McKinsey & Company

Helping a utility prepare for rising climate impacts

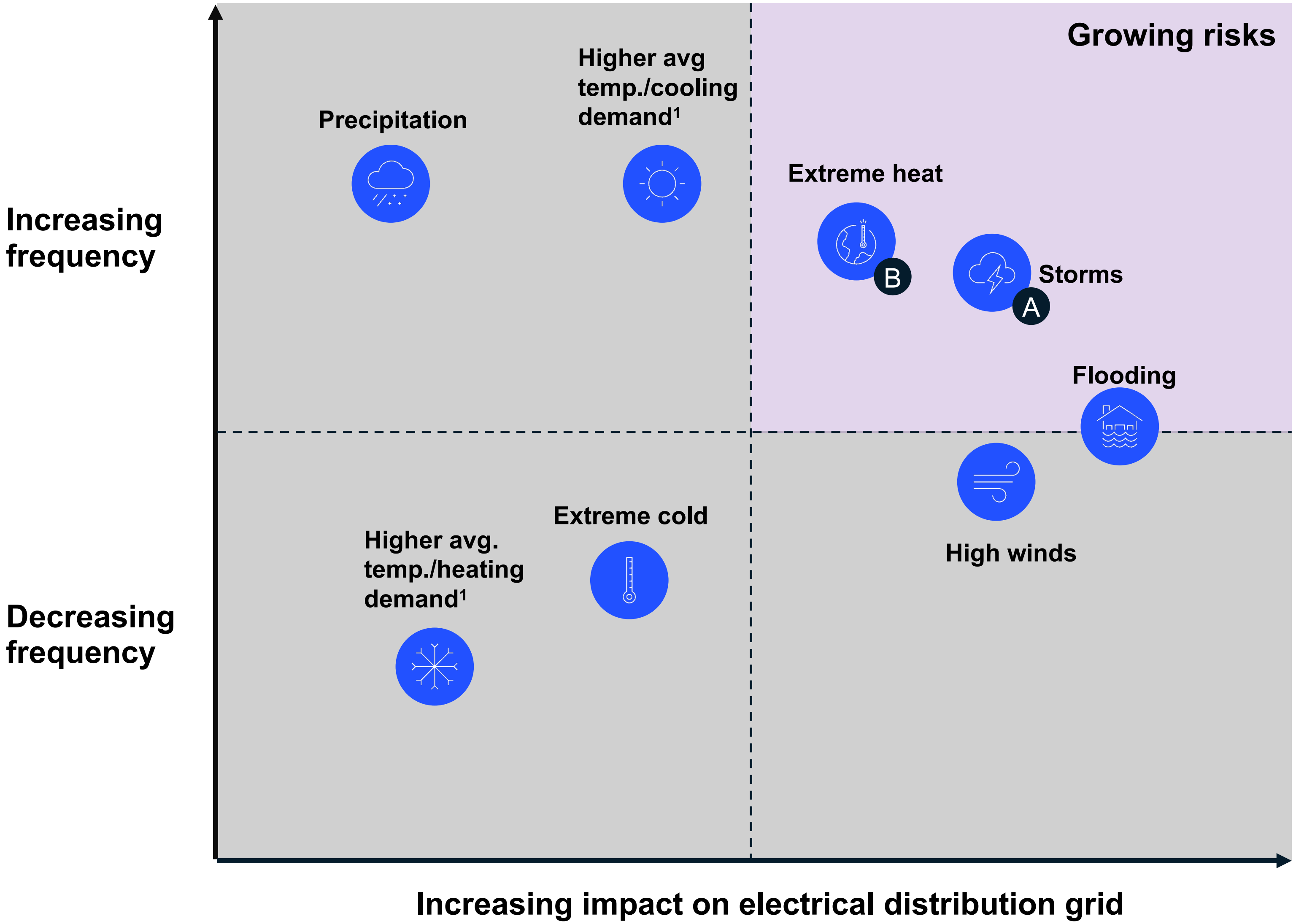
Hamid Samandari

28 May 2023

A utility asked us to help answer three questions

1. **What is our physical climate risk exposure in 2030?**
2. **What is our transition risk exposure from additional power demand from, e.g., EVs?**
3. **What do we do about it?**

