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HILP

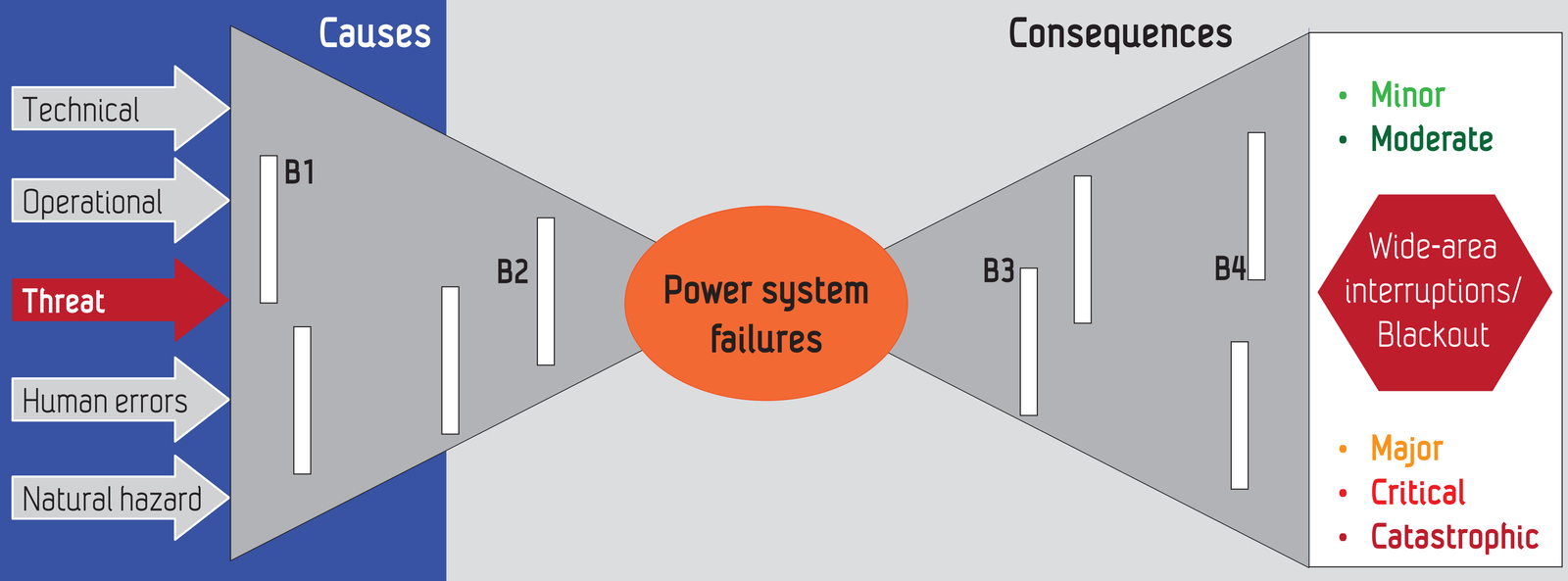
A framework for handling HILP events

Wide-area interruptions are extraordinary events with severe impacts on society's critical functions, but usually with low probability (high impact low probability - HILP events). Controlling risks and vulnerability related to HILP events is an essential part of asset management.

In risk based asset management it is important to find the right trade-off between investments and maintenance on one side and security of electricity supply (SoS) and societal impact of interruptions on the other.

A framework for handling HILP events is presented, and used to structure and analyse some previous blackouts and extraordinary events.

Framework for HILP events
Threats, unwanted events, consequences and different barriers (B1- 4)



