

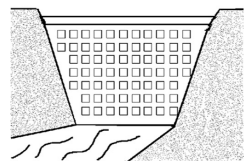


From Glaciers to Grids: Preparing Seattle City Light for Climate Change

Crystal Raymond
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Seattle City Light

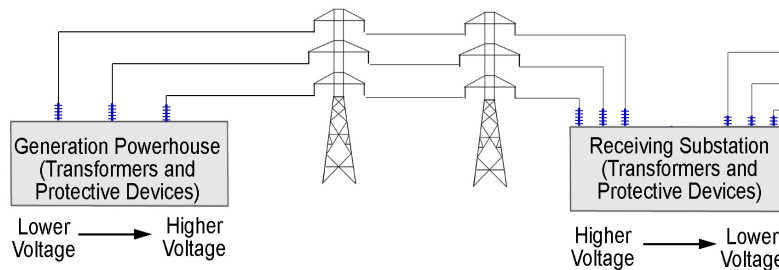
SEATTLE CITY LIGHT INFRASTRUCTURE

Generation

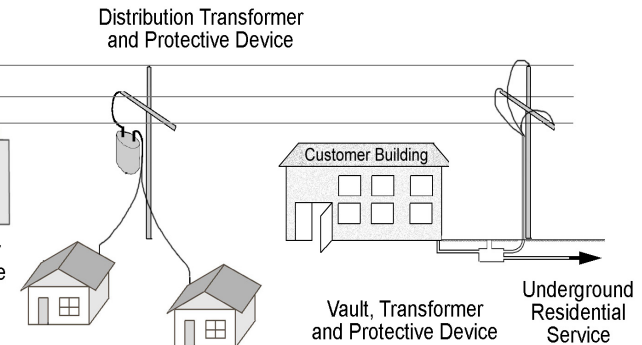


Hydro, Fossil Fuel, Nuclear,
Wind, Solar, Etc.

Transmission



Distribution



- Two hydro-electric projects
- Communities of Newhalem and Diablo
- 650 transmission circuit miles
- Towers
- 2,300 distribution circuit miles
- 400,000 residential and commercial customers

IMPACTS TO GENERATION: AUGUST OPERATIONS



- Maintain minimum flows for Steelhead and Chinook
- Keep Ross lake full for recreation



Skagit hydroelectric project (21% of 2012 power)