1: The effort prioritized the most frequent and severe risk hazards to model in granular detail



1. Higher average temperatures, leading to higher cooling loads in the summer, and lower heating loads in the winter

Source: McKinsey Climate Analytics

1: Circuit-level view of climate risks helped identify areas where interventions would have the highest resiliency ROI

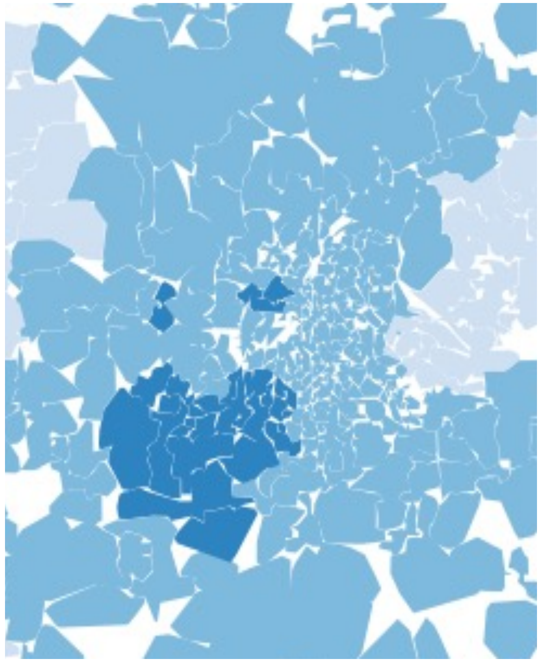
Level of impact

Low — *High*

2030 climate risk map

A1 Thunderstorms

A2 Year-round storms



A3 Freezing rain and ice

B Cooling loads

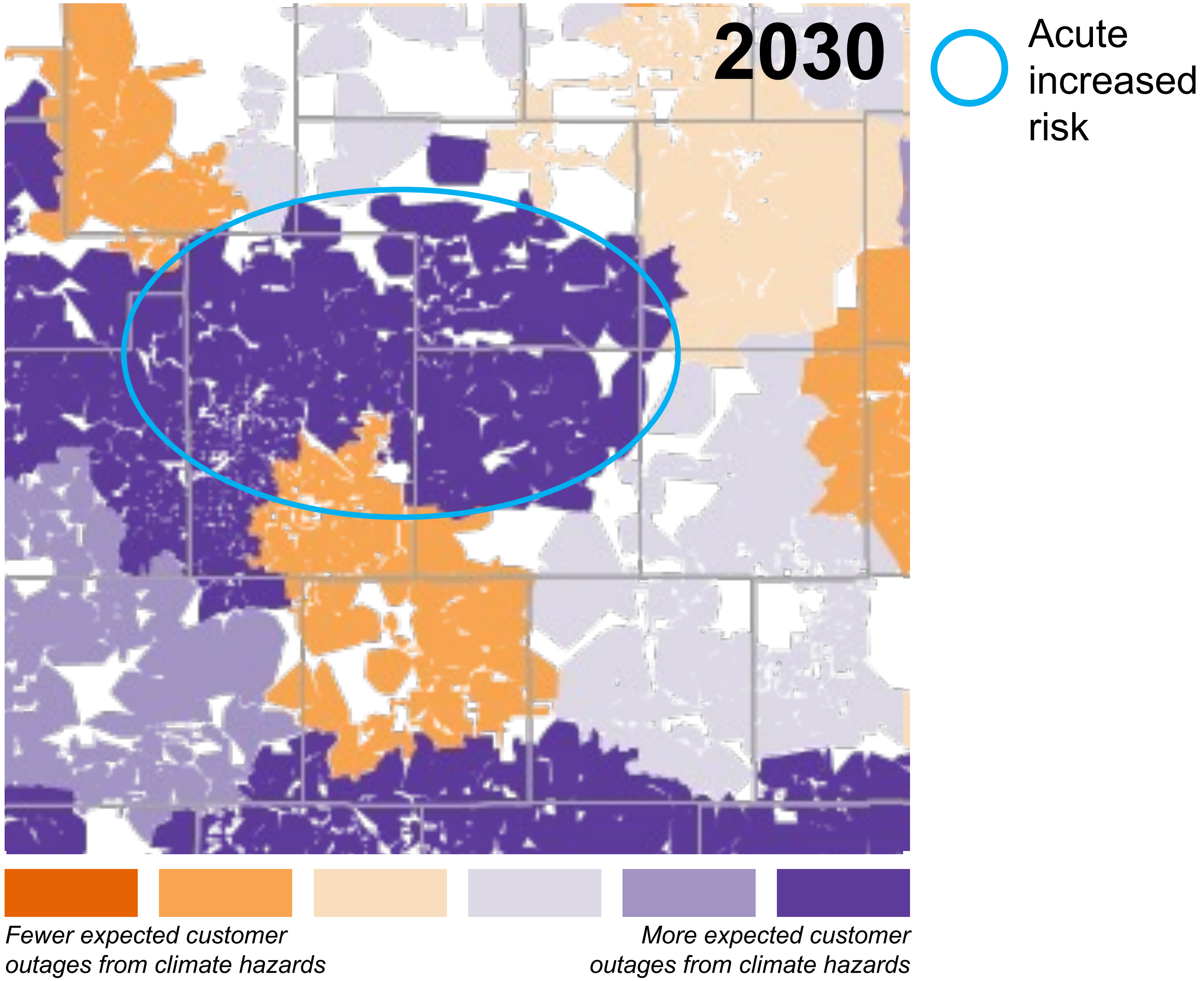
Data	Proprietary utility data with load and demographic information at the customer level[1] 4km x 4km resolution climate, weather and hazard data built from a five-model ensemble[2]

