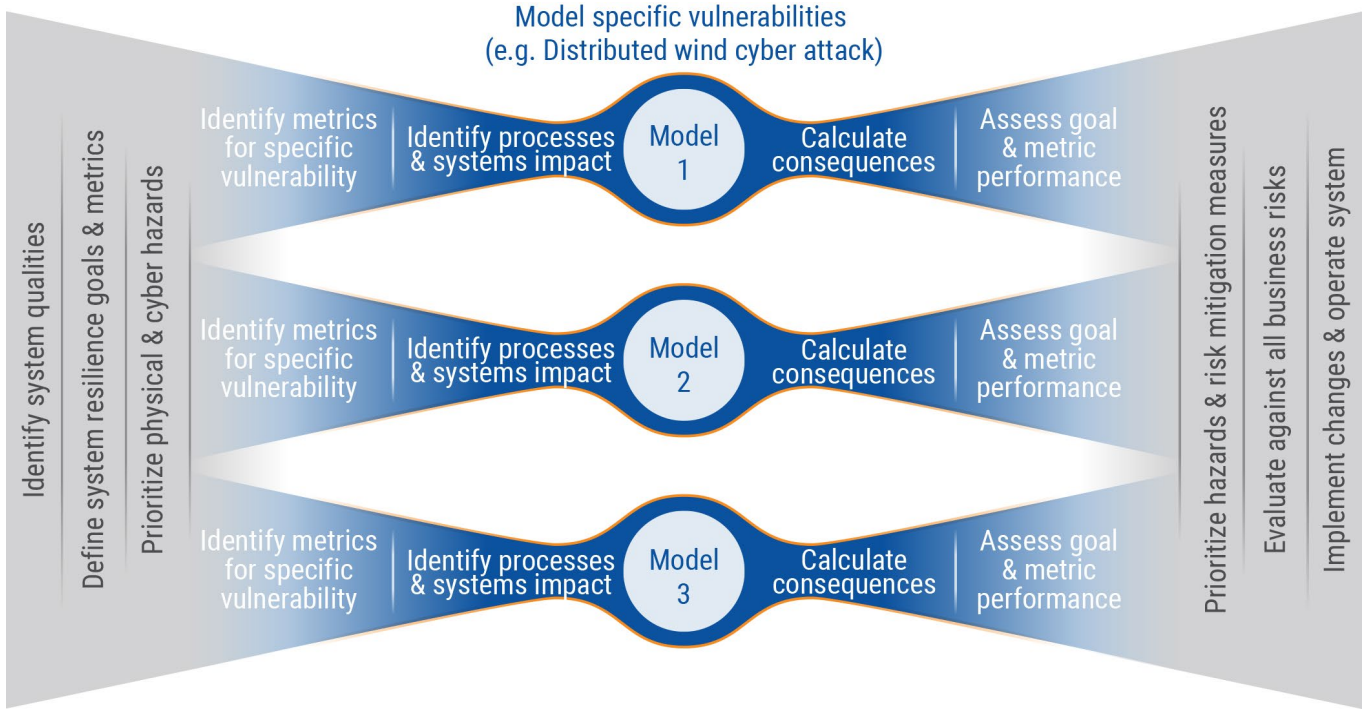
INL/MIS-22-69579

Resilience Framework for Electric Energy Delivery Systems



Resilience Planning Tool:
Motivation

- Make the resilience framework more accessible
- Allow users to customize analysis to their system
- Hazards are difficult to model – tool can help motivate