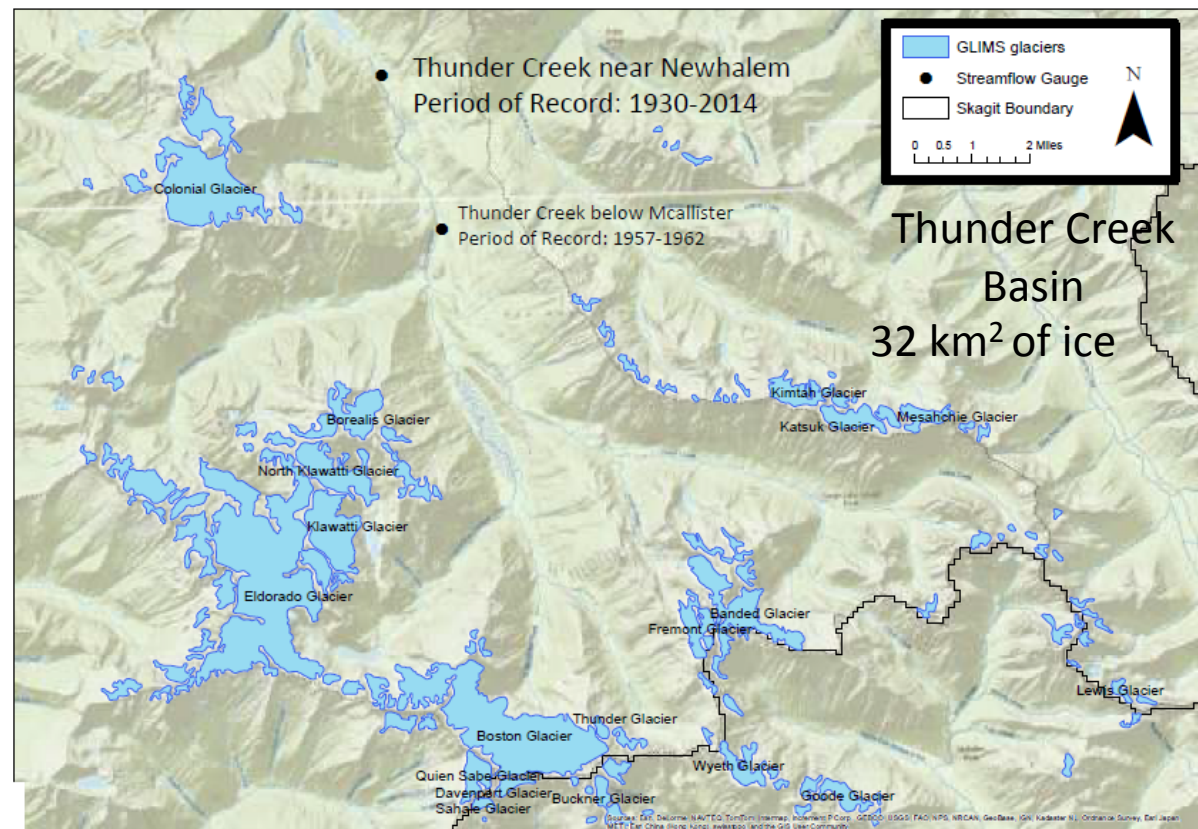


GLACIER RESEARCH



Glacier meltwater is important for meeting Aug objectives

Research: UW Civil and Environmental Engineering

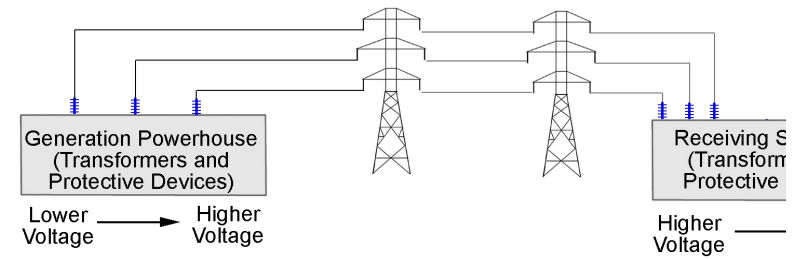


ADAPTATION OF THE GENERATION SYSTEM

Opportunities for “mainstreaming” adaptation

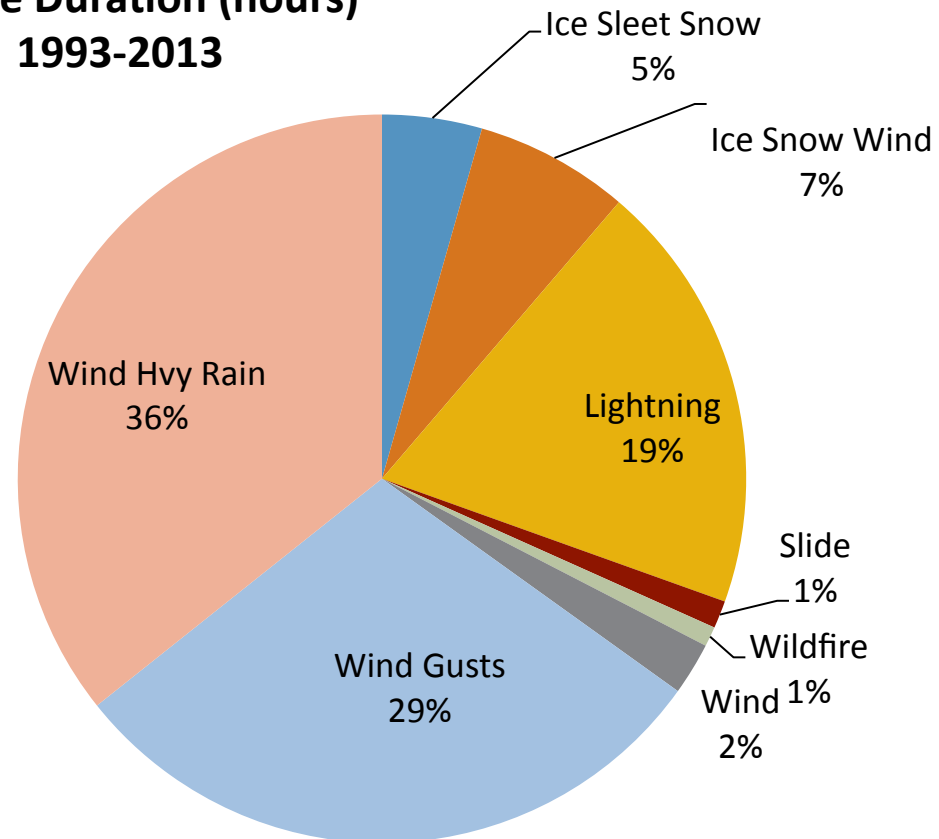
- Leverage existing capacity to respond to climatic variability
 - Annual monitoring of snowpack and fish
 - Dynamic operations in response to streamflow variability
- Integrated Resource Plan (20-year plan updated every 2 years)
- Skagit hydroelectric project FERC re-licensing

IMPACTS TO TRANSMISSION



**Generation & Transmission
Outage Duration (hours)
1993-2013**

- Hardening and Resilience
- Research on wind and lightning patterns (Eric Salathe, University of Washington)



Some utilities do this....



But there are many benefits to keeping more vegetation.

ADAPTING THE TRANSMISSION SYSTEM

Opportunities

- Diablo and Newhalem Community Wildfire Hazard Risk Assessments
- Vegetation Management

Barriers

- Limited land ownership
- Need to balance other objectives for the rights-of-way (aesthetics, wildlife habitat, invasive species)



ADAPTING THE TRANSMISSION SYSTEM

Opportunities

- Seattle Hazard Identification and Vulnerability Analysis
- Seattle City Light All Hazards Mitigation Plan
- FEMA Mitigation Funds