1. Included peak and average load, and customer information on building type, income range, age, employment status, and interests
2. CanESM2, CCSM4, GFDL-ESM2M, HadGEM2-365, MIROC5, which accounts for a range of warming sensitivity from the latest CMIP6 data

Source: McKinsey Climate Analytics

1: Combining hazard risks showed which regions would benefit most from interventions

Total storm-driven outages per region

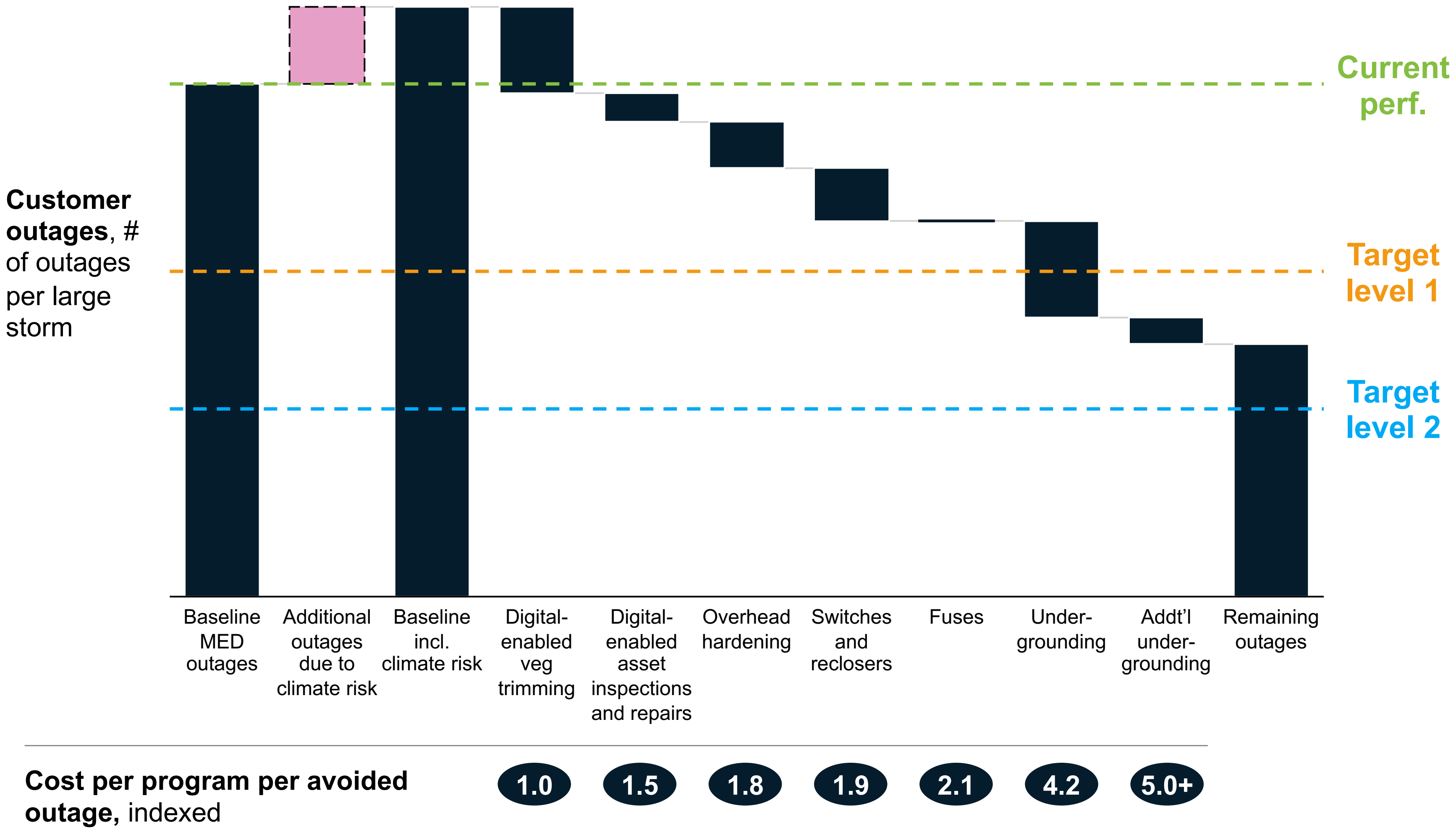


- Analysis informed local investment planning instead of equal distributions or age-based approaches