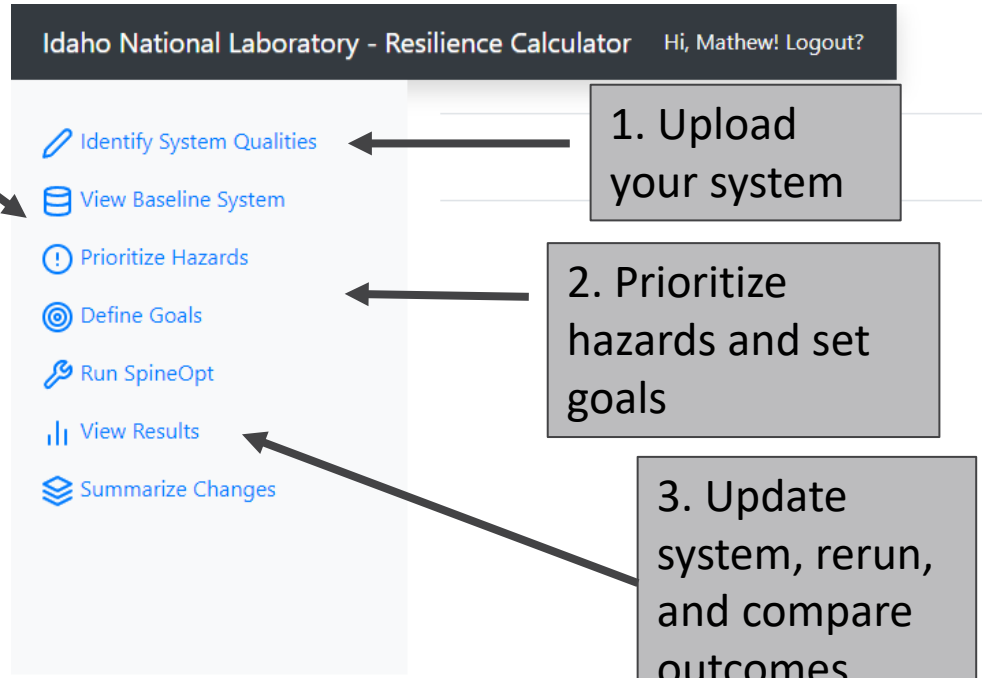
Partners

IOWA STATE UNIVERSITY

ENERGY REFORM CONSULTING SERVICES

Resilience Planning Tool:
Web Application

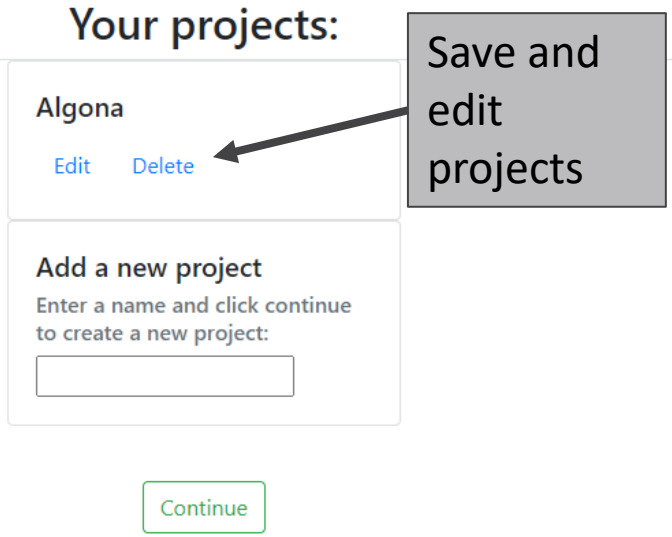
Seven tabs to walk through planning



1. Upload your system

2. Prioritize hazards and set goals

3. Update system, rerun, and compare outcomes



Save and edit projects

Resilience Planning Tool:
Workflow

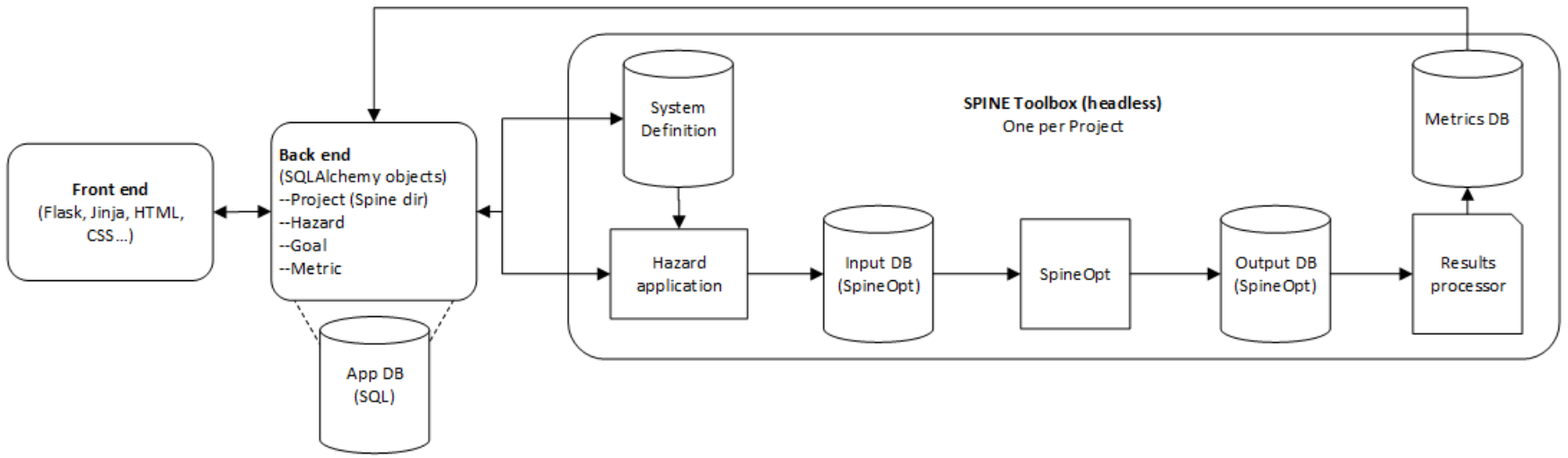
- Automate the resilience framework planning process
- Modeling and simulation performed using Spine