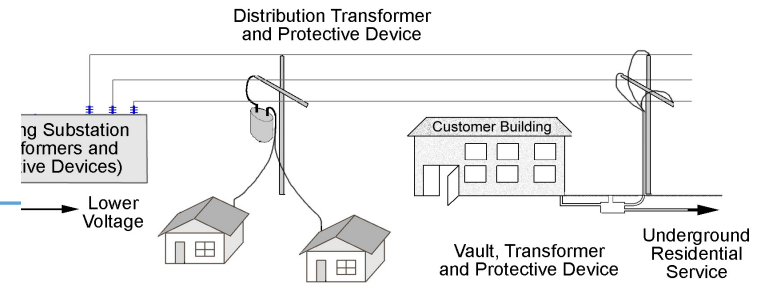
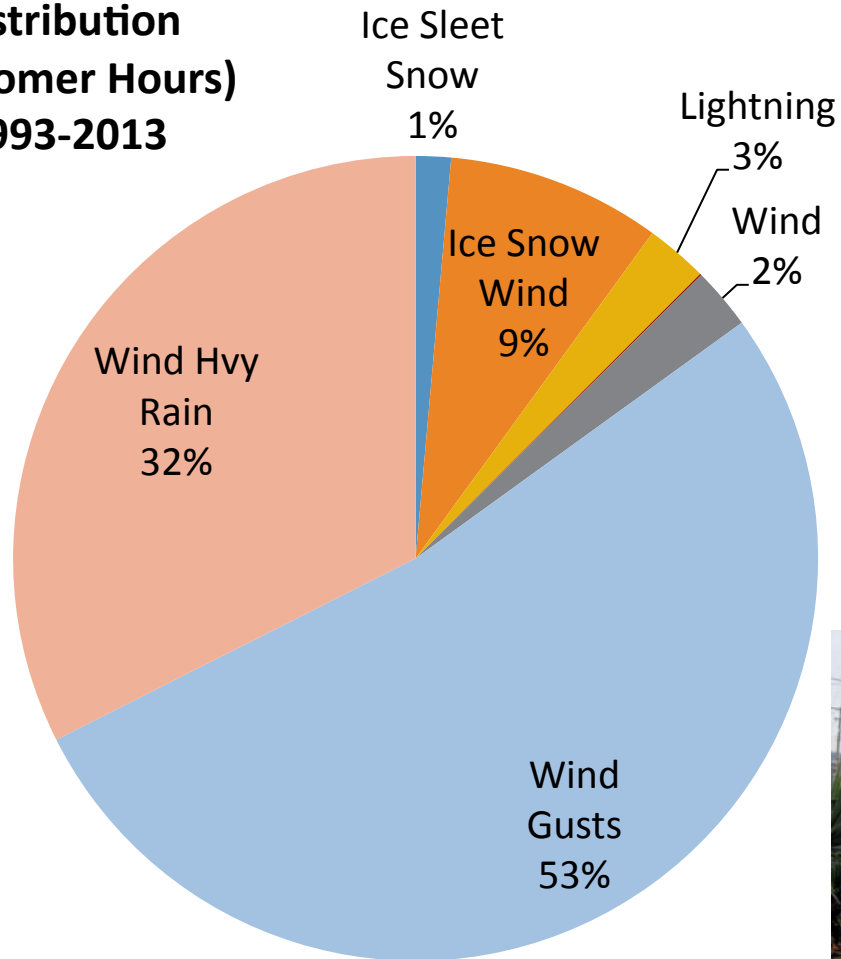
Barriers