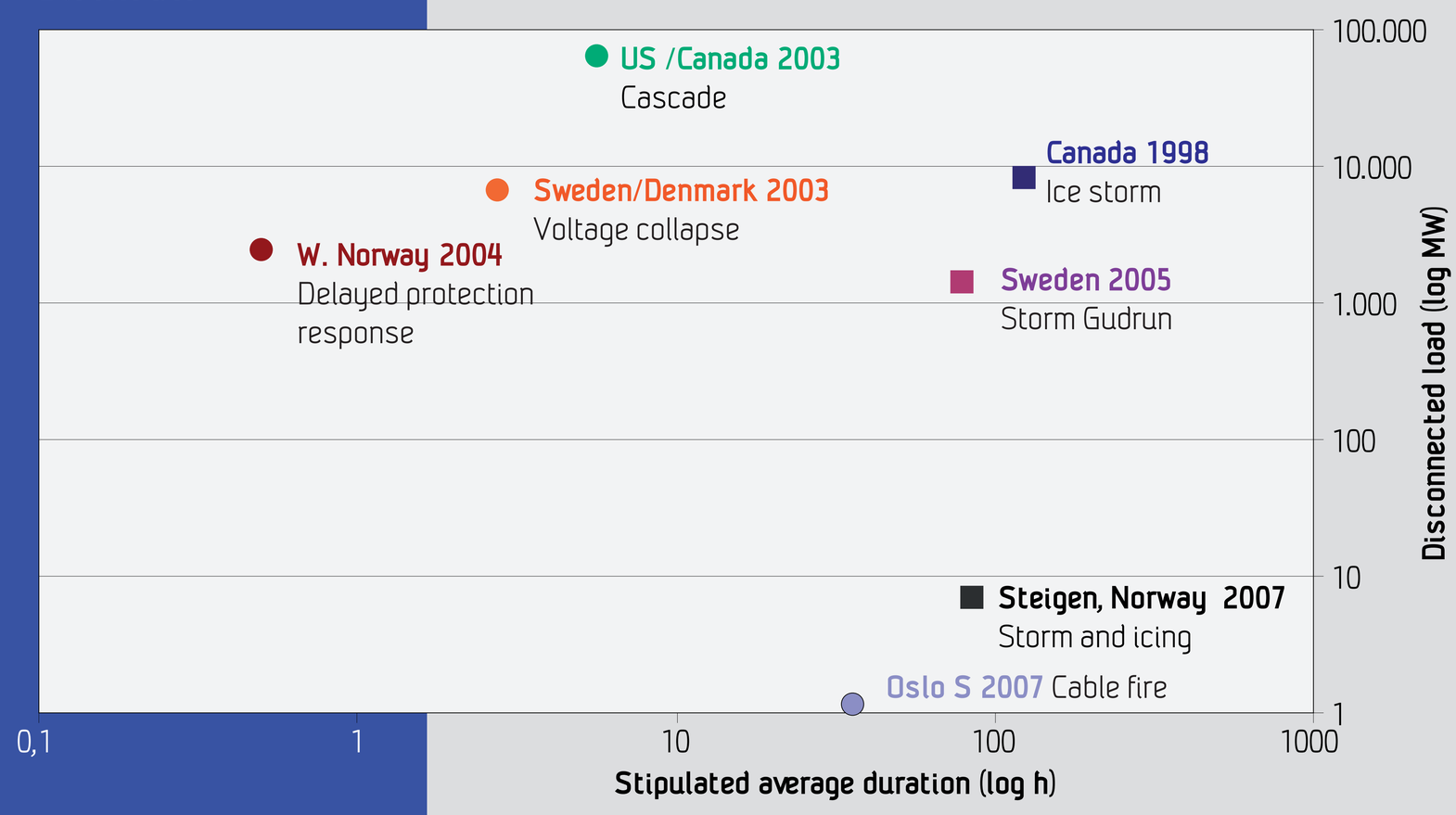
The bow-tie framework is used to structure HILP events:

- Threats/hazards
- Unwanted events
- Final consequences for end-users
- Emergency preparedness, restoration of supply
- Vulnerabilities and barriers.

Barriers grouped in four types:

- Prevent component failure (**B1**)
- Prevent power system failure (**B2**)
- Facilitate restoration (**B3**)
- Reduce end-users consequences (**B4**)

Blackouts



Blackouts: Inadequate barriers

Barriers	Gudrun 2005	Steigen 2007	Oslo S 2007
Prevent component failure			
Strength and design of construction	●	●	●
Vegetation management and adequate choice of right-of-ways	●	●	
Condition monitoring		●	
Prevent power system failure			
Redundancy; reserve capacity		●	●
System operation response			●
Facilitate restoration			
Good and known restoration plan	●	●	●
Access to personnel and material	●		
Communication	●		
Coordination and clarification of responsibility	●		●
Reduce end-users consequences			
Alternative energy supply	●	●	●
Back-up in connected infrastructure			●
Information to the public	●	●	

Conclusions

- Previous blackouts: several barriers had inherent weaknesses.
- Need for indicators and models to describe vulnerabilities.
- The framework will help classify events, identify barriers and vulnerability indicators.
- The framework will be used in further work to identify needs for indicators and tools to monitor vulnerabilities.

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CIRED workshop
Sustainable Distribution Asset Management & Financing
7-8 June 2010 | Lyon, France
www.cired2010-workshop.org