Web Framework

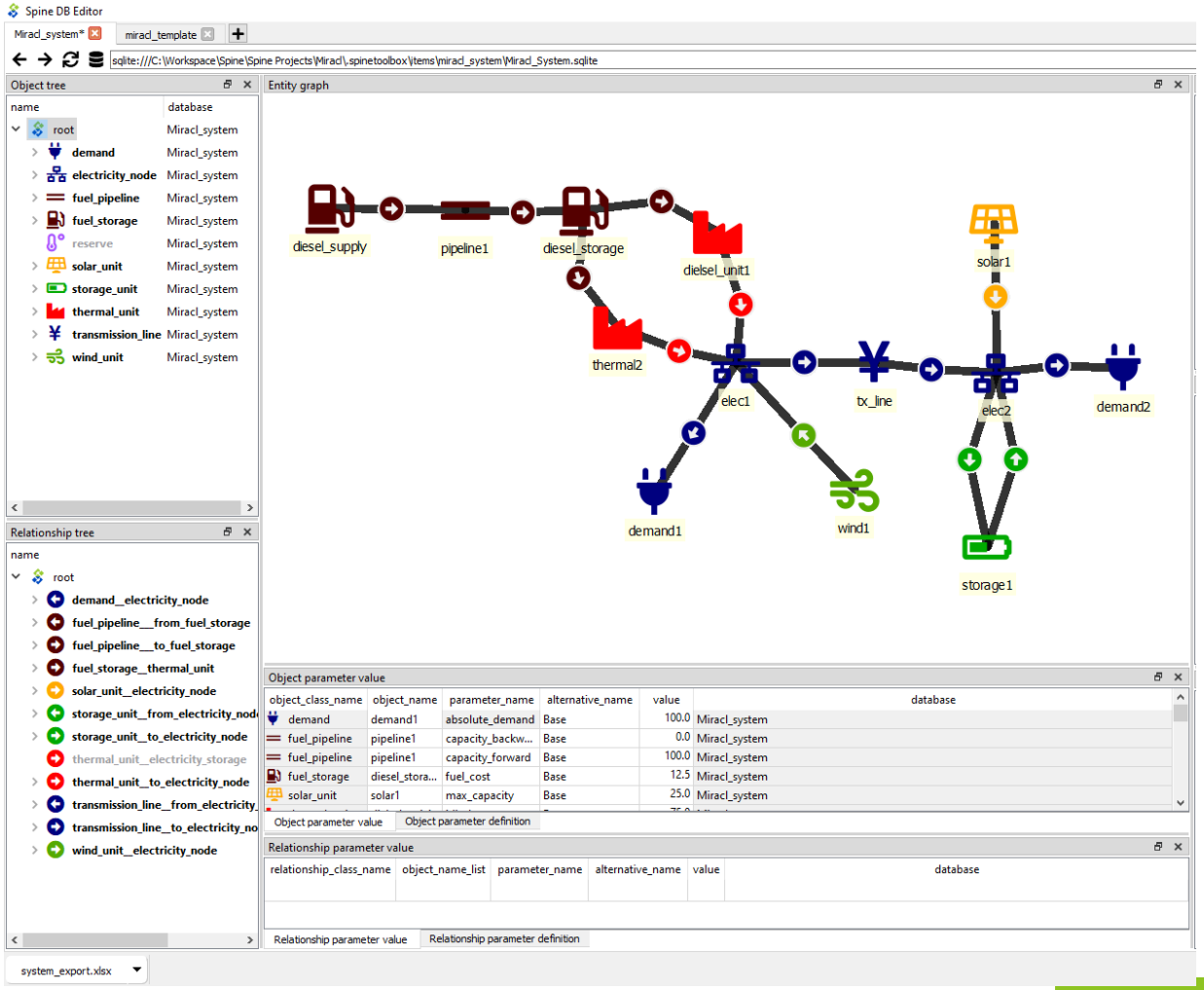
Authentication

Database Toolkit

Database

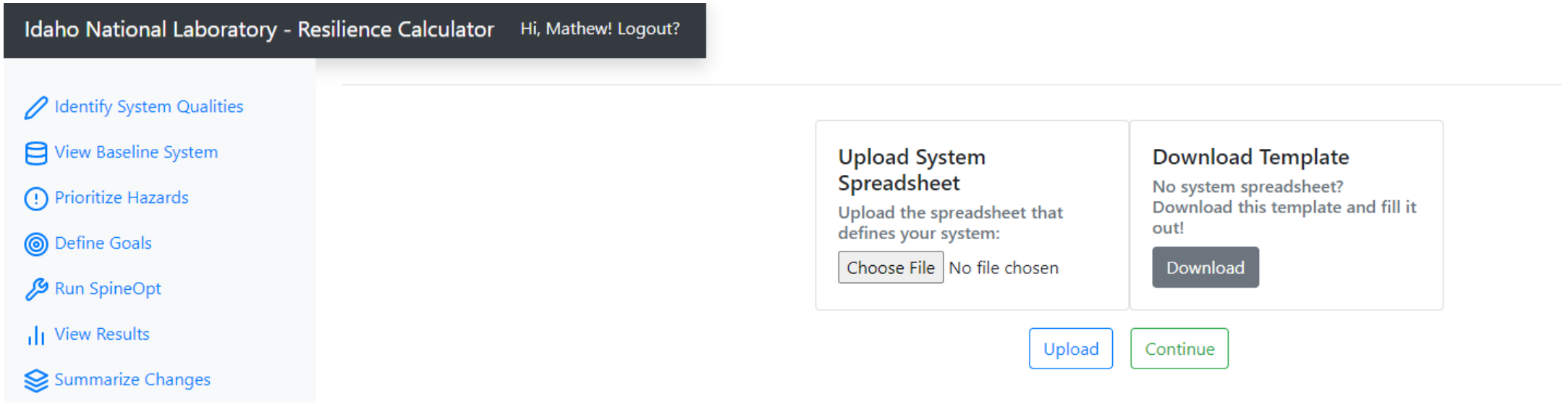


Resilience Planning Tool:
Defining a system in Spine

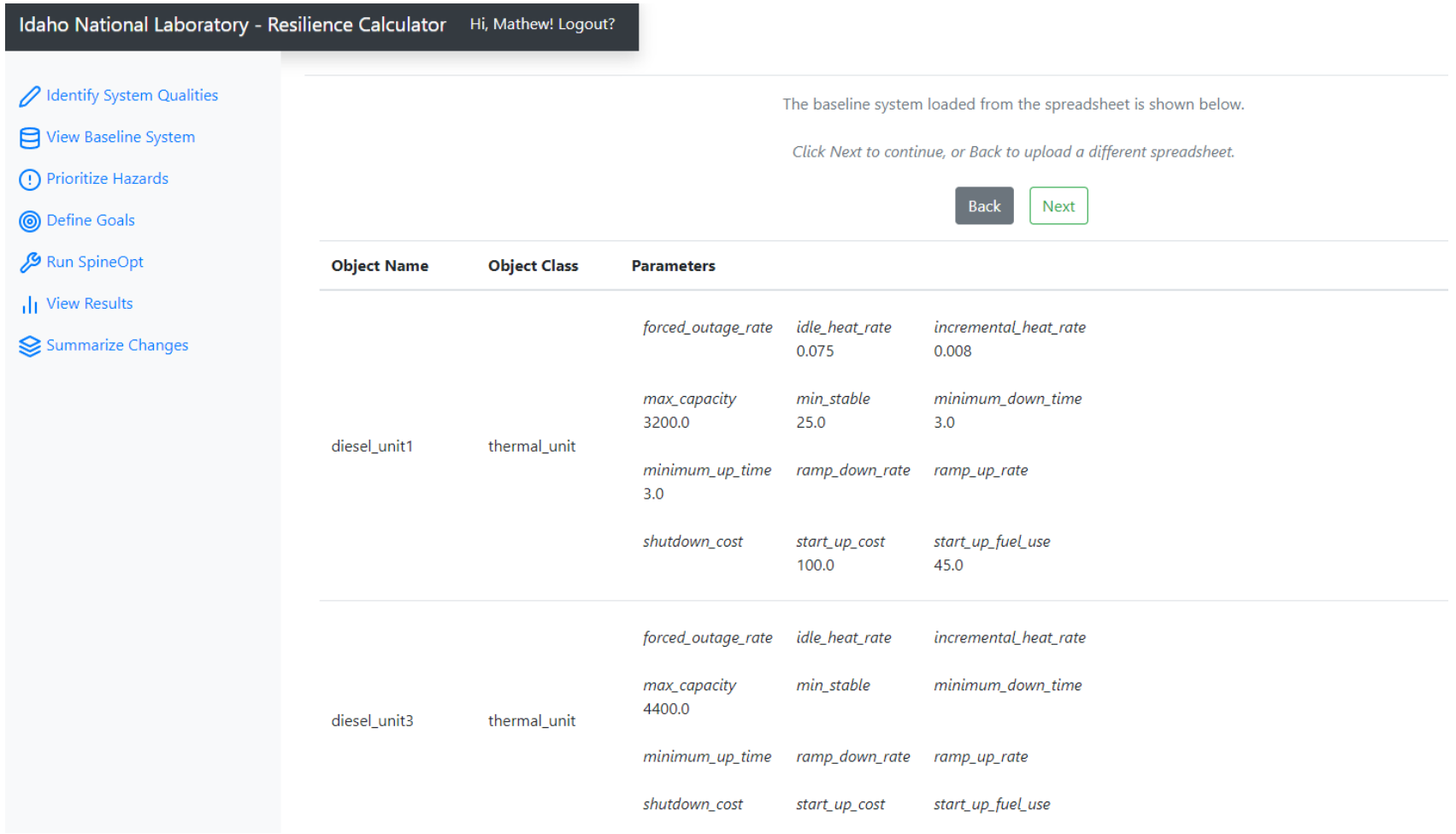


Spine DB editor, part of Spine Toolbox

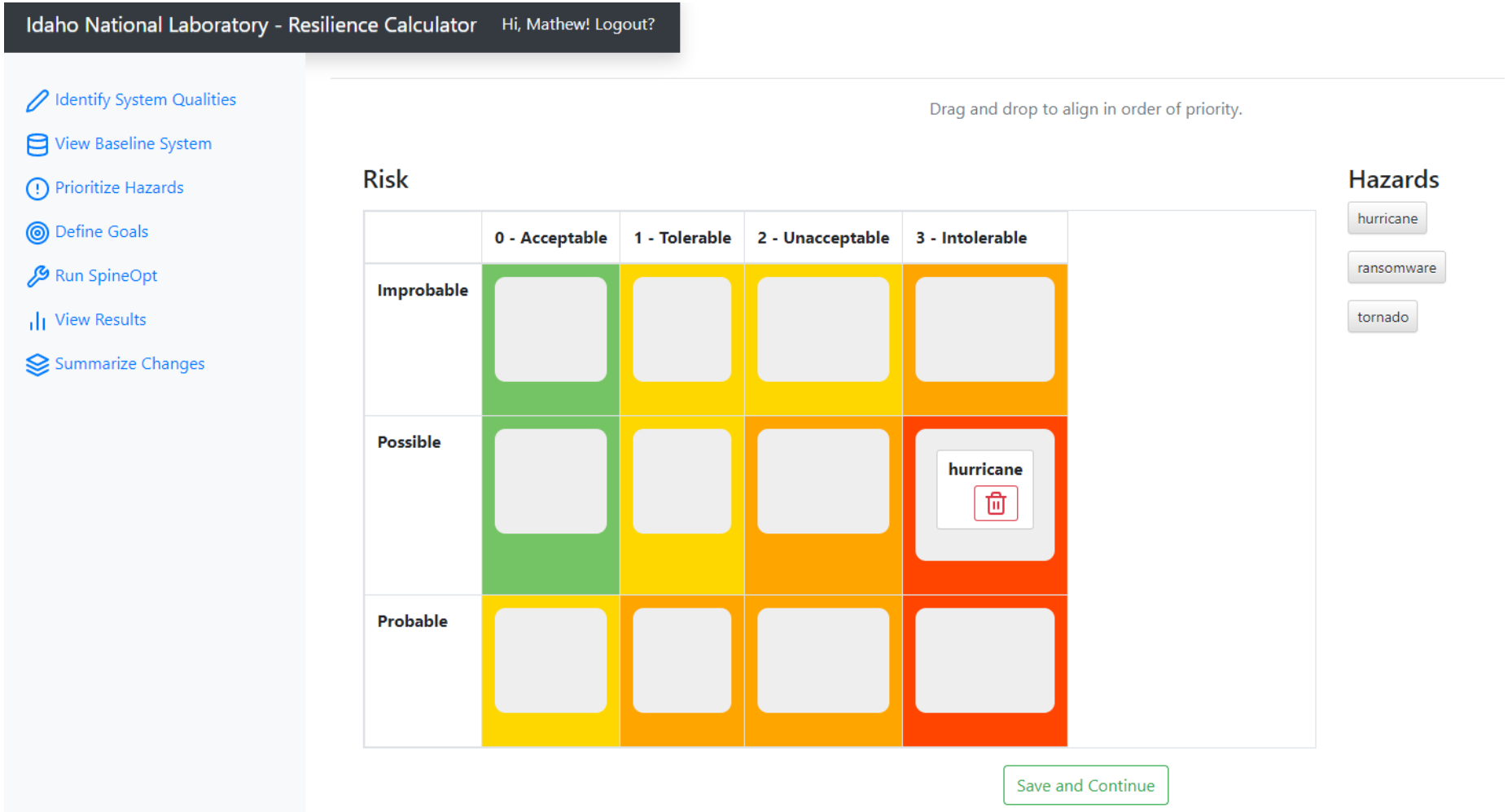
Resilience Planning Tool:
Uploading Spine System as a Spreadsheet



Resilience Planning Tool:
Viewing Spine System in Web Application



Resilience Planning Tool:
Prioritizing Hazards



Resilience Planning Tool:
Hazard Modeling

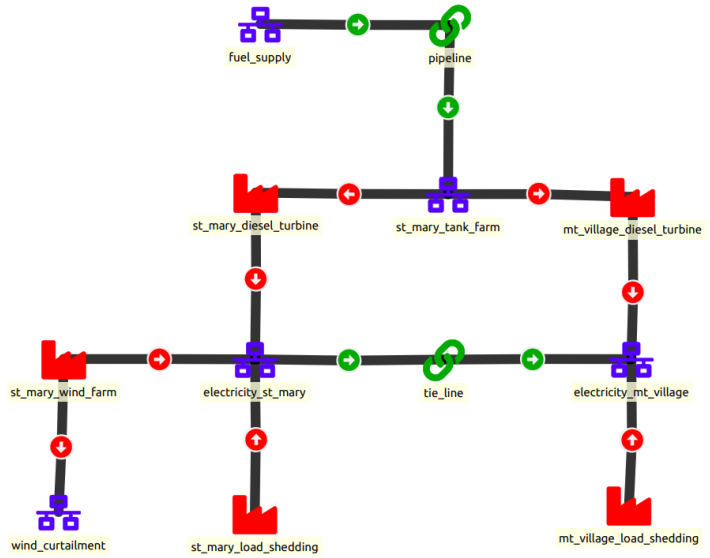
- Alternatives represent different states of components
- Scenarios are collections of alternatives

Alternative/Scenario tree

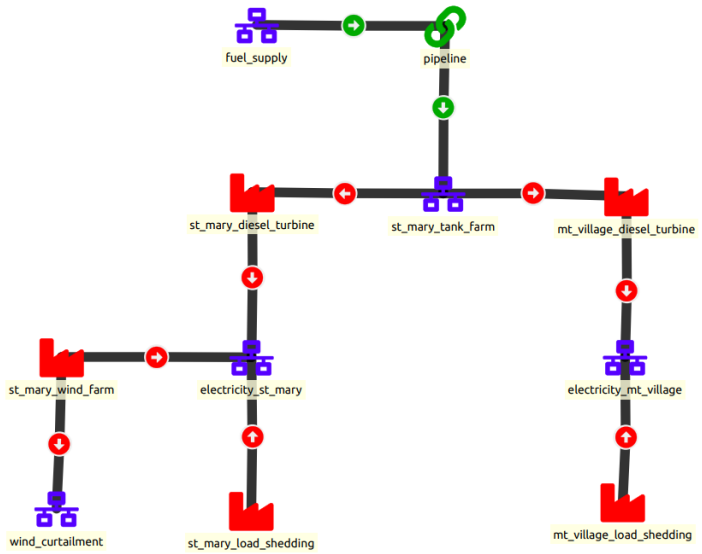
name	description
Input SpineOpt DB	
alternative	
Base	Base alternative
miracl_hazard	Hazard alternative
Type new alternative name here...	
scenario	
base_case	
active: yes	
scenario_alternative	
Base	Base alternative
Type scenario alternative name here...	
hurricane	
active: no	
scenario_alternative	
miracl_hazard	Hazard alternative
Base	Base alternative
Type scenario alternative name here...	
Type new scenario name here...	

Object parameter value

object_class_name	object_name	*parameter_name*	alternative_name	value	database
connection	tie_line	is_active	miracl_hazard	False	Input SpineOpt DB
connection	tie_line	is_active	Base	True	Input SpineOpt DB

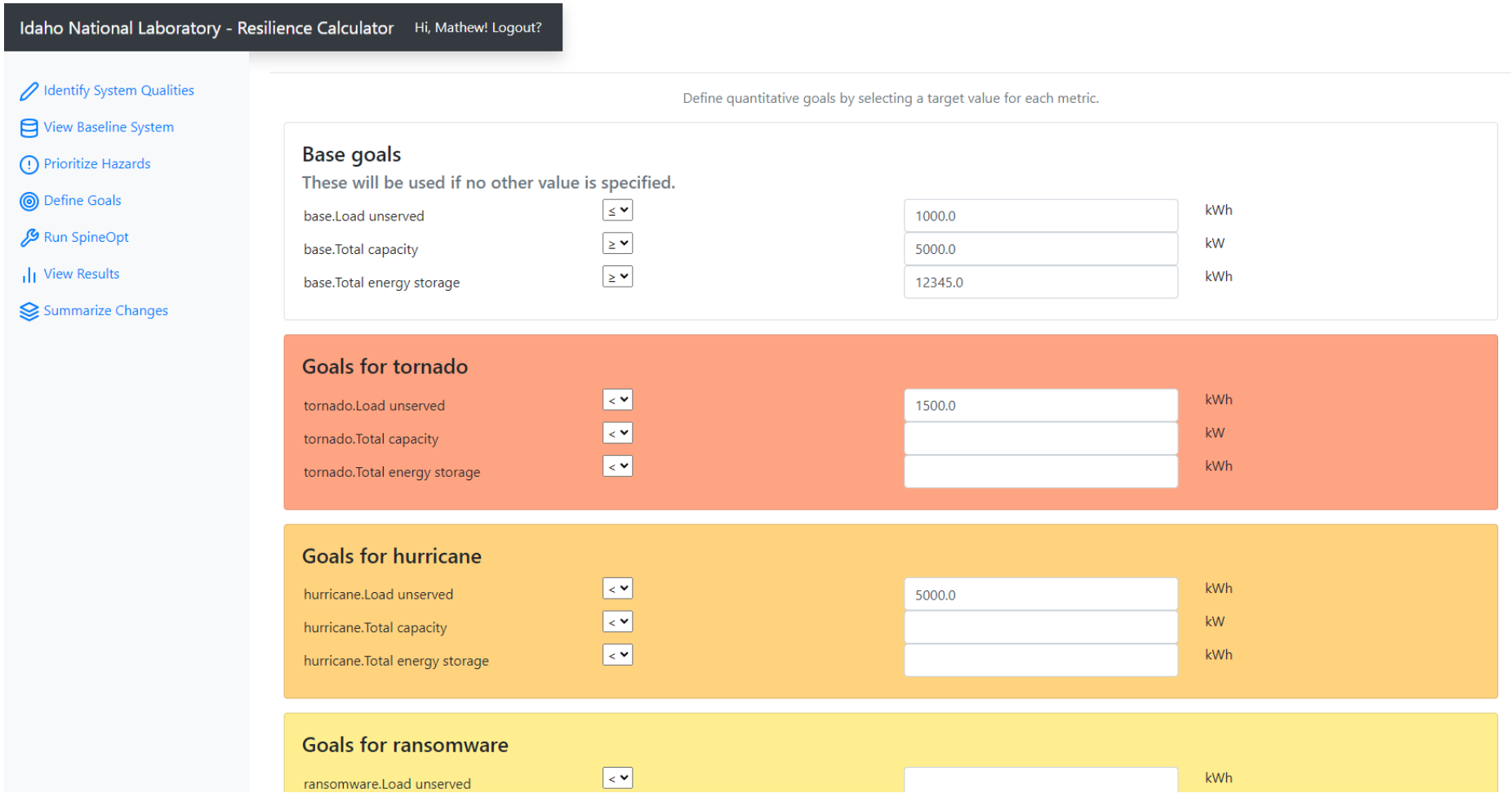


Base case system

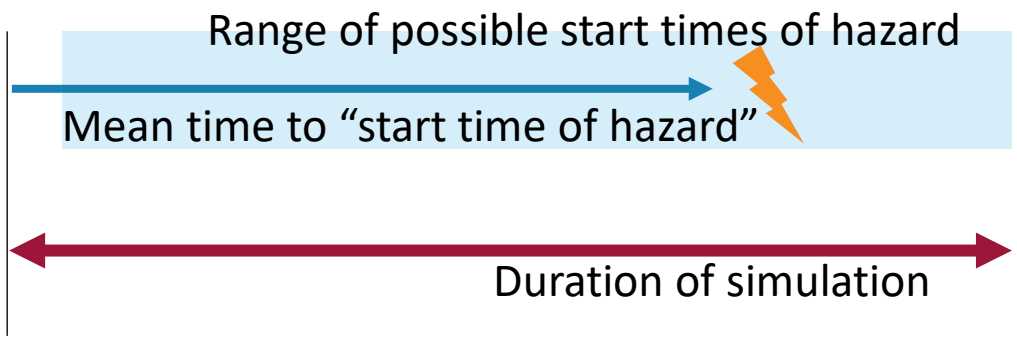


System with hazard applied

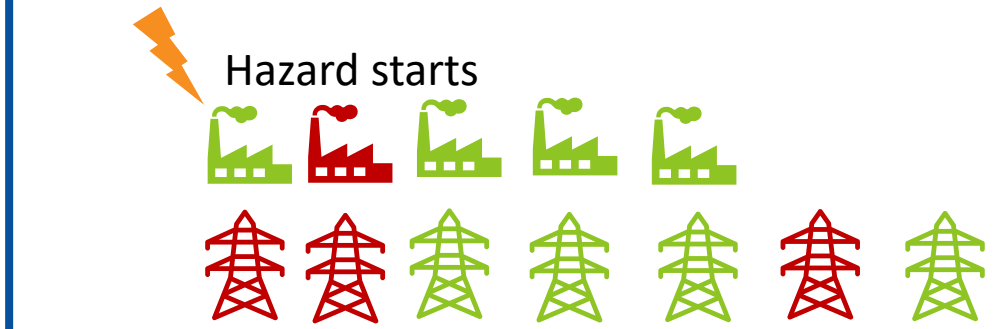
Resilience Planning Tool:
Setting Resilience Metric Goals for each Hazard



Resilience Planning Tool:
Automated Hazard Analysis

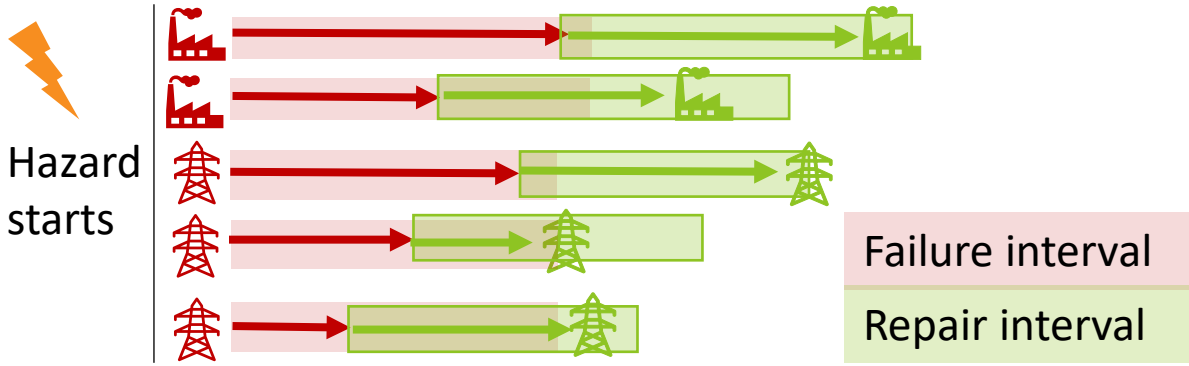


Randomizing start time of hazard



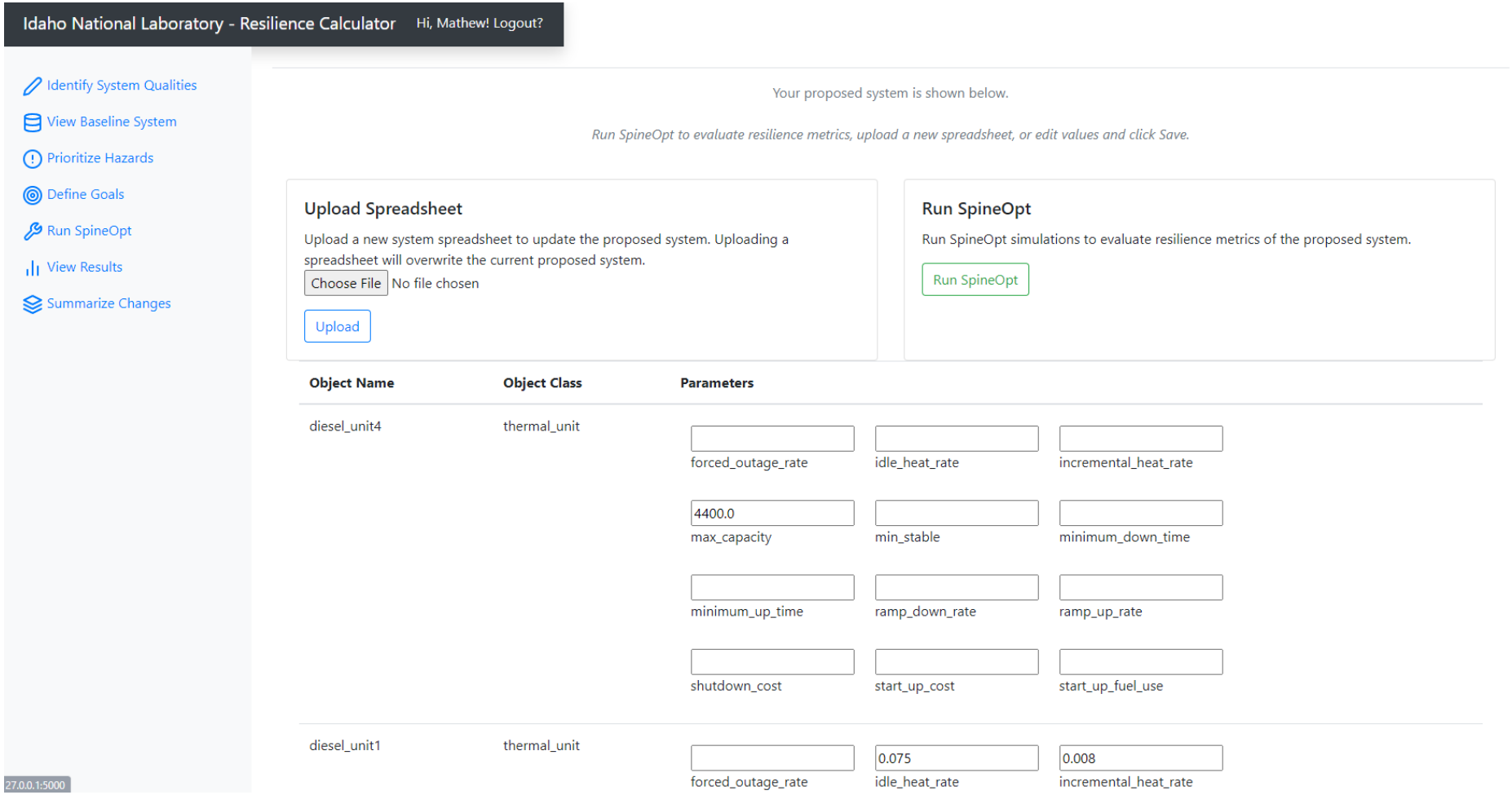
Define components that could be affected

a) Apply hazard for duration of failure

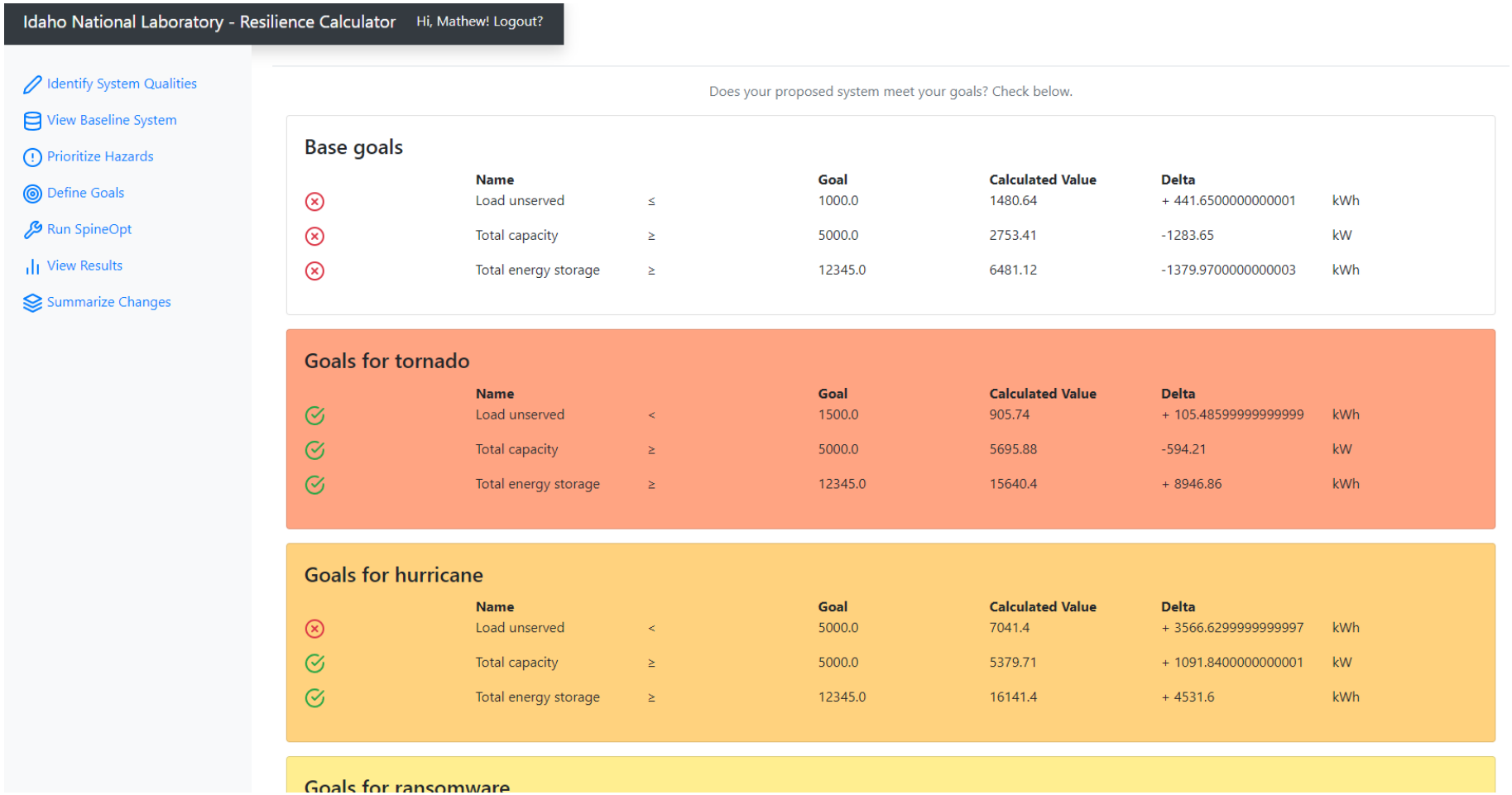


b) Apply mean time to failure/repair

Resilience Planning Tool:
Automated Hazard Analysis from Web Application

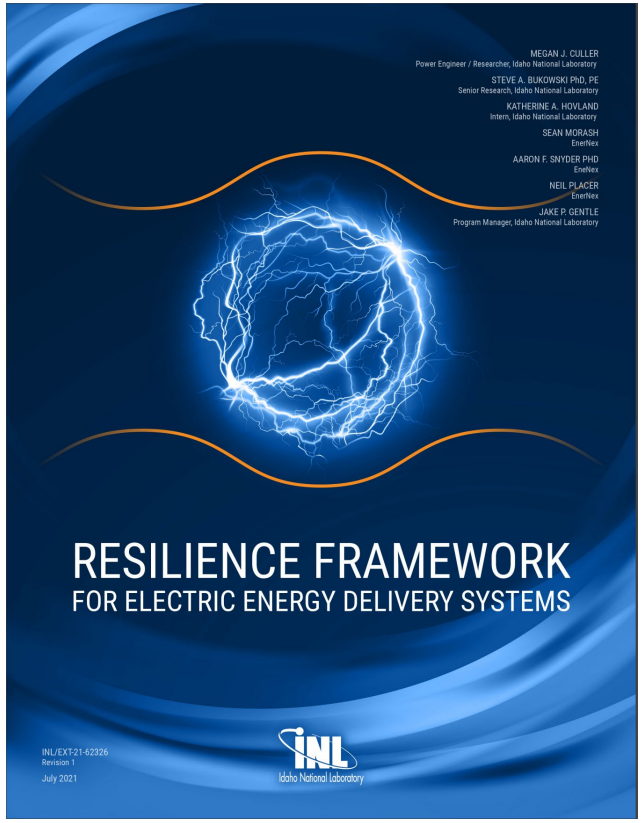


Resilience Planning Tool:
Web Application Results



Resources

- Resilience Framework for Electric Energy Delivery Systems
- Case Study: Applying the Framework to St. Mary's, Alaska
- Case Study: Applying the Framework to Iowa Lakes, Iowa
- Isolated Grids and Grid-Connected Turbine Reference Systems
- More coming soon



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