- Cost-benefit analysis
- Changes in the likelihood of events



IMPACTS TO DISTRIBUTION

**Distribution
(Customer Hours)
1993-2013**



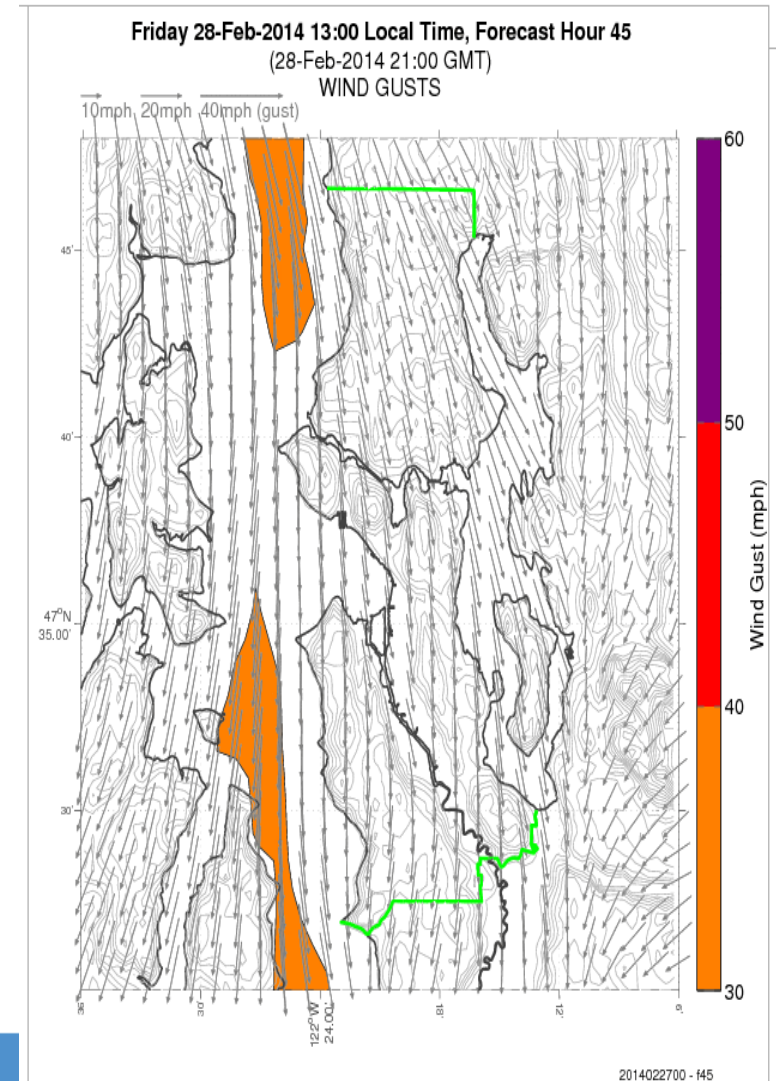
ADAPTING THE DISTRIBUTION SYSTEM

Opportunities

- Winter storm preparedness and WindWatch
- Vegetation Management Program
- Engineer for lighting resilience

Barriers

- Urban trees have many benefits (aesthetics, urban heat reduction, wildlife habitat)
- International and national standards for reliability do not address climate change
- Is SCL resilient enough?



QUESTIONS

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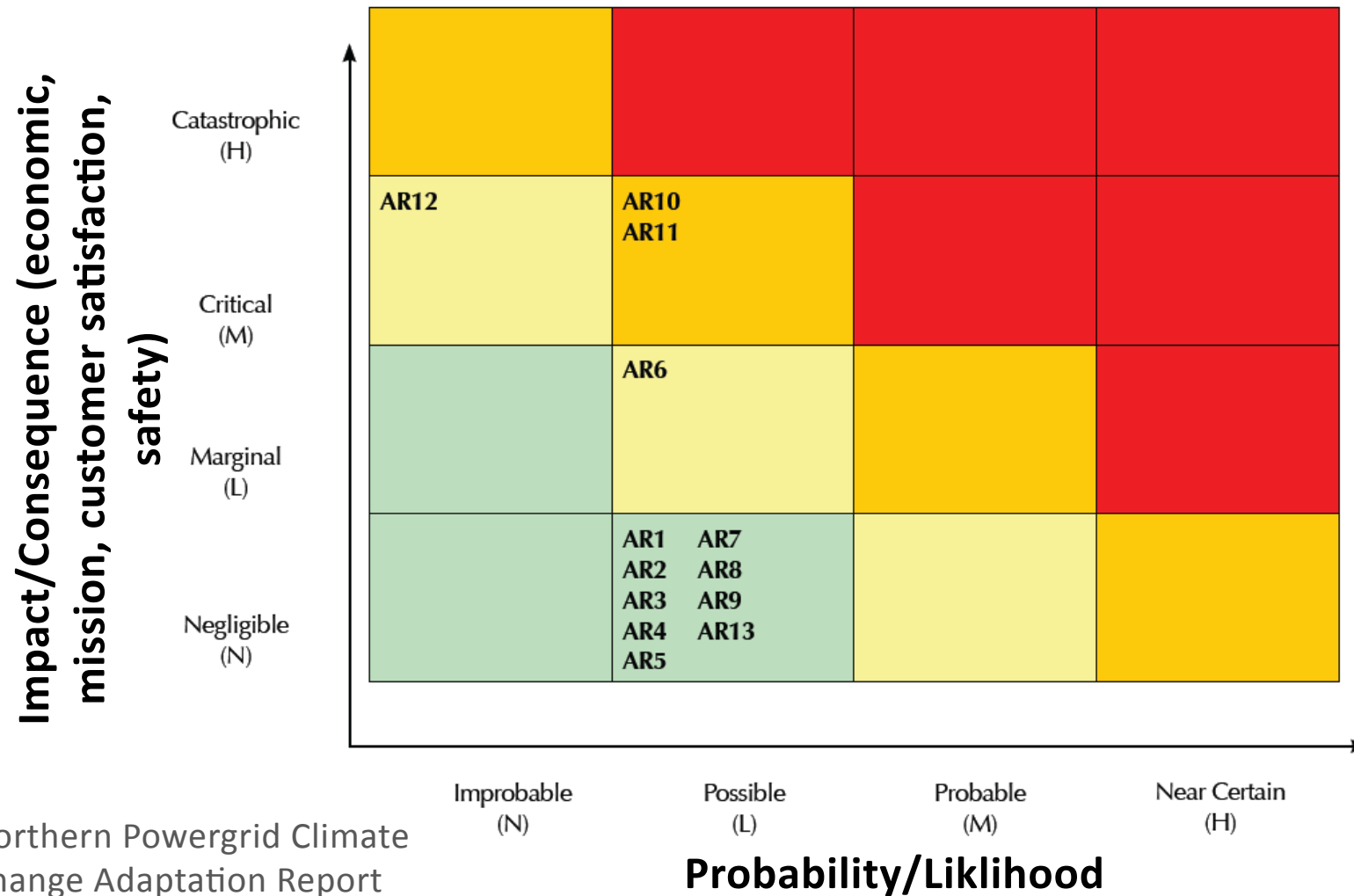
ADAPTATION PLANNING