- Allowed the utility to focus on 15-30% of circuits with highest risk
- Expected to lead to 60% higher reliability/ resiliency with targeted additional spend

Source: McKinsey Climate Analytics

1: Investments were allocated first to highest impact measures

Required investments to meet 2030 resiliency targets



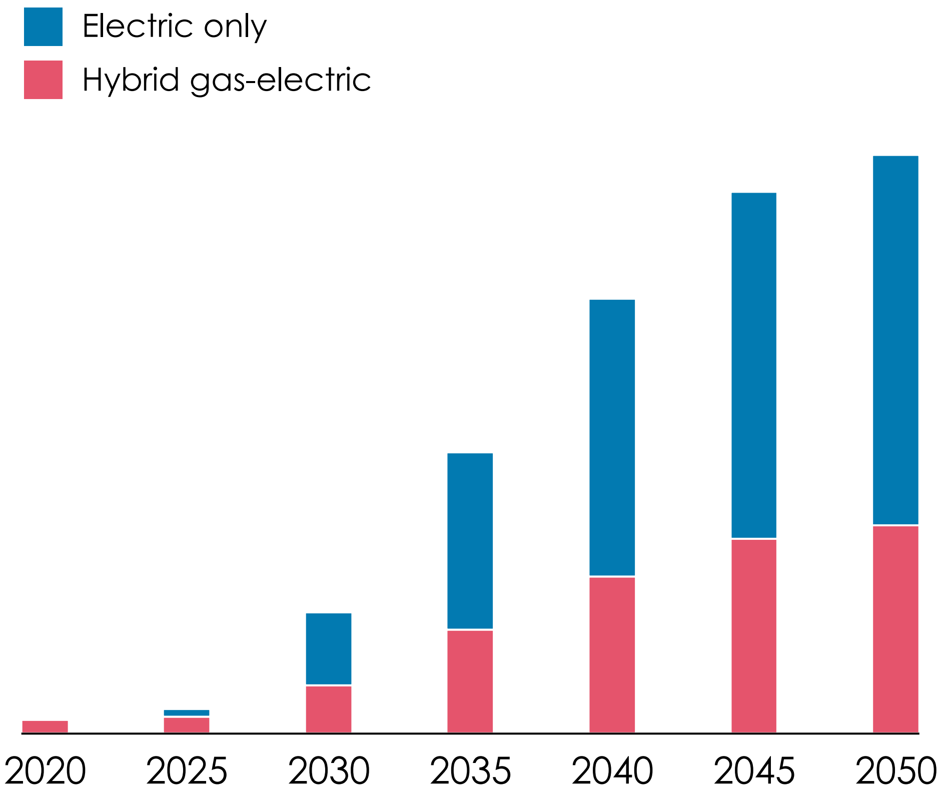
- Risks increase, and keeping today's performance already requires intervention
- Programs costs increase with higher reliability targets
- A prioritized approach allows the utility and regulator to ensure expenditures maximize customer experience

2: Circuit-by-circuit view gives a previously unavailable option to plan locally to manage transition risk

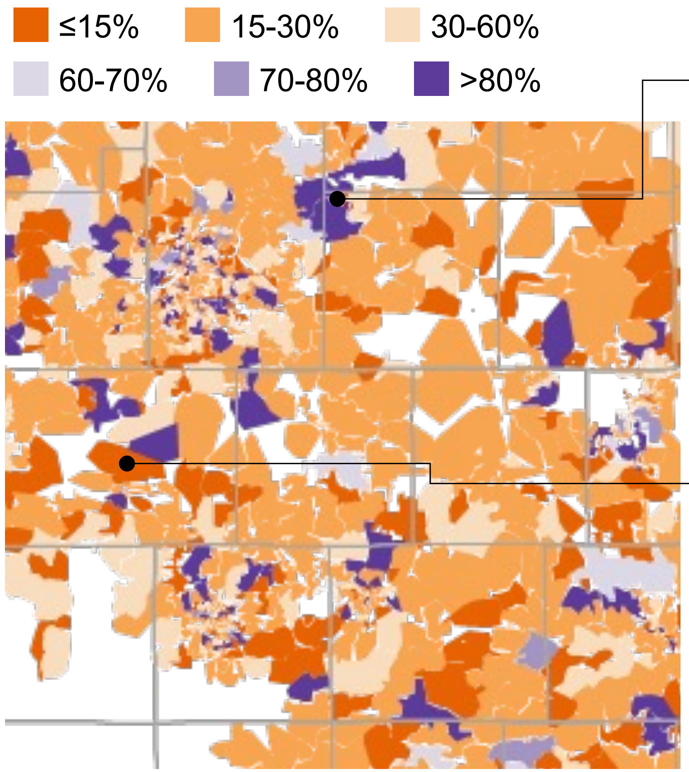
From a service-territory view…

…to actionable circuit-level granularity

Heat pumps in territory



2030 circuit load increase, % of peak



Suburban circuit

- Affluent, expected high levels of new technology adoption
- Highly capacity constrained, intervention would be needed

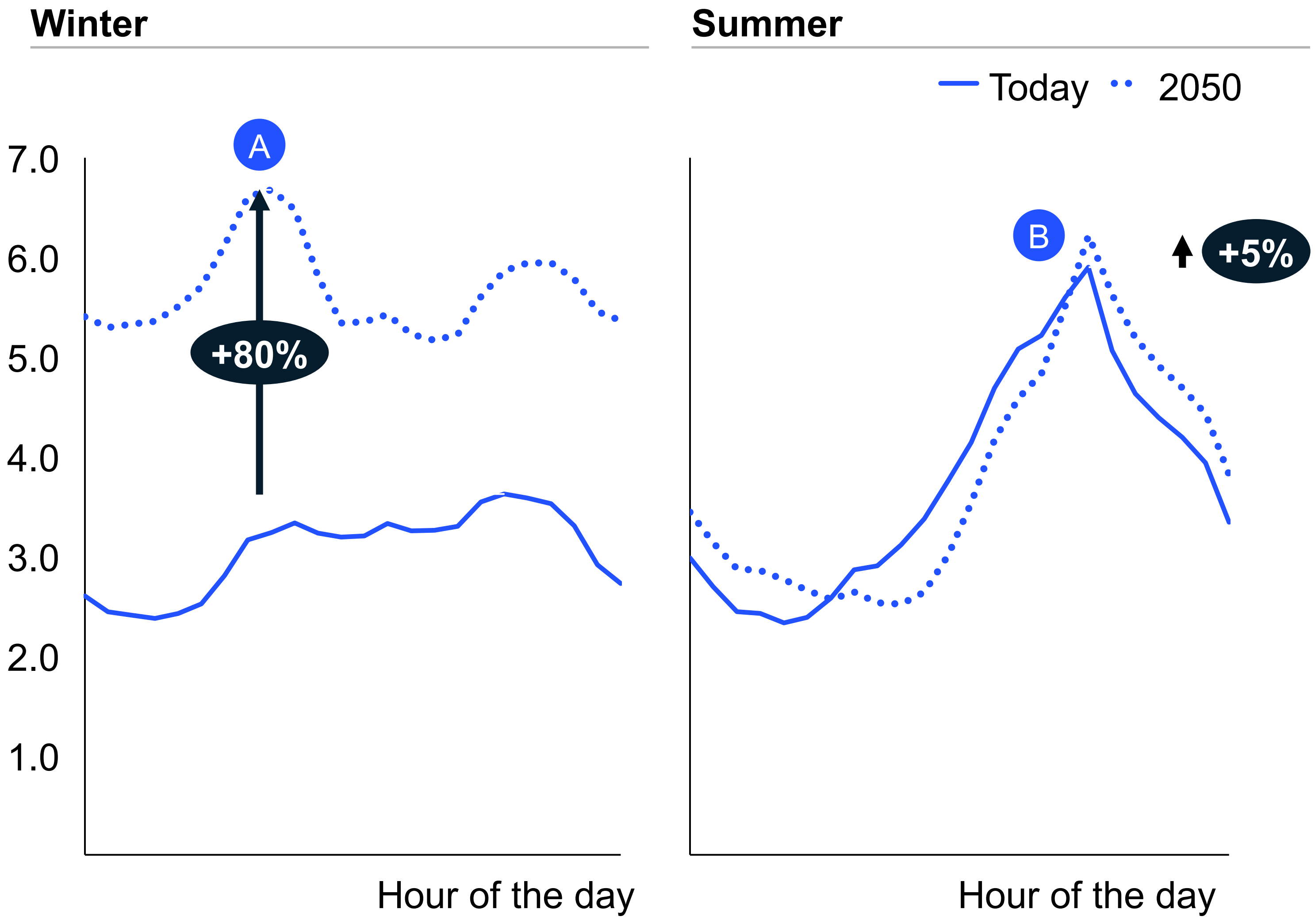
Industrial outskirts circuit

- Mix of industrial and lower income residential, with relatively lower extreme temperature impact
- Capacity would be sufficient, no intervention needed

Source: McKinsey Climate Analytics

2: Demand will shift at the circuit level and some circuits will move to a winter peak

Loads on suburban sample circuit, MW



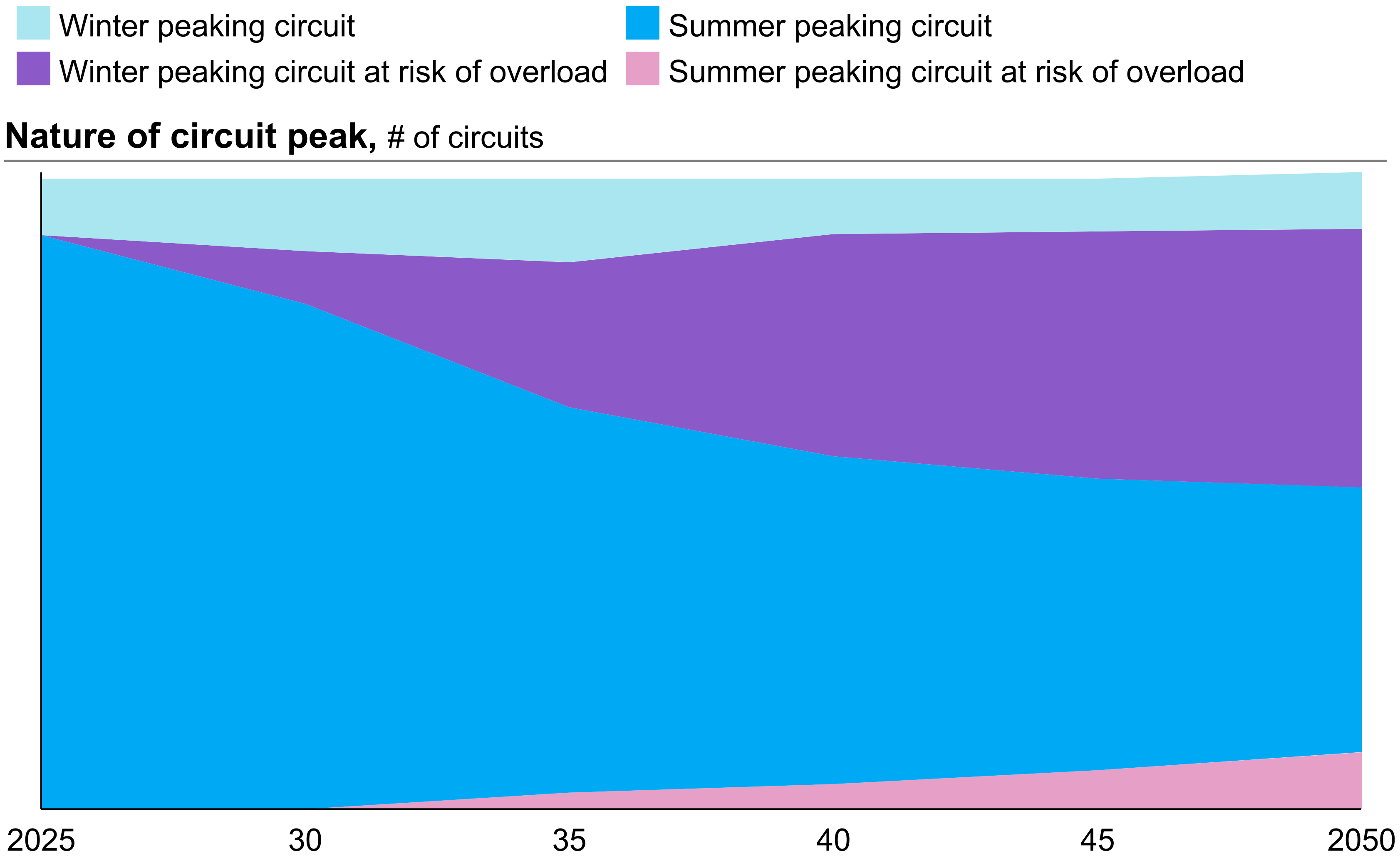
Without detailed circuit-level models, load growth impacts on distribution infrastructure were not accessible

Taking a circuit-level approach uncovered:

- A Winter load growth is significant, with heat pump adoption driving peaks by 80%+
- B Summer profile stagnant as growth from EVs is offset by solar DG with local batteries

2: Analysis showed peaks shifting to winter over time across territory, with some at risk of overload

Nature of circuit peak, # of circuits



Strong trend towards more circuits at-risk of reaching peak capacity with electrification (e.g., EVs, electric heating)

Analysis showed **overall system peaking behavior moving to winter over time,** building up from individual circuits

3: What do we do as a result?

The effort helped to achieve a **much-improved grasp on resiliency and transitional capital needs**

- Set data-based targets to **reduce outages by 50-80%**
- **Prioritize individual circuits** for investment instead of one-size-fits-all approaches – resulting in **an 8x factor of investment** between lowest-risk and highest risk regions
- The utility could identify **future needs for additional capital planning** with an increased awareness of **key signposts to monitor** (e.g., acceleration of electrification)