Strategic adaptation plan

Implement by “mainstreaming” adaptation into current policies and operations

PRIORITIZATION THROUGH RISK MANAGEMENT



Northern Powergrid Climate
Change Adaptation Report

Seattle City Light Sources of Power

2012 SOURCES OF POWER

(in percent megawatt-hours)

GENERATED

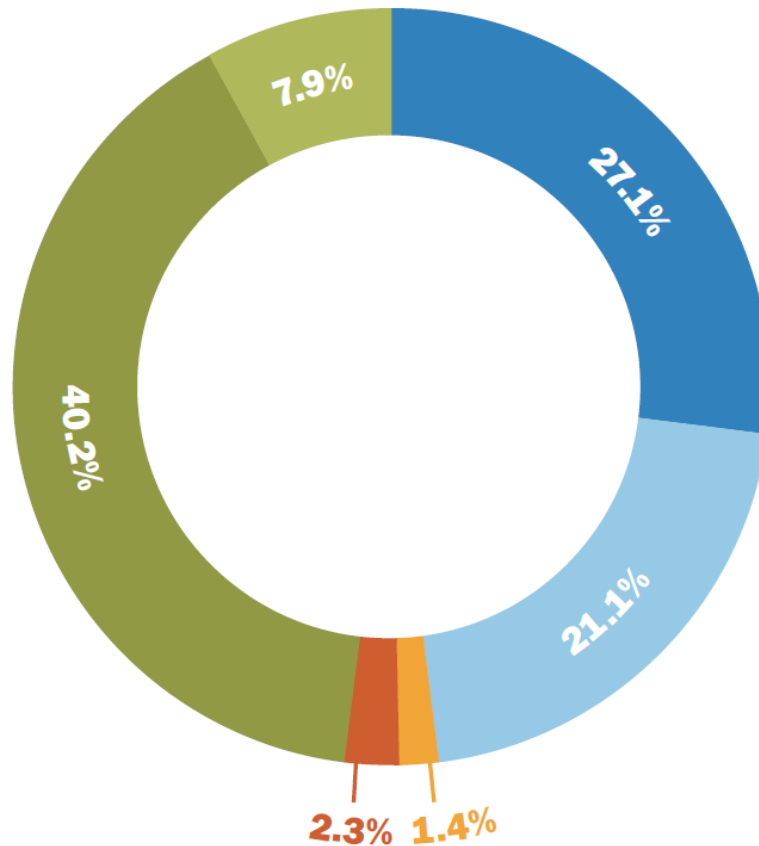
- Boundary
- Skagit
- Cedar Falls & South Fork Tolt

TREATY

- BC Hydro

PURCHASED

- BPA
- Other



GENERATION

Barriers

- No legal or regulatory requirements to address climate change impacts
- Shorter term impacts (population growth, economics, technology, and the price of carbon and natural